Final Report

Sustainable Construction in Indian Country Initiative

May 2011-May 2013

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

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Final Report
Sustainable Construction in Indian Country Initiative

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U.S. Department of Housing and Urban Development, Office of Policy Development and Research

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Disclaimer

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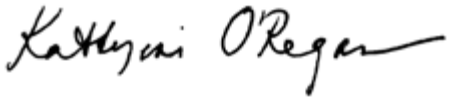
Foreword

The U.S. Department of Housing and Urban Development (HUD) has worked as a partner with Native American communities since the Department's creation in 1965. The Native American Housing Assistance and Self-Determination Act (NAHASDA) of 1996 moved that partnership to a new level. NAHASDA emphasized flexibility that led directly to some of the wonderful examples of sustainable housing described in this report that are taking place in Indian Country.

These innovations are needed now more than ever. Indian Country faces new challenges related to energy and climate. Although these challenges resonate globally, within the United States, Native American communities are more likely to be affected by these challenges because of their often-remote locations and disproportionately low income levels. American Indian tribes and Alaska Native villages may already face high fuel costs because of their remote locations, and these costs are exacerbated by volatile fuel prices. Extreme weather conditions can also drive up fuel costs, cause additional fuel needs, and threaten housing stock.

In implementing the Sustainable Construction in Indian Country initiative, HUD has found that many tribes and villages are already taking steps to weatherize their housing to increase consumer comfort and energy efficiency and to decrease utility and maintenance costs. Every HUD region has many exciting examples of Native American residential housing using sustainable technologies. These examples include, but are not limited to, the use of structural insulated panels in the Citizen Potawatomi Nation, lava block manufacture at the Pueblo of Isleta, straw bale construction at the Coeur D'Alene Tribe of Indians, and a geothermal system in a development of the St. Regis Mohawk Tribe. As part of the demonstration project selection process and training sessions, Native American communities shared their experiences in working together to gain the knowledge required to make informed choices about the sustainable technologies that are best adapted and most cost effective in their regions and communities. Even more communities asked how they could do the same.

Still, the distance that HUD has come in constructing new housing, renovating deteriorating units, and demolishing substandard housing may not always be remembered in the face of painful continuing concerns about overcrowding and substandard units. It can be hard to plan for the future when many pressing needs are in the present. Investments made wisely today, however, will contribute to increased prosperity, economic health, and an improved ability to meet housing needs tomorrow. HUD applauds these communities for their commitment to their communities and to the world.



Katherine M. O'Regan
Assistant Secretary for
Policy Development and Research

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Executive Summary

The Sustainable Construction in Indian Country (SCinIC) initiative was a congressionally mandated effort of the Department of Housing and Urban Development (HUD), Office of Policy Development and Research, in partnership with the HUD Office of Native American Programs (ONAP). The initiative promoted and supported sustainable construction practices in Native American communities[1] through a range of tasks.

Initiative Overview

The initiative included four tasks.

- **The review of current activities** identified Native American communities that had or were developing on sustainable construction projects, funding resources, and technical assistance (TA) resources as of July 18, 2011.

- **A national impediments meeting** identified impediments to sustainable construction practices and opportunities for TA and training for the Native American communities.

- **Demonstration projects** were sought that could be featured in best practice case studies. These case studies will enable others to benefit from these best practices.

- **Training** was made available to Native American communities based on results of the other initiative tasks.

Sustainability can be defined in many ways. For purposes of this contract, the initiative defined sustainability using the U.S. Green Building Council definition of green homes, as being generally "healthier, more comfortable, more durable, and more energy efficient and have a much smaller environmental footprint than conventional homes."[2]

The SCinIC initiative was designed to provide types of assistance that can play a role in promoting understanding about the benefits of sustainable construction technologies. Between 2011 and 2013, it has—

- Educated demonstration project teams about the range of sustainable construction technologies available.

- Provided supplemental TA to help tribes incorporate appropriate sustainable technologies into their residential construction projects.

- Helped build relationships among tribal staff and sustainability industry specialists that grow the capacity of both parties and facilitate sustainable design and implementation.

- Promoted the use of available tools for helping tribes make informed decisions about which sustainable construction technologies to implement. Potential tools include free blower-door

1 Native American communities refers to American Indian tribes and Alaska Native villages. As defined in NAHASDA, the terms "tribe," "Indian tribe" and "American Indian tribe" are used throughout to refer to Indian tribes, bands, nations and other organized groups or communities including Alaska Native villages or regional and village corporations.

2 U.S. Green Building Council (2007): 4.

testing through HUD ONAP, free modeling and benefit analysis software, and the U.S. Department of Energy's Tribal Energy Program TA.

- Highlighted regional best practice case studies of successful tribal sustainable projects.
- Supported tribes in collecting energy-related data for demonstrating energy and rehabilitation benchmarks and savings associated with sustainable technologies. This assistance can show savings for tribally designated housing entities (TDHEs) and residents.

Key Findings

Analysis of the SCinIC activities supports the following key findings.

1. **Many obstacles to sustainable development in Indian Country are the same as the obstacles to conventional development in Indian Country.**

   These obstacles include disruptions to the—often short—building cycle; the length of time to navigate requirements imposed by federal programs, funding, and tribal leadership; staff turnover; land ownership and usage issues; and political roadblocks.

2. **The dilemma between more housing and better housing can undermine the desire for sustainable construction.**

   Overcrowding and pent-up desire for housing combine with limited housing authority budgets to complicate new housing production and rehabilitation decisions in many Native American communities. The upfront costs and sometimes the perceptions of sustainable construction as luxury can defeat efforts to make housing healthier, more durable, less expensive to operate, and more energy efficient. On the other hand, rehabilitating older housing with appropriate sustainable technologies might be a way to avoid some criticism and make similar gains in health, durability, and utility savings.

3. **Obstacles specific to sustainable development can also impede the adoption of technologies.**

   Tribal housing authority staff, planners, and architects or engineers may not be familiar with the track record of different sustainable technologies within their climate. They may then disregard certain technologies or, if using them, fail to maintain them properly. Tribal force account[3] construction crews and local non-Native construction teams may have to bring in outside specialists to assist with installation or construction, increasing costs and potentially decreasing employment opportunities for tribal members.

4. **Obstacles to sustainable development are often rural development obstacles.**

   Rural Native American communities often pay more for materials or have difficulty locating sustainable materials. Shipping materials long distances—when possible at all—can undermine the goal of decreasing the carbon footprint and can increase the development expenditures.

3 *Tribal force account* refers to the method of construction controlled by the tribe or TDHE rather than contracted out. The tribe uses tribal employees or members to do construction work.

Rural Native American communities also experienced difficulties locating affordable, nearby, or experienced installation or maintenance specialists. The cost and difficulty decreases the cost-effectiveness or the lifetime of the technology.

5. **Resources exist to help alleviate some of the top obstacles specific to sustainabilty identified in the national meeting, including building codes, capacity building, and planning—but these resources are not adequate to need.**

   An active federal interagency workgroup has been addressing issues of tribal building codes. TA and training, often regional in nature, exist to support capacity building, but tribes outside a region may not know what is taking place elsewhere. Federal and other opportunities exist to encourage master-planning efforts, but these resources are not well known and many more tribes need planning support than these resources can support.

6. **Training and technical support for new green residential construction for tribes is focused in Alaska, the Pacific Northwest, and the Southwest. The opportunities for Native American communities to receive these needed services in other regions of the country are more limited.**

   One of the critical factors in supporting and increasing sustainable residential construction in Indian Country is having several organizations that provide training and TA with new green construction projects. Although several organizations do a lot of work with tribes, relatively few organizations provide training and TA on new sustainable construction in Indian Country. For example, key informants often mentioned the same entities in a given region: Cascadia Green Building Council in Alaska and the Pacific Northwest, Cold Climate Housing Research Center in Alaska, and the Enterprise Green Communities program in the Southwest. Increasing the sustainability of existing homes has more support, with the Environmental Protection Agency (EPA) and HUD offering training and regional workshops.

7. **Educational groups, such as tribal colleges, can help tribal members acquire professional green building skills and foster tribal capacity building, another example of tribes helping tribes. Tribal colleges, however, are primarily clustered in the Great Lakes, the Dakotas, Montana, and the Southwest.**

   Educational organizations include Construction in Indian Country, in partnership with Arizona State University, and the College of the Menominee Nation. Although Red Feather Development Group and the Zuni Housing Authority have implemented successful models for increasing housing authorities' capacity to do their own sustainable construction projects, they are the exception rather than the rule. Most tribes depend on local construction firms and use tribal members in only relatively unskilled capacities. Further, in at least one ONAP region, tribes reported difficulty accessing construction firms with experience in sustainable construction technologies.

8. **Strong enthusiasm exists among those who are implementing sustainable technologies.**

   At the training sessions and during the selection interviews, it became apparent that tribes that had already implemented sustainable technologies had champions who were strongly committed to the technologies and had the political ability to inspire others. This phenomenon seemed

especially true in the Upper Midwest and the west coast. These champions frequently expressed interest in getting the word out to other Native American communities.

9. **More tribes wanted help with sustainable design and construction than were able to receive it.**

   This finding is positive in that it illustrates the enthusiasm for exploring sustainable technologies in Indian Country. It also shows, however, that more resources are needed—both TA and financing—than are currently available.

10. **Funding is still mostly limited to federal resources.**

    Federal funding is still the source of the most capital for housing development or rehabilitation. The investment and housing finance industries, when they are familiar with Indian Country at all, hesitate to enter financial relationships because of political and land-ownership issues. Still, tribes are adding funding sources to their toolkits by working with Native community development financial institutions, among other solutions.

11. **Capacity building can include a broad range of skill sets.**

    Capacity building, which in the area of Native American housing development is often taken to mean the ability to construct housing inhouse, is an economic development tool. The adoption of new technology and the ability to take on housing projects sized to both address overcrowding and allow for economies of scale can strain inhouse resources, however. Capacity building also means knowing how to request and receive specific outcomes from potential consultants and subcontractors, manage subcontractors, control the quality of work, manage the process, and harness the data to gain educated estimates of cost-effectiveness.

12. **Sustainable features are often linked with cultural features.**

    As indicated in the section, "Historical Reference to Sustainability in Native American Communities," sustainability is integral to many Native American communities. Instances exist of reinvigorating traditional building styles to be better adapted to climate, as in the octagonal shape of a house in the Native Village of Kwinhagak (Alaska). Sustainable housing, however, also can include ensuring that culturally relevant features are part of the initial design, such as orienting duplexes for the Nez Perce Tribe of Indians to the east in accordance with past practices.

Native Village of Kwinhagak Energy Efficient Single Family Housing Under Construction

Image: Cold Climate Housing Research Center for HUD SCinIC

Recommendations

Together with other federal agencies and other committed partners, this initiative has implemented strategies that led to a new perspective for some and a deeper understanding of green for others. The SCinIC activities scratched the surface of potential support, however. Additional changes to policy, continued education, tools to support change, and increased federal agency cooperation are needed to continue to support tribes in making their housing more sustainable. The following recommendations promote continuing support for sustainable construction.

1. **Leverage available federal resources and materials to support tribes and TDHEs.**

   Resources include, but are not limited to, the SCinIC case studies, the interagency Tribal Green Building Codes Workgroup, and the HUD grantees—especially tribal and rural grantees—under the Office of Sustainable Housing and Communities (OSHC) to increase knowledge of the benefits of sustainable construction. The past grantees may be able to provide voluntary advice, mentorship, or networking support. Federal entities may encourage tribes to participate in EPA tribal TA and training opportunities or disseminate available HUD materials, including SCinIC case studies.

2. **To support tribes in making informed decisions about when an investment is reasonable, assist tribes in accessing resources that will help them determine the true cost-effectiveness of sustainable materials and strategies.**

   This recommendation may include access to modeling and other software or certification services, but it may also include information on how to request needed services and evaluate data provided by sustainability professionals.

3. **Encourage Native sustainable construction champions to participate in training and conferences to discuss their own projects, but also to assist in inspiring and training a new and larger wave of sustainable building proponents.**

   The best examples for Native American communities are other successful Native American communities. As indicated in the recommendations, tribal representatives who use sustainable technologies and materials are eager to spread the word. Their words may be especially convincing to other communities that have not yet tested sustainable construction.

4. **Host a green building blog at HUD and use it to actively promote Native sustainable building models and conversations with tribes.**

   A blog can provide a low-cost, easily shared strategy for disseminating information about successes and challenges in Indian Country and providing a space for discussion.

5. **Encourage green building within federal programs and funding sources.**

   Federal programs often have flexibility to include incentives for green building in notices of funding availability. Additional flexibility exists in waiver opportunities that can be linked to sustainable construction and the ability to leverage federal funds to encourage private investment. Another way to encourage a longer term and interrelated view of development is by coordinating funding opportunities among federal agencies.

6. **Support funding for and partnerships with tribal colleges and other colleges and universities with a strong American Indian and Alaska Native presence in their efforts to create sustainable training programs.**

   Tribal colleges are one source of capacity building for the next generation of leaders in Indian Country. They are already taking steps to offer degree and certificate courses in sustainable construction that will strengthen economies in Native American communities and provide generations of young workers with critical green-collar economy skills that will be in demand on and off the reservation.

Introduction

In 2010, the first year of the Transformation Initiative (TI), the Department of Housing and Urban Development's (HUD's) Fiscal Year 2010 Appropriations Act made as much as 1 percent of program funds available for (1) research, evaluation, and program metrics; (2) program demonstrations; (3) technical assistance (TA); and (4) information technology. One 2-year program that Congress mandated through the TI was the Sustainable Construction in Indian Country (SCinIC) initiative. This initiative fulfilled many TI goals and brought increased attention to the issue of sustainable construction practices within Indian Country.

TI is part of a reinvention of HUD that leverages technology and a new way of doing business to respond to the need for increased transparency and improved service delivery. The SCinIC initiative benefited from TI's infusion of much-needed funding into the neglected areas of program demonstrations and innovative, crosscutting TA that goes beyond program compliance to improve grantee capacity, performance, and outcomes. HUD's Office of Policy Development and Research (PD&R) plays two roles in the TI, administering the research and demonstrations and serving as the technical lead department wide on TA projects.

The purpose of SCinIC was to facilitate sustainable construction in Indian Country by providing TA and by documenting these activities and disseminating the results. PD&R undertook the following tasks to promote sustainable construction in Indian Country: (1) it selected specific qualified sites that volunteered as Indian sustainable construction demonstration partners, (2) it provided TA to the demonstration partners to assist them in using sustainable building techniques in housing developments, and (3) it documented the activities undertaken in this project and assisted in disseminating the demonstration results to a wider audience.

This final report comprehensively documents activities, successes, and lessons learned during the 2-year course of this initiative.

Historical Reference to Sustainability in Native American Communities[4]

Overview

Sunrise Acres Housing on the St. Regis Mohawk Reservation

Image: Akwesasne Housing Authority

Sustainable construction within the Native American world, as elsewhere, is implemented for cost savings, energy savings, enhanced durability, and environmental benefit. The practice of sustainability in American Indian tribes, however, also carries with it a strong cultural component that is both contemporary and traditional. Most North American Indian tribes practiced environmental sustainability, or respect for the environment. Environmental sustainability is the "philosophy and practice in which people do not extract more resources from the environment than necessary, leaving resources available for future generations."[5] Thus, it was fully consistent when the executive director of the Akwesasne Housing Authority (AHA), Retha Herne, stated at a training session that AHA's sustainable housing development, Sunrise Acres, expresses itself culturally through its use of renewable energy and its land use conservation practices.[6]

Tribal cultures express their view of nature and the environment in several ways. The concept of seven-generation sustainability, which originated with the Iroquois, said that people must consider the effect of their actions on the seventh generation—that is, look into the future before they make decisions about the present. The Constitution of the Iroquois Nations: The Great Binding Law includes the passage, "Look and listen for the welfare of the whole people and have always in view not only the present but also the coming generations, even those whose faces are yet beneath the surface of the ground—the unborn of the future Nation."[7]

Contemporary tribal leaders and advocates of many tribes articulate similar views. Oren Lyons, Chief of the Onondaga Nation, wrote, "We are looking ahead, as is one of the first mandates given us as chiefs, to make sure and to make every decision that we make relates to the welfare and well-being of the seventh generation to come."[8] Lyons' viewpoint is not limited to a particular tribe. Lydia Sigo, a Suquamish Indian and Suquamish Museum archivist/curator, said, "In traditional cultures, we try to look to the next seven generations. My concern is trying to sustain the environment for those future generations."[9] Winona LaDuke, an environmental activist from the White Earth Reservation, stated, "Elders used to tell younger

4 *Native American communities* refers to American Indian tribes and Alaska Native villages. As defined in NAHASDA, the terms "tribe," "Indian tribe," and "American Indian tribe" are used throughout to refer to Indian tribes, bands, and nations or other organized groups or communities including Alaska Native villages or regional and village corporations.

5 Sustainable UCR (2009).

6 Herne (May 8, 2013).

7 "Constitution of Iroquois Nation." Available at http://www.indigenouspeople.net/iroqcon.htm (accessed April 29, 2013).

8 Lyons (1994).

9 Grimley (2008).

generations how to live in one location for 1,000 years without destroying the land" and that a similar care for the environment could be seen in some families adopting older traditions.[10] In addition, Bonnie Butterfield wrote, "Many Native Americans had no concept of land ownership. Land was a gift from the creator and used in common by the whole society for survival and sustenance."[11]

Stewardship and Living in Harmony

The fundamental way that American Indians related to nature before the Europeans arrived has been described as follows.

> Indians generally considered themselves to be just one among many entities in an animate world, living according to culturally defined canons of respect for other members, while nevertheless developing tools and technologies that allowed them to provide for their own subsistence.[12]

Native Americans, including Lakota lawyer and author Vine Deloria, Jr., Winona LaDuke, and others, believe "that Indians lived in accordance with ecological limits and limited the number of animals they hunted."[13] Carolyn Merchant quoted LaDuke as saying—

> We have a code of ethics and a way of living on this land which is based on being accountable to [natural] law. That is the understanding of most indigenous peoples.[14]

The evidence strongly suggests that Native Americans have a historic tradition of environmental stewardship.

> The native peoples of the Cahuilla tribe inhabited present-day San Diego County and eastern Riverside County near Palm Springs. The Cahuilla lived in a harsh desert environment and had little access to water; due to the scarcity of water, there was limited plant or animal life for food. The natives realized that if they were to survive in such an environment, they would have to live sustainably and make a minimal impact on the environment. Mesquite beans were a common ingredient in the Cahuilla diet. They harvested the beans and ground them into a powder. The Cahuilla realized that if they harvested all of the mesquite beans available at one time, there would be no seeds left to produce more trees. Thus, they understood that their own survival as a people was closely tied to the well-being of their surrounding environment, and saw that it was absolutely essential they preserve the planet.[15]

Another, broader example of sustainable behavior is the Native American use of fire ecology.

> The native peoples of America often practiced fire ecology to prevent massive, uncontrollable forest fires. Dead plant material, such as leaves, bark, and branches naturally accumulates on the forest floor. If too much organic litter accumulates on the forest floor and it catches on fire during a lightning storm, the entire forest could be burned down. To prevent such dangerous forest fires, indigenous peoples regularly burned the underbrush in a controlled manner. Trees soon became

10 Grimley (2008).

11 Butterfield (n.d.).

12 Merchant (2007): 14-15.

13 Merchant (2007): 21.

14 Merchant (2007): 21.

15 Sustainable UCR (2009).

> adapted to Native American fires; seeds of many tree species do not germinate unless they have been exposed to high temperatures that can only be provided by a fire.[16]

Many believe that Indians were the "original conservationists," because of their reciprocal relationship with their natural environment and belief in the unity between their spiritual and physical worlds.[17] Stuart G. Harris of the Confederated Tribes of the Umatilla Indian Reservation, described the traditional land ethic as "stewardship and kinship… equality of all species."[18] Talking about the environmental infrastructure, Harris stated—

> My elders taught me to see the whole system. They taught me that our traditions and behaviors are conscious responses to rigorous environmental shaping. They understood the value of systematic observation and used inductive reasoning to determine the most probable reactions of very complex, interrelated ecosystem functions. They understand that ecological thermodynamics forms the basis of our resilient and adaptive holistic environmental management science. The application of this science has been codified into law and has been distilled into daily practice. This knowledge is still transferred between generations. Attention to and application of this knowledge means personal survival and enhancement of our ecology, culture and religion. Disregarding this knowledge can result in eating a poison, starving, degrading resources, or societal collapse.[19]

Nathan Sherrer and Tim Murphy stated that the typical Native American's "entire method of living is inherently ecological because, to them, everything in the nature world was interrelated and shared the same life. Their lifestyles as well as their religion only served to emphasize this relationship between man and his environment."[20] Eve Darian-Smith said that scholars of Indian law and the anthropologists, sociologists, and historians who study Native Americans "have documented the role the environment plays in tribal jurisdictional authority, social organization, cultural property, religion, health, and economic and cultural stability."[21]

Traditional View of Nature

The following quotations express some Native American views of nature in the past and in the present, orally and in writing.[22]

> Treat the earth well. It was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors, we borrow it from our Children.
> —Ancient Indian proverb

> When all the trees have been cut down, when all the animals have been hunted, when all the waters are polluted, when all the air is unsafe to breathe, only then will you discover you cannot eat money.
> —Cree prophecy

16 Sustainable UCR (2009).

17 Anderson (n.d.).

18 Harris (n.d): 8.

19 Harris (n.d.): 9.

20 Sherrer and Murphy (2006):16.

21 Darian-Smith (2010):361.

22 United Association of HigaononTribes (n.d.).

Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect.
—Chief Seattle, 1854

Honor the sacred. Honor the Earth, our Mother. Honor the Elders. Honor all with whom we share the Earth: four-leggeds, two-leggeds, winged ones. Swimmers, crawlers, plant and rock people. Walk in balance and beauty.
—Native American elder

I do not think the measure of a civilization is how tall its buildings of concrete are, but rather how well its people have learned to relate to their environment and fellow man.
—Sun Bear of the Chippewa Tribe

You must teach your children that the ground beneath their feet is the ashes of your grandfathers. So that they will respect the land, tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children, that the earth is our mother. Whatever befalls the earth befalls the sons of the earth. If men spit upon the ground, they spit upon themselves.
—Unknown

Rain Garden in Yard at Pokagon Band of Potawatomi Indians

Image: Department of Natural Resources, Pokagon Band of Potawatomi Indians

Social Marketing Related to Environmental Sustainability and in Native American Communities

Developing case studies, creating promotional materials, and even selecting demonstration projects speak to the goal of the Sustainable Construction in Indian Country initiative to go beyond capacity building in the Native American communities with which the initiative has worked to inspiring and influencing other communities who come into contact with SCinIC products, activities, and demonstration project representatives. The message is not only that sustainable technologies have benefit and can be cost effective, but also that they are technologies appropriate to Native American communities and that Native American communities are implementing them to the benefit of the community and approval of tribal leadership and housing residents.

Background

Although social marketing has been implemented for more than 40 years, it has been used primarily in the area of health education. For some time, however, social marketing—in particular, message framing—has been used in the United States to raise understanding of the state of the environment and to encourage behavior that is environmentally sustainable.[23] Cheng et al. noted that, "although the persuasive effects of message framing have been widely publicized in the field of social and cognitive psychology, there is a surprising dearth in the literature regarding the role of message framing as a strategy within the context of social marketing to influence environmentally sustainable behaviors."[24] SCinIC research found nearly no literature regarding message framing or social marketing in Native American communities in the area of environmental sustainability.

Social marketing uses marketing principles for the purpose of societal benefit rather than commercial profit.[25] It is "the application of marketing to achieve specific behavioral goals for a social good."[26] Social marketing was "born" as a discipline in the 1970s, when Philip Kotler and Gerald Zaltman realized that the same marketing principles that were being used to sell products to consumers could be used to sell ideas, attitudes, and behaviors.[27] Social marketing has been used extensively in international health programs and is being used more frequently in the United States.

Social marketing—

> …draws on psychology, sociology, economics and anthropology in an attempt to fully understand people. Once this understanding has been gained, it develops products, services and messages that provide people with an exchange they will value. This concept of exchange is really important if you want to achieve sustainable behavior change.[28]

Because people do not always behave in their own or society's best interest, it is important to educate people about important health and environmental issues in the hope of effecting behavior change.

23 Cheng et al. (2011).

24 Cheng et al. (2011): 48.

25 Social Marketing National Excellence Collaborative (2002).

26 James (2010).

27 Weinreich (n.d.).

28 Merritt, Truss, and Hopwood (2011).

Social marketing typically addresses broad issues in health education, such as the use of condoms to prevent sexually transmitted diseases and HIV/AIDS, antismoking, breastfeeding, diabetes prevention and management, and so on. In a similar way, social marketing in Indian Country is focused primarily on health and safety—for example, HIV/AIDS prevention; methamphetamine use prevention; suicide prevention; mental health; and gay, lesbian, bisexual, transgendered, and transsexual support. Social marketing, however, is increasingly used for environmental sustainability.[29]

Social Marketing and Energy Conservation

One successful example of the use of social marketing in increasing energy conservation is the case of the Pacific Gas and Electric Company (PG&E) in California. The company's experiment, conducted in 1990, gave homeowners a free home inspection and advice on ways to make their dwelling more energy efficient.[30] The program was unsuccessful until auditors incorporated two behavior-change tools during their home visits.

> First, auditors began communicating with vivid, personal information. For instance, rather than simply point out cracks around doors, the auditor would compare the cracks to a hole the size of a baseball. ... Second, auditors were instructed to involve the customer during the home visit. For example, home owners might be asked to take measurements or read meters. This strategy was used to induce homeowners into making a commitment to weatherizing their homes.[31]

Doug McKenzie-Mohr, an environmental psychologist specializing in the behavioral aspects of sustainability and a leader in the field of social marketing for sustainability, presented an example of the effectiveness of social marketing on increasing energy conservation. In a 1994 study, he drew on the results of the PG&E study, identified social psychological variables relevant to residential energy conservation, and trained home auditors to use them.[32] Techniques included—

- Capturing the householder's attention; for example, by looking at utility bills and describing how much money is being lost by not retrofitting.
- Gaining the householder's trust; for example, by wearing an identification badge and sending material to the house in advance that highlights the assessor's training.
- Getting the householder to make a minor commitment; for example, agreeing to make changes by a certain date.
- Framing information in terms of loss rather than gain; for example, instead of focusing on the savings from retrofitting, telling the householder how much money is being lost by not weatherizing.
- Helping the householder understand household resource consumption; for example, explaining that visible devices like lighting consume fewer resources than less visible resources like water heaters and furnaces.

29 James (2010).

30 Community-Based Social Marketing (n.d.).

31 Community-Based Social Marketing (n.d.).

32 McKenzie-Mohr (1994).

- Explaining the savings that the householder realizes from retrofitting.

These activities illustrate another motivator for change. Involving householders in the effort increased buyin by inspiring them to accept themselves as the type of people who care about energy efficiency and to take steps to save money and weatherize.[33]

McKenzie-Mohr reported that using social psychological knowledge increases the likelihood that people will engage in sustainable behaviors. The home auditors who were trained to use the techniques described previously rated themselves as significantly better able to encourage homeowners to adopt energy-conserving technologies."[34]

Discussing information in terms of loss rather than gain is a technique supported by message framing. Message framing is a communication technique within social marketing. This technique assumes that a message can be created in such a way that a specific audience will interpret the message to create a specific response. This response is often hoped to be a change in behavior.

Cheng et al. noted that loss-framed messages tend to be more effective in promoting environmental behavior. In particular, "loss frames were more effective for the low salience issue of energy conservation, whereas gain frames were more effective for the high salience issue of recycling. "Also, "loss framing was most persuasive when the losses were emphasized on the current generation as opposed to future generations."[35] The authors, however, also found that certain audiences were more susceptible to loss or gain framing than others. This finding suggests that research might be required to determine if Native American audiences might be more likely to change their behavior based on a particular style of message. For instance, the American Indian cultural emphasis on future generations might suggest that Native audiences would be likely to respond to gain-framed messages that focus on future generations.

In another study, researchers used monthly feedback to reduce and control electricity use.[36] Participants received a letter each month stating the percentage change in electricity consumption from the same month both 1 and 2 years ago. The letter also showed how much money participants saved or lost and the difference in kilowatt-hours. The letter arrived a few days after the utility bill every month. Although individuals were not aware that they were participating in this study, households that received the letter reduced their electricity by 4.7 percent. The authors stated that—

> The results of this study demonstrate the effectiveness and practicality of this form of feedback. In total, approximately $16 was spent on this project, which is substantially less than other methods of attempting to reduce electricity such as advertisements and monetary payments.[37]

One Native Community and Energy Efficiency Audits

In 1995, a Canadian province conducted a successful social marketing campaign to promote energy efficiency in an Indian community. British Columbia's BC21 PowerSmart was a provincewide project

33 Heath and Heath (2010).

34 McKenzie-Mohr (1994).

35 Cheng et al. (2011): 53.

36 Community-Based Social Marketing (n.d.b).

37 Community-Based Social Marketing (n.d.b).

to conserve resources and create jobs.[38] The project used energy audits and incentives to encourage residents to improve their energy and water efficiency. BC21 PowerSmart later used a similar approach in the Okanagan First Nations Community Project, a project for Canada's Indian population living in the Okanagan Valley. In addition to creating jobs and conserving resources, the program focused on training First Nation members and improving their housing stock.

The program specifically attempted to be respectful of First Nation culture and to engage First Nation members.

> A BC21 PowerSmart Okanagan First Nations Committee, made up of representatives from each of the six participating bands, was established to provide input about the specific needs of the community. This was essential for the program's success, as there were some very sensitive issues which needed to be addressed, including political friction between band chiefs and the government, and a general mistrust of the government within the community. It was important to introduce the program as being neutral. To help achieve this, the project manager's office was set up in his home in the Okanagan Valley, rather than in a government or band council facility to help overcome skepticism about the project by householders. First Nations members were hired as staff.[39]

Professional installers provided on-the-job training to staff (that is, the home auditors) in "basic building technology, product installation, customer service, and documentation and reporting. This helped them to provide related services to their own community, and to compete for utility and government contracts."[40]

After the audit was complete, the home auditors offered to install one of each energy-saving product needed per home. The products included the following:

- Hot water tank blankets.
- Pipe insulation.
- Weatherstripping.
- Caulking.
- Gasket plugs.
- Faucet aerators.
- Flush reducers.
- Low-flow showerheads.

Both the audit and the products were provided free of charge as an incentive to encourage households to participate in the program. Program participants said they were very satisfied with the products and the service they received. They were happy that the project provided services that benefited their community.

Effect on SCinIC

Research data are not available to prove that social marketing and message framing are especially effective at persuading Native American communities to adopt sustainable construction technologies. Research in behavior change, however, offers some concepts that point in the direction of the SCinIC

38 Tools of Change (n.d.).

39 Tools of Change (n.d).

40 Tools of Change (n.d.).

activities. Chip Heath and Dan Heath, for example, discussed the ability of "bright spots" to serve as champions and avenues forward to success for others who might otherwise feel overwhelmed by the size of the change they are trying to create within their own community. "These flashes of success—these bright spots—can illuminate the road map for action and spark the hope that change is possible."[41] The SCinIC case studies, which emphasize the varied journeys that seven demonstration partners took in incorporating green technologies and materials into their housing, highlight these "bright spots." This approach is intended to focus the reader on the ability of Native American communities to create their own sustainable change.

The "appeal to identity" referenced previously indicates that increasing the ability of communities that are already carrying out sustainable construction to tell their own story may be useful in appealing to other communities with an interest but no existing champion. The Native representatives involved in this initiative, and those encountered at training sessions and events, have an interest in sharing their journey. Other tribes that are at the beginning of a sustainable construction process may be especially receptive to their example and lessons.

41 Heath and Heath (2010): 40.

Relationship of HUD Housing and Native American Communities[42]

The federal government, including the Department of Housing and Urban Development, has played a role in supporting housing in Indian Country since the 1960s. At times, this role has been somewhat prescriptive or perceived as such. With the passage of Native American Housing Assistance and Self-Determination Act of 1996 (NAHASDA), the relationship of tribes, and their tribally designated housing entities (TDHEs), to HUD has changed enormously. NAHASDA has emphasized flexibility and a local focus that has enabled tribes and TDHEs, far more than ever before, to prioritize according community need, leverage funds, and incorporate cultural and sustainable features into housing, if so desired. It has opened the door to the type of sustainable activities that this initiative has documented.

United States Housing Act of 1937 and Establishment of the Office of Native American Programs

With its creation in the 1960s, HUD was assigned the task of providing affordable housing assistance to American Indians. The United States Housing Act of 1937 (1937 Act) was the primary vehicle for this early assistance.

The 1937 Act created the national public housing program for low-income households but did not initially address specific housing needs of Native populations living in Native American communities. In 1961, the Public Housing Administration, an agency that became part of HUD, issued legal opinions that American Indians living on reservations and in other Indian areas were eligible to participate in public housing programs.

Administration

As a result of this determination of tribal eligibility, the Public Housing Administration created Indian housing authorities (IHAs) for maintaining, operating, and developing affordable housing in Native American communities. IHAs were designed to operate similarly to public housing agencies (PHAs).

By the 1970s, however, HUD recognized that Native American communities (later still, Native Hawaiian communities) faced unique housing conditions, in part, related to remote geographical locations, economic conditions, historical land issues, historical discrimination, and tribal cultural practices. PHA operational practices and programs also differed from those of IHAs, because they both operated in different relationships to their local communities and because they received some of their funding from different sources.

To provide Native American communities with an advocate within HUD for their community and housing development needs, HUD established the Office of Indian Programs in 1974. In 1984, HUD established the Office of Indian Housing as a part of the Department's Office of Public and Indian Housing (PIH). The Office of Indian Housing was renamed the Office of Native American Programs (ONAP) in 1992. This change included creating regional offices for administering Native American programs under the management of a central office. ONAP in 2013 consists of a headquarters office in Washington, D.C., and a network of six field offices in Chicago, Oklahoma City, Phoenix (and Albuquerque), Denver, Seattle, and Anchorage. ONAP's mission is to—

42 This section on HUD and housing is largely adapted from HUD (n.d.b).

- Increase the supply of safe, decent, and affordable housing available to Native American families.
- Strengthen communities by improving living conditions and creating economic opportunities for tribes and Indian housing residents.
- Ensure fiscal integrity in the operation of the programs it administers.[43]

Programs

Under the 1937 Act, 14 programs provided funding to American Indian tribes and IHAs. They were administered in a variety of ways: competitive, noncompetitive formula, and first-come, first-served. The primary housing programs administered under the 1937 Act were—

- **Low Rent (LR).** Beginning in 1961, Native American communities gained access to the LR program, which closely mirrored the Low Rent Public Housing Administration Program. HUD funds would go to an IHA that used them to acquire the rights to land and to build new units—or to acquire and rehabilitate existing ones—for rent by income-eligible families. The IHAs then managed the properties and received additional HUD funds representing the difference between allowable operating costs and tenant payments toward rent.
- **Mutual Help (MH).** The MH program provided opportunities for lower income Native families to purchase decent, affordable housing beginning in 1962. As with the LR program, the IHA developed the housing with HUD funding. The individual homebuyer became responsible for all operating and maintenance costs after completing the purchase, however. The program was a lease-purchase arrangement that built equity in an MH equity account, which was applied toward the purchase price of the home or refunded if the family left the MH program before achieving ownership. Families did not actually gain title to their properties until all their payment obligations were met, they exercised their option to acquire title, and the tribe completed conveyance, generally a 25-year process. For as long as the home was administered by the IHA, the IHA was responsible for operation and maintenance costs using 1937 Act funds. The MH program was available to qualified low-income Indian families on Indian lands. The Indian Housing Act of 1988 also established a self-help component that allowed lower income Indian families to contribute a major portion of the labor necessary to build their homes.[44]
- **Modernization Program.** Another very significant HUD program for the IHAs was the modernization program, funded through the Comprehensive Improvement Assistance Program (CIAP) and the Comprehensive Grant Program (CGP).

The National Affordable Housing Act of 1990 expanded the allowable uses for CIAP beyond modernization for rental housing to include modernization grants for MH units and management improvement grants for other homeownership developments. CIAP was distributed through a competitive allocation process. CGP, which became effective in 1992, provided large PHAs and IHAs (250 units or more) with a more flexible program distributed by a formula allocation.

43 HUD (n.d.a).

44 HUD (n.d.c.).

Effect of the 1937 Act Program in Indian Country

These housing programs had a significant effect on the provision of housing in tribal areas in the decades after 1961.[45] By the end of fiscal year (FY) 1997, more than 100,000 units were either complete or in various stages of the production pipeline—many of them replaced significantly substandard housing. In FY 1998, 41.3 percent of the units were LR and 57.6 percent of the units were MH. The MH program was very popular because of the strong preference for homeownership in Indian Country.

The following table illustrates the housing inventory for the LR, MH, and Turnkey III (TK3) programs, as represented by the number of units in management by the six area offices at the beginning of FY 1998, the first year of NAHASDA.

Units Under Management by Six Area Offices

Area Office	Low Rent	Mutual Help	Turnkey III	Total
Alaska	903	5,038	0	5,941
Eastern/Woodlands	5,376	3,574	382	9,332
Northern Plains	9,635	6,572	322	16,529
Southern Plains	3,124	10,255	0	13,379
Southwest	8,425	12,674	53	21,152
Northwest	1,926	2,879	6	4,811
Total	**29,389**	**40,992**	**763**	**71,144**

Source: Indian Housing Block Grant Database, FY98FIN.spss file

Although these programs created a substantial amount of affordable, decent housing on Indian reservations, serious problems and concerns persisted. Some tribal governments objected to the structure of HUD programs, saying that the somewhat independent role of the IHA undermined tribal sovereignty, in part because the IHAs were compelled to comply with HUD regulations and practices, in some cases in contradiction to tribal practice. Some IHAs, on the other hand, complained about excessively involved tribal councils.[46]

Significantly substandard and overcrowded housing conditions persisted—in part exacerbated by federal rules and regulations that limited IHAs and tribes in exploring more efficient and creative solutions to resource allocation.[47] Furthermore, HUD practices and regulations developed for urban settings did not always translate into often rural, Native American communities. Creating subdivisions, clustering housing units, and using non-Native architectural styles and materials contributed to housing abuse and deterioration, the growth of gang culture, and the loss of culture and clan relationships. These programs did not address the difficult land ownership issues that discouraged private investment in housing, land, and mortgage opportunities. [48]

45 HUD (n.d.c.).

46 Biles (2000) and the Harvard Project on American Indian Economic Development (2008).

47 HUD (1996).

48 HUD (1996).

NAHASDA

The passage NAHASDA on October 26, 1996,[49] signaled a new era in HUD's relationship with American Indian tribes and Alaska Native villages, with significant practical and policy implications. From a policy standpoint, NAHASDA recognized the right of tribal self-governance and the unique relationship between the federal government and the governments of Indian tribes, established by longstanding treaties, court decisions, statutes, Executive orders, and the United States Constitution.[50]

NAHASDA eliminated several separate programs (including the LR, MH, TK3, and modernization programs) and replaced them with single block grant program: the Indian Housing Block Grant (IHBG). NAHASDA created more flexible reporting rules, recognizing the different needs and conditions in different Native American communities and providing federal assistance for Indian tribes in a manner that recognized the rights of tribal self-governance.

NAHASDA has been the primary housing program for tribes since FY 1998. Section 202 of NAHASDA lists the following eligible affordable housing activities.

- **Indian housing assistance.** Modernization or operating assistance for housing previously developed or operated by HUD's former Indian housing programs.
- **Housing development.** Acquisition, new construction, reconstruction, and moderate or substantial rehabilitation of affordable housing.
- **Housing services.** Housing-related services for affordable housing, such as housing counseling for rental or homeownership assistance, the establishment or support of resident management organizations, energy auditing, activities related to self-sufficiency, and other services.
- **Housing management services.** Management services for affordable housing.
- **Crime prevention and safety activities.** Safety, security, and law enforcement measures and activities appropriate to protect residents of affordable housing from crime.
- **Model activities.** Specifically HUD-approved housing activities that are designed to develop and support affordable housing.

The style or design of the housing is not defined except as *moderate design*, defined in 24 CFR§1000.156 as "housing that is of a size and with amenities consistent with unassisted housing offered for sale in the Indian tribe's general geographic area to buyers who are at or below the area median income." This definition relates to all affordable housing development activities, including acquisition, new construction, reconstruction, moderate or substantial rehabilitation of affordable housing, and homebuyer assistance and model activities.

In a project, units with the same number of bedrooms must be comparable with respect to size, cost, and amenities.[51]

49 Public Law No.104-330, 110 Stat. 4016 (codified as amended at 25 U.S.C. §§ 4101-4195 (Supp. IV 1998)).

50 HUD, Office of Public and Indian Housing (2007).

51 66 FR 49790, Sept. 28, 2001.

HUD Sustainable Housing Support in Indian Country

HUD has several mechanisms in place to support sustainable building technologies in Indian Country housing.

Budgeting for developing affordable housing under NAHASDA is strongly shaped by total development costs (TDCs). TDC values are developed annually by ONAP based on average construction cost data from two sources, RSMeans Reed Construction Data and Marshall & Swift/Boeckh, leading suppliers of construction cost information. These construction cost data are adjusted by adding an additional 75 percent for site development.

Architectural Rendering of Planned Nez Perce Multifamily Construction

Image: 7 Directions Architects/Planners for HUD SCinIC

Tribes may develop their own standards of moderate housing design and may exceed TDC by up to 10 percent before needing to seek approval.[52]

In addition, using the TDC variance request, tribes can include sustainable housing technologies in their eligible housing activities. Tribes and TDHEs have long been able to request variances to allow them to meet costs beyond allowable TDCs on a cost-per-unit construction basis. Beginning in 2006, however, green technology was mentioned specifically as a potential reason for waiver, provided the requester had also worked with the Area ONAP to lower the costs of the project.

> Significant additional costs for incorporating green building, energy efficiency or other innovative practices, such as Indian Energy Resource regulation compliance.[53]

TDC variance for Alaska follows a somewhat different pattern. The PIH notice on TDCs for tribes automatically allows for a slight increase in published TDCs in Alaska to allow TDHEs, villages, and corporations to meet Alaskan energy efficiency standards.

> Additionally, this Notice constitutes HUD approval for a 2% increase above the attached TDCs for construction projects in Alaska to meet Building Energy Efficiency Standards (BEES) requirements. BEES are only required when funds provided by the State of Alaska are used in conjunction with HUD funds.[54]

For certain sustainable technologies, tribes and TDHEs may also choose another approval option. Tribes and TDHEs may seek approval under NAHASDA for model demonstration activities. The cost cap in this case is the lesser of up to 20 percent of the grant or $2 million.

HUD wrote incentives for sustainable construction into its American Recovery and Redevelopment Act

52 Most recently authorized in PIH Notice 2011-63, described most recently in PIH Notice 2010-47.

53 PIH Notice 2006-17: 3.

54 PIH Notice 2010-47: 4.

of 2009 (ARRA) notices of funding availability awarded in 2009. Under the IHBG competitive ARRA program, applicants could receive up to seven additional points for using ENERGY STAR products; having the units rated by a home energy rater as ENERGY STAR-qualified home; providing homebuyers with a housing counseling curriculum, including an energy conservation, budgeting, and ENERGY STAR component; and having the program certified under programs including—

- LEED (Leadership in Energy and Environmental Design).
- ENERGY STAR Plus Indoor Air Package.
- ENERGY STAR Advanced New Home Construction.
- Earthcraft.
- Enterprise Green Communities initiatives.
- National Association of Home Builders Green Building guidelines.

The Indian Community Development Block Grant (ICDBG) program, an annual funding program, allows for energy efficiency and green development for either housing rehabilitation or public facilities. Public services "directed toward improving the community's public services and facilities, including…energy conservation"[55] are also eligible under ICDBG.

HUD has written support for energy efficiency and energy conservation into the ICDBG application process. An ICDBG application may receive a point for compliance with HUD policy priorities for sustainability provided it successfully addresses the following.

> (1) Support and promote an energy-efficient, green, and healthy housing market by retrofitting existing housing or community facilities, supporting energy-efficient new construction, and improving home energy labeling. An applicant must demonstrate that the rehabilitation or construction of housing or community facilities at a minimum meets the standard for Energy Star for New Homes, or recognized green building rating standards utilizing one of several recognized green rating programs for new construction or substantial rehabilitation. An applicant should also identify the buildings or units that will include healthy design features that meet or exceed the mandatory requirements identified in a green building standard. The application must indicate which standard will be used by the applicant. Grantees will be expected to report on outcome measures including the number of housing units or community facilities rehabilitated or constructed to meet energy efficiency and green development standards, or the number of housing units or community facilities rehabilitated or constructed to meet healthy design standards.[56]

Applicants also gain points for developing feasible and measurable outcomes. HUD has written the potential for sustainability into this rating subfactor as well. Allowable outcomes that an applicant may cite as measurables for the project include the reduction of drug-related crime or health-related hazards and improved energy efficiency.

More language supporting HUD's environmental sustainability priority is found in its housing standards policy. If an ICDBG applicant requests approval for housing standards less stringent than the Section 8 Housing Quality Standards, the new standards the applicant develops must provide for "a livable home environment and an energy efficient building and systems that incorporate energy conservation measures."[57]

55 http://portal.hud.gov/huddoc/2013icdbgnofa.pdf (accessed February 19, 2013).

56 http://portal.hud.gov/huddoc/2013icdbgnofa.pdf (accessed February 19, 2013).

57 http://portal.hud.gov/huddoc/2013icdbgnofa.pdf (accessed February 19, 2013).

Not all HUD sustainability grants are construction based. Just as the Sustainable Construction in Indian Country initiative worked with demonstration projects on issues related to planning and standards, HUD's Office of Sustainable Housing and Communities has provided tribes, among others, with regional planning grants and partnered with federal agencies on community challenge planning grants. Tribes were among the awarded grantees in each of these grant programs between 2010 and 2013.

Between 2005 and 2008, HUD ONAP provided onsite assessments of mold and moisture conditions in a limited number of tribal housing units. In 2008, HUD expanded the program area to include energy assessments. The program included quarterly material dissemination, regional training sessions, written site visit reports with energy efficiency recommendations, and three Greener Homes National Summits, which brought tribes together for topics including energy efficiency and renewable energy sources. Between 2005 and March 2013, this contract assessed 616 housing units, providing tailored assessment and recommendations on rehabilitation and energy efficiency upgrades to 74 different American Indian tribes and Alaska Native villages.

Within the limits of the current fiscal belt tightening, HUD is taking steps to demonstrate its commitment to policies and programs that support increasing sustainability and that nurture innovation in housing in Indian Country while also maintaining affordability and decreasing overcrowding. These steps are not enough to meet the need, however.

Task Overview and Implementation

The Sustainable Construction in Indian Country initiative included four tasks.

- **The review of current activities.** Identifying American Indian and Alaska Native American communities that have or are working on sustainable construction projects, funding resources, and technical assistance resources.

- **National impediments meeting.** Conducting a national meeting to identify impediments to sustainable construction practices and opportunities for TA and training for Native American communities.

- **Demonstration projects.** Seeking demonstration project partners that can be featured in best practice case studies. These case studies will enable other tribes to benefit from these best practices.

- **Training.** Making available to Native American communities training based on experience and needs.

The Review of Current Activities

The statement of work assigned the contractor to "conduct a review of current activities promoting sustainable construction in Indian country."[58] This review set the stage for other activities under the contract by beginning the process of defining the TA and financial resources available for tribes seeking to implement sustainable technologies in their residential housing and by providing some insight into the amount of knowledge of and enthusiasm for sustainable technology on the part of federal, tribal, nonprofit and other organizations working with tribes. Interviewees also naturally described current and future sustainable residential construction or rehabilitation projects, which are also briefly described in the report. The report process, key informants, findings, and statistics on tribal projects are in the section, "Findings and Recommendations From the Review of Current Activities." The full report was completed on July 18, 2011, and is reproduced in appendix A.

National Impediments Meeting

The Department of Housing and Urban Development conducted a meeting to explore impediments to sustainable construction practices and solutions to these impediments. The meeting consisted of two parts: (1) a set of focus groups and (2) a followup analysis session. The meeting was conducted at HUD's third Greener Homes National Summit in Denver on September 28 and 29, 2011. Participants from governmental, nongovernmental, and tribal focus groups offered observations regarding impediments to sustainable construction in Native American communities.

Representatives of the focus groups met the next day to analyze the primary obstacles identified by each group, prioritize these obstacles in terms of their effect on sustainable housing, and brainstorm potential solutions. Because several participants were from federal agencies, the group focused on steps that federal partners might be able to implement. HUD completed the draft report on this meeting on January 29, 2011, and posted it on the HUD USER website. The full report is also reproduced in appendix B.

58 R-DEN-02502, Task Order No DEN-T0006 Sustainable Construction in Indian Country: 5.

Demonstration Projects

Selection Process

The selection process required the development of a request-for-projects letter, an interview protocol, and a set of selection considerations. HUD sent out a request for demonstration projects in November 2011. The mailing list included 788 tribes and tribally designated housing entities. HUD received 25 requests to be part of the program, and SCinIC team members conducted 17 interviews.

Cocopah Indian Housing and Development Multifamily Building Scheduled for Rehabilitation

Image: Cocopah Indian Housing and Development

More partnering sites would have benefited from TA than could be funded. The demonstration project selection process included diversity in climate regions, in Office of Native American Programs regions, in housing types, in sustainable technologies, and in completed versus planned projects. In addition, selection considerations included a determination that construction funding was secured, that tribal leadership was onboard with the project, and that the prospective demonstration was willing to receive TA and participate as a possible case study. Tribes received TA only and no funding was used for construction.

At least one demonstration project was selected in each HUD ONAP region. The following table lists each project's technologies and project types.

Demonstration Projects

Demonstrations	Sustainable Technologies	Project Type
Pokagon Band of Potawatomi Indians	Community master plan; Best Management Practices (BMP) in site plan including bioswales, cluster housing design, permeable pavement, use of prairie grass, and indigenous vegetation.	Completed 2004-2006. Sustainable water management and conservation in single-family housing subdevelopments.
Nez Perce Housing Authority	Hybrid straw bale construction with ductless minisplits; culturally adapted design; low-emissivity (low-E) windows; BMP in site plan.	Planned 2012-2013. New construction of 20 single-story duplex units.
Cocopah Indian Housing and Development	Compact Fluorescent Lamps (CFLs); ENERGY STAR appliances; indoor and outdoor lighting.	Planned 2013. Rehabilitating three eight-unit multifamily buildings.
Navajo Housing Authority	Green standards; green review process; green request for proposals .	Planned 2013. New construction and policies to support sustainable development.
Pawnee Housing Authority	Insulating concrete forms (ICFs).	Planned 2013. New construction of duplex units.
Akwesasne Housing Authority	Geothermal heating and cooling; ICFs; solar voltaic panels; solar domestic hot water.	Completed 2011. Five quadplex buildings for seniors within a community containing sustainable features.
Choctaw Housing Authority	Structural insulated panels (SIPs); low-E windows and doors; CFLs; ENERGY STAR appliances.	Completed 2009-2012. Eight duplexes and 74 single-family houses.
Native Village of Kwinhagak	Monolithic spray foam envelope; aerodynamic shape; whole-house truss.	Planned 2012-1013. Five single-family houses.
Muscogee (Creek) Nation	SIPs; geothermal heating and cooling; SIPs manufacturing plant.	Completed 2012. Housing development for seniors with 24 units and individual replacement houses.

Technical Assistance

HUD stipulated that TA be supplemental in nature. The TA providers were not to take a leading role in the demonstration project.

The types of TA "necessary for the incorporation of sustainable construction techniques and technologies into Tribal projects" per the Statement of Work[59] are broad in nature. Types of TA that the team recommended offering included—

- Assistance with developing procurement and bid announcements.
- Charrette implementation.
- Architectural design drafts.
- Existing design review and recommendations.
- Engineering schematic development.
- Appropriate sustainable product, material, and technique recommendations.
- Assistance with product, material, and technique installation.
- Education on the maintenance of products and materials.
- Assistance with the Green Communities and LEED for Homes designation processes.
- Assistance in developing or adopting a Green Development Standard.
- Energy modeling for the analysis of optimal systems, materials, orientation, openings, and energy use.
- Life-cycle analysis to assist in determining the costs and benefits of specific systems.
- Conceptual site plans.
- Postconstruction testing (blower door).

The tribes or TDHEs with projects already completed as of 2012 included the Pokagon Band of Potawatomi Indians, the Akwesasne Housing Authority, the Choctaw Housing Authority, and the Muscogee (Creek) Nation. These demonstration projects primarily requested postconstruction-related TA. In some cases, these demonstration projects requested assistance to benefit planned projects connected with the completed projects.

The demonstration projects with forthcoming construction or rehabilitation primarily requested assistance in making their housing designs more energy efficient. This benchmark included a wide range of recommendations, from changes to site plans, to passive solar orientation, to the incorporation of sustainable materials and technologies. In one case, the TA included helping the housing entity link up with its utility provider to access programs for which the housing entity and tenants were eligible.

59 R-DEN-02502, Task Order No DEN-T0006 Sustainable Construction in Indian Country: 11.

Technical Assistance Provided

Demonstrations	Technical Assistance Provided
Pokagon Band of Potawatomi Indians (Michigan, Indiana)	Appropriate sustainable product, material, and technique recommendations (geothermal costs and incentives); energy modeling; charrette assistance; design recommendations.
Nez Perce Housing Authority (Idaho)	Charrette implementation; energy modeling; appropriate sustainable product, material, and technique recommendations (straw bale); low-income housing tax credit application support; research into certification opportunities.
Cocopah Indian Housing and Development (Arizona)	Liaison in linking to utility program; developing energy modeling; appropriate sustainable product, material, and technique recommendations.
Navajo Housing Authority (Arizona, Utah, New Mexico)	Assistance with developing procurement and bid announcements; design review and recommendations; creating green standards; recommendations for adding sustainability to request for proposals; recommendations for creating a green design review process.
Pawnee Housing Authority (Oklahoma)	Appropriate sustainable product, material, and technique recommendations (insulating concrete forms).
Akwesasne Housing Authority (New York)	Energy modeling; appropriate sustainable product, material, and technique recommendations (for rehabilitating older units).
Choctaw Housing Authority (Mississippi)	Design review and recommendations; site plan recommendations.
Native Village of Kwinhagak (Alaska)	Design revisions and revised construction manual; assistance with product, material, and technique installation.
Muscogee (Creek) Nation (Oklahoma)	Postconstruction testing.

The energy modeling and postconstruction testing yielded TA resource reports that provided communities with useful information. Assessments of energy usage provided communities with completed projects with a baseline against which to measure and compare their future use. Those communities could also use the recommendations section with potential or estimated payback and other cost-effectiveness information to measure against the real-world costs or longevity of their own installed technologies. Likewise, communities planning future projects could use the recommendations sections to plan their budgets and determine how to invest the upfront dollars for a cost-effective return.

All demonstration projects with planned projects received TA, but not all reached their anticipated goals, for a variety of reasons. These reasons were reflective of the findings in the review of current activities

and the national meeting and included—

- Need for additional TA.
- Need to scale back because of lack of anticipated funding, or need to pursue additional funding for added sustainable elements or additional specialists because tribe members or local area residents lacked training in specific techniques.
- Longer learning curve with new techniques or equipment.
- Weather or archeological delays.
- Internal politics.

Case Studies

According to the statement of work, case studies were intended to "provide both technical and general information that will be of value and interest to ONAP and Tribes. The text shall be concise but informative with an emphasis on technologies and builders' experience in both installation and operation after installation. It shall be presented in such a manner that stakeholders can learn from it and take action."[60] Although HUD is emphasizing best practices, "the case study shall include 'challenges to' implementation and strategies for addressing those challenges."[61] SCinIC team members conducted interviews and collected data and images from the Native Village of Kwinhagak, Muscogee (Creek) Nation, Nez Perce Tribal Housing Authority, Cocopah Indian Housing and Development, Pokagon Band of Potawatomi Indians, and the Akwesasne Housing Authority. These case studies are in appendix C.

Outreach

Early in the contract, the initiative established a web presence on the HUD USER website, at http://www.huduser.org/portal/SCinIC/home.html. From this site, users could sign up for periodic e-mail updates, read updates on the progress of the demonstration partners, download TA documents developed under the contract, and learn about training opportunities or other events.

On May 2, 2013, HUD's Office of Policy Development and Research (PD&R) and ONAP cosponsored a reception with Enterprise Community Partners, Inc. The event celebrated sustainable construction projects that were demonstration projects and case studies under both the SCinIC contract and the PD&R Small Grants Program. At the event, 21 communities with 25 projects were represented with case studies, posters, videos, speakers, and other materials. Invitees to the event included federal partners, green and affordable building industry representatives, tribes and TDHEs, and members of Congress.

Training

Training topics were determined based on the outcomes of the national meeting, TA interactions with the demonstration projects, and discussions with trainers on what the next logical steps would be if the HUD Greener Homes regional trainings offered additional indepth information. As a result, HUD offered

60 R-DEN-02502, Task Order No DEN-T0006 Sustainable Construction in Indian Country: 12.

61 R-DEN-02502, Task Order No DEN-T0006 Sustainable Construction in Indian Country: 12.

training sessions titled "Sustainable Construction in Indian Country: Assessing Conventional-Built and Sustainable Buildings." The training session materials are reproduced in appendix D.
Training task activities included site selection, developing an agenda and curriculum, identifying trainers, creating training material and a notebook, marketing, registration, and delivering training.

The curriculum included benchmarking, modeling, state and local utility funding opportunities and policies, and energy-reduction cost measures with a real-life focus on the TA provided to the cold-climate Akwesasne Housing Authority and the warm-climate Cocopah Indian Housing and Development.

Two training sessions took advantage of economies of scale by adding a day of sustainable construction training after a Greener Homes regional training session. The trainer at all sessions was Kate Brown of the University of Illinois at Urbana-Champaign. Her co-trainer at Hogansburg, New York, was Kevin Fitzgibbons, consultant and former HUD official. Data on those trainings, speakers, and participants are in the following tables.

December 13, 2012 **Skirvin Hilton—Oklahoma City, Oklahoma (SPONAP)**	**Overall Rating:**	**100%**
	Number of Participants:	**12**
Attendees		
• Comanche Nation Housing Authority. • Housing Authority of the Choctaw Nation of Oklahoma. • Housing Authority of the Pawnee Tribe. • Muscogee (Creek) Nation Environmental Services. • Osage Nation Housing Department. • Sun'aq Tribe of Kodiak. • HUD Southern Plains ONAP.		
Speakers		
• Tom Lance, Sun'aq Tribe of Kodiak, Alaska; James Williams, Muscogee (Creek) Nation.		

February 14, 2013 Marriott—Albuquerque, New Mexico (SWONAP)	Overall Rating:	100%
	Number of Participants:	22
Attendees		
• Consolidated Solar Technologies. • Dry Creek Rancheria • Energy Tech. • Ho-Chunk Housing and Community Development Agency. • Hopi Tribal Housing Authority. • HUD—EWONAP. • Native American Housing Consultants, LLC. • Navajo Housing Authority. • Navajo Nation Community Housing and Infrastructure Department. • Ohkay Owingeh Housing Authority. • Pueblo Acoma. • Pueblo of Santa Ana Planning and Building Services. • Sandia National Laboratories. • Santo Domingo Tribal Housing Authority. • Santo Domingo Tribe. • U.S. Department of the Interior, Bureau of Indian Affairs.		
Speakers		
• Chelsea Chee, Sandia National Laboratory; Ken Hughes, New Mexico Energy Conservation Management Division; Neil Whitegull, Ho-Chunk Housing and Community Development.		

Part of the AHA's new sustainable housing project included a training center. The AHA offered to provide complementary training space for sustainable construction training. To take advantage of the hands-on opportunities at this location, the training expanded to include a tour of the new sustainable housing and an optional tour of the Frank S. McCullough, Jr., Hawkins Point Visitors Center and Boat Launch, a source of renewable hydropower energy. Data on this training is in the following table.

May 7–9, 2013 Sunrise Acres Training Center—St. Regis, New York	Overall Rating:	100%
	Number of Participants:	23
Attendees		
• Akwesasne Housing Authority. • Eastern Band of Cherokee Indians. • Kickapoo Housing Authority. • Mohawk Housing Corporation. • Seneca Nation of Indians. • St. Regis Mohawk Tribe.		
Speakers		
• Retha Herne, Executive Director, Akwesasne Housing Authority; John MacArthur, Beardsley Design Associates; two residents of the housing complex; staff from the Diabetes Center for Excellence.		

Findings and Recommendations From The Review of Current Activities

Several clearly defined awards, organizations, and certification programs can help an observer locate sustainable residential construction and sustainable affordable residential construction activities—if not really define the universe thereof. They include the U.S. Green Building Council, Enterprise Green Communities, AIA/HUD Secretary's Awards, the Environmental Protection Agency (EPA), Department of Housing and Urban Development, Policy Development and Research Best Practices online, and the U.S. Department of Energy. Tribes and tribal organizations are eligible to participate, but not well represented, in these programs. Thus, it can be difficult to gauge the actual state of sustainable construction in India n Country.

The review of current activities of the Sustainable Construction in Indian Country initiative aimed to identify sustainable construction projects, resources, and technical assistance within Indian Country. Team members interviewed 26 organizational representatives, conducted literature reviews, and followed up with reviews of websites as appropriate. The report reached out to federal agencies, regional tribal housing associations, green building industry organizations, educational organizations, and nonprofit organizations.

The report, completed in July 2011, reported on 37 green tribal residential projects in 18 states that were in the planning stages, in progress, or recently completed, as the following map shows. This list is not all encompassing but does provide a good indication of the scope and popularity of sustainable construction activities taking place in Alaska and the lower 48 states. The enthusiasm for sustainable building in Indian Country was also reinforced when the application process for demonstration projects began; 24 tribes in 15 states sought demonstration project status, nearly all self-selecting. (Of the tribes interviewed, five were listed in the review of current activities, although they did not necessarily seek assistance with the project described in the report.)

Findings

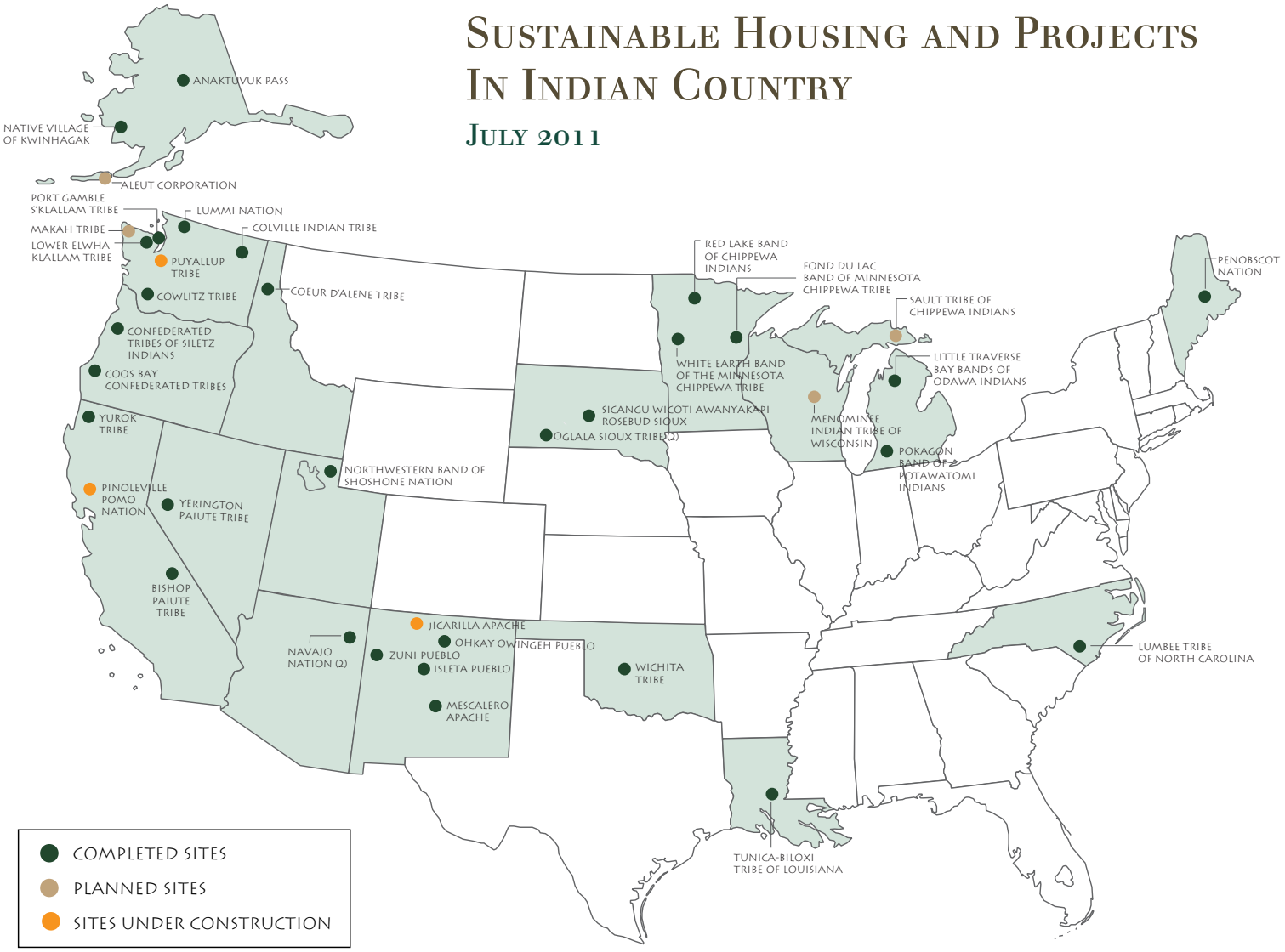
1. **More green building services are targeted toward America Indian and Alaska Native American communities to meet needs related to existing housing projects than to meet needs related to new residential construction projects.**

   More organizations provide training and TA for increasing the sustainability of existing homes. For example, EPA conducts substantial training on assessment and remediation of indoor air quality and mold on existing homes. Since 2005, a HUD program focused on energy efficiency and rehabilitation has conducted approximately 12 energy assessments annually and conducted regional workshops. The federal Bonneville Power Administration has a low-income weatherization program for tribes in the Pacific Northwest.

   Fewer organizations provided training and TA on new construction in Indian Country. Key informants often mentioned the same entities in a given region; for example, Cascadia Green Building Council in Alaska and the Pacific Northwest, Cold Climate Housing Research Center in Alaska, and the Enterprise Green Communities program for American Indians in the Southwest.

Sustainable Housing and Projects In Indian Country

July 2011



2. **Educational entities such as tribal colleges offer avenues for tribes to increase the number of members with professional green building skills.**

   The report found four tribal colleges and one branch of a state university in a tribal community that offered degree or certificate programs in areas related to green-collar construction jobs. The tribal colleges, however, geographically clustered primarily in the Great Lakes, the Dakotas, Montana, and the Southwest.

3. **The ability of tribes to implement sustainable construction technologies may be limited by (1) their lack of internal residential construction capacity, coupled with (2) their inability in small and rural communities to hire general managers or construction firms with experience to implement the technologies.**

   Red Feather Development Group and the Zuni Housing Authority both have implemented successful models for increasing the capacity of housing authorities to carry out their own construction projects, but this model is not common in Indian Country. Most tribes work with the construction firms available in their area, and, when they use tribe members, it is usually in

relatively unskilled capacities. In at least one region, tribes have had difficulty accessing construction firms with experience in sustainable construction technologies, which is especially true when they are required to use the lowest bidder.

4. **Tribal funding sources are very limited.**

   Although regional funding sources such as the Alaska Finance Corporation and the Greater Minnesota Housing Fund exist, most of the funding for residential construction in Indian County comes from government sources such as Indian Housing Block Grant and the Indian Community Development Block Grant. The American Recovery and Reinvestment Act funds used between 2010 and 2012 were a tremendous creator of sustainable residential housing in Native American communities. Housing authorities and tribally designated housing entities typically combine funding from several of or all these sources in conjunction with state or private financing (for example, the New Mexico Mortgage Finance Authority).

5. **Tribes interviewed expressed a desire for TA.**

   Tribes were interested in hearing about the initiative and about resources for additional support and TA.

Recommendations

The report did not include recommendations because it was an exploration of activities and opportunities. The following are two recommendations drawn from the findings to support the continued development of sustainable construction in Indian Country.

1. **Increase national support for TA.**

   Elevate support for TA to a national level in areas including design, construction management, procurement, materials, and certification to provide support for geographic areas with fewer resources.

2. **Increase support for educational resources.**

   Partner with and support colleges and universities serving significant numbers of Native students, including tribal colleges and universities.

Ranking and Recommendations From National Impediments Meeting

This section summarizes the results and recommendations generated by focus groups and the coordination meeting that made up the national impediments meeting.

To help ensure that trainers and technical assistance providers were aware of what factors tribes and organizations working with tribes perceive as impediments to sustainable construction practices, an opening task of this initiative was to conduct a meeting to explore the impediments and the solutions to these impediments. Invited participants from governmental, nongovernmental, and tribal focus groups offered observations regarding impediments to sustainable construction in Indian and Alaska Native American communities. Participants in a followup coordination meeting ranked the impediments associated with sustainable construction and brainstormed about potential solutions. The full report of the meeting is in appendix B.

SIP House Subdivisions on the Mississippi Band of Choctaw Indians Reservation

Image: Pritchard Engineering

Ranking

This list cannot be considered exhaustive because it was developed from small focus groups, but it is indicative of concerns that the TA team members encountered in the field and that training participants echoed. Working from the wide variety of impediments identified by the focus groups, members of the coordination meeting ranked these four impediments to sustainable construction as most important.

1. **Building codes.**
2. **Costs and funding.**
3. **Capacity building.**
4. **Planning.**

The following graphic provides a brief summary of these impediments.

Highest Ranking Impediments to Sustainable Construction in Indian Country	
Building Codes:	Communities develop building codes to protect health and safety, but also to show commitment to particular issues. Minnesota and Washington States, for instance, require compliance with green building codes or standards. Tribes have the ability to adopt existing green building codes or standards, or to create their own. The balancing act with a building code is to avoid being overly strict or posing undue cost burden and, thus, inhibiting desired growth.
Costs and Funding:	Sustainable construction is perceived as more expensive, but this is not always true. Some sustainable construction technologies require more expensive upfront costs; however, the energy savings and more durable housing can offset the higher costs or lead to savings later. Some sustainable construction technologies are more expensive and lack a payoff time that is practical for communities with a strong need for affordability. Some sustainable construction technologies do not add additional construction costs. Education can change the perspective and life cycle assessments and benefit analyses can provide tools to determine the technologies that provide the greatest bang for the affordable buck.
Capacity Building:	Tribal housing authorities may have difficulty building capacity or even maintaining levels of capacity due to understaffing and staff turnover. New elections in tribal council or decreased Federal budget funds can lead to enormous changes in staffing. Some smaller tribes may not have the staffing on a regular basis to carry out the housing development their community needs to keep pace with housing need. Repeated training, onsite training, and partnerships with other organizations are ways to build lasting capacity.
Planning:	Sometimes tribes find themselves planning projects simply because Federal funds are suddenly available. This can lead to a mismatch in community need and available resources—land, staff time, housing, funds, etc. Long-term planning, on the other hand, can help rebalance that mismatch, and support a tribe's overall goals, such as creating a cohesive "place" with increased opportunity for all residents, increasing healthier housing, supporting economic development, and moving toward energy self-sufficiency.

Recommendations

Because the participants in the coordination meeting were primarily from federal agencies, they primarily developed recommendations of what federal agencies may do to assist in resolving these impediments. Given the time constraints and the focus on sustainability, the group primarily limited its recommendations to the first four (the highest ranking) impediments related to the sustainable construction process.

1. Building codes

Green building codes or standards are a topic of interest for tribes in some parts of the country. Green building standards already affect several tribes. In Minnesota, tribes must abide by state green building codes when they incorporate certain types of state funding into affordable housing projects. In Washington State, tribes must abide by the energy code.

These standards comprise another area in which tribes have the freedom to develop standards that reflect their cultural priorities, and they have the option to be more stringent than state standards. The Pinoleville Pomo Nation developed its own green building standards between 2008 and 2012 with TA from the interagency Tribal Green Building Codes Workgroup. One issue they encountered was difficulty getting their units insured.[62] If tribes do not always know that they can develop their own codes and standards, then the housing industry is not always sure what to do with these codes—just as they struggle to incorporate new types of sustainable housing such as straw bale.

In addition, the process does require caution because too much strict regulation can inhibit construction. One possibility is to adapt the International Green Construction Code to each individual tribe's needs. Federal agencies can provide incentives to tribes to implement green practices and to meet green standards. Another part of the process includes considering ways to build tribal capacity to enforce building codes. The level of interest in green building standards at the tribal level is evident in the work of the Tribal Green Building Codes Workgroup.

Best Practices: Building Codes

The interagency Tribal Green Building Codes Workgroup, begun in March 2010, includes more than 50 representatives from federal and tribal agencies and nonprofit organizations engaged in exploring how tribes can adopt or adapt sustainable building codes or standards to support housing that meets "the environmental, social and cultural priorities of Tribal people" (National Tribal Green Building Codes Summit statement). Building codes shape federally funded housing standards in Indian Country, but not all tribes have building codes or standards that express their priorities.

The workgroup held its first summit June 23 and 24, 2011, when it developed a set of priorities that included—

- "It is important to maintain clarity about the need to have tribally-driven and culturally-based process."
- "Our emphasis needs to be on the development of a ***process*** rather than a product, from which tribally determined green building codes, and, or tribe-specific systems can develop."
- "Codes need to support each Native Nation's sovereignty, and be reflective of the community and culture."

For more information, contact Michelle Baker at 415–972–3206 or baker.michelle@epa.gov, or Laura Bartels at 970–379–6779 or laura@greenweaverinc.com.

62 Chee (2013).

2. Costs and funding

Costs and funding are constants, especially in an economic period focused on reduction rather than on growth. The group suggested options for doing more with less, which promote the use of sustainable construction practices from two directions.

- **Education.** The first direction can show tribes how sustainable investments can save money and how tribes can get their money's worth. Each session of the Greener Homes and the Sustainable Construction in Indian Country training provided information on how participants could identify federal, state, and utility funding for sustainability. The SCinIC trainings also included information on contacting state energy offices, locating information on net metering and policies through American Council for an Energy-Efficient Economy, carrying out online benchmarking programs, and accessing data sheets to evaluate payback on sustainable investments.

- **Federal program use.** The second direction, a thorough understanding of federal programs, reveals built-in supports to sustainable construction practices.

Education-related recommendations included letting tribes know how the health benefits of sustainable housing can spill over into savings in other arenas. For example, healthcare costs can decrease when people live in healthier buildings, and maintenance costs can decrease when materials are more durable.

Other suggestions included creating tools to help tribes make smart energy improvement choices, such as cost-benefit analysis tools or a matrix for tribal housing that shows the energy improvements with the greatest returns on investment, similar to the matrix for public housing agencies available at http://www.energystar.gov/index.cfm?c=affordable_housing.affordable_housing_phas. In addition, federal agencies could develop a matrix that enumerates potential governmental funding sources for green improvements. In addition to the funding coordination listed in the previous text box, federal agencies could incentivize sustainable building practices in their grant programs, as they did American Recovery and Reinvestment Act grant programs.

Muscogee (Creek) SIP House

Image: FirstPic, Inc. for HUD SCinIC

Some other education suggestions involved federal agencies reaching out to other housing industry entities such as banks and lenders, insurance companies, and appraisers to educate them on the added value in energy-efficient homes.

Federal programs have flexibility and credibility. Department of Housing and Urban Development (HUD) funding is still often seen simply as housing money, but it is also a tool that tribes can use to leverage other funds. Leveraging can be written into grants as a matching requirement, but HUD staff can also emphasize it in training, when reviewing Indian Housing Plans and when working with tribes. Sustainable building components can be added into existing HUD training curricula. Federal agencies together can ensure that their training and TA efforts cross-reference and consistently provide information on federal efforts such as the Environmental Protection Agency's green labeling programs, HUD's green construction programs, and the U.S. Department of Energy's weatherization and energy efficiency programs. In addition, although it might also be useful for total development costs to include life-cycle costs, tribes are already eligible to apply for a variance to exceed the TDC with area-office approval based on the incorporation of sustainable building technologies.[63]

Best Practices: Federal Agency Funding Coordination

An exciting example of federal agencies joining forces to standardize requirements, combine funding sources, and enhance collaboration is the groundbreaking cooperation between the HUD Office of Sustainable Housing and Communities, the Department of Transportation (DOT), and the Environmental Protection Agency (EPA) on the Interagency Partnership on Sustainable Communities. This partnership promotes better access to affordable housing, more transportation options, and lower transportation costs.

It has also led to coordination planning, policy, and investment such as in the Transportation Investment Generating Economic Recovery (TIGER) II grants. In TIGER II, for the first time, DOT and HUD jointly awarded grants for local planning activities that will eventually lead to integrated transportation, housing, and development.

The U.S. Department of Agriculture and the EPA also assisted with the grant program.

For more information, visit http://www.sustainablecommunities.gov/

3. Capacity building

To expand the capacity of the tribes seeking to develop sustainable housing and communities, participants suggested expanding the services provided by nongovernmental organizations and supporting an increase in the capacity and number of community development corporations (CDCs). Some suggested that the number of Native CDCs with the specific mission of serving Native American communities might be increased. One underused resource may be tribal colleges. Tribal colleges are not only providing critically important training certificates and degrees in sustainable building vocations, they are, in many cases, leading the way in educating their communities and regions about sustainability from a long-term Native perspective. See the following text box for a brief overview of sustainability efforts at one tribal college, the College of Menominee, Sustainable Development Institute.

63 PIH Notice 2010-47.

Best Practices: Capacity Building and Sustainability Education

The College of Menominee, Sustainable Development Institute (SDI) is one example of a college creating a rounded approach to sustainability by increasing campus efficiency, educating and inspiring students and regional communities in sustainability efforts, and providing training in green-collar careers. SDI—

- Provides financial assistance to student interns researching sustainability issues, such as campuswide baseline conditions including energy benchmarking and greenhouse gas emissions, vermiculture, and indoor air quality.
- Has increased the environmental education units in all areas of study and is engaging the campus community on campus sustainable development through nine visioning sessions with more than 90 participants.
- Has engaged Great Lakes-area tribes in climate change education and outreach.
- Supports carpooling and other efforts among staff and on campus.
- Conducts applied, participatory action research as identified by tribes, including the sustainability indicators research project.

For more information, contact Beau Mitchell at 715–799–5600, ext. 3145 or bmitchell@menominee.edu.

During this meeting, a few participants reacted to the need for education because of frequent leadership and other turnover and also to help leadership embrace quality, which would decrease the need to rebuild as frequently. These recommendations, similar to suggestions mentioned previously, include providing incentives and rebates for sustainable construction, developing baselines and collecting comparison information on efficiencies and savings, adapting analyses on sustainability in other communities for Native American communities, and getting the word about model tribal projects out to other tribes. One suggestion was for a tribal college version of the solar decathlon, where college teams compete to build innovative, affordable houses—often rooted in their regional culture or meeting a regional need—powered with solar energy. For sustainable building to be successful, educating prospective homeowners is as important as educating leadership, because they will live in and need to maintain the final product.

Tribal capacity building also refers to the need to develop specific technical skill sets that will enable Native American communities to control some costs of sustainable construction by doing the work inhouse.

The partnership of the U.S. Army Corps of Engineers (USACE) and American Indian tribes in Oklahoma offers a different model, wherein smaller tribes that lack the capacity and staffing to carry out aspects of a construction project can collaborate with USACE. USACE takes on some of the technical aspects and wins quality and cost gains for the tribes.

Best Practices: Capacity Building

Smaller tribes do not always have the capacity or staffing to manage construction projects. In Oklahoma, because of a memorandum of understanding between HUD and USACE, allowed by 10 U.S.C. 3036d, the Chief's Economy Act, tribes can partner with USACE to help with their grant applications and project management.

USACE will work with tribes to provide supporting documentation for their project applications, which adds credibility to the package. This documentation can include floor and site plans, a letter of support, and cost estimates. If the project is awarded, the tribe enters into a contract to pay USACE approximately 6 percent of a grant.

USACE, as is typical, will provide the tribe with request for qualifications and interview support, documentation for the audit process, analysis of prospective subcontractor cost proposals, and design review. USACE has structural, mechanical, and architectural engineers on staff.

During the project, USACE provides tribes with multiple quality assurance inspections, which have led to an increase in the quality of materials used in projects and an increase in the square footage of projects. They review the pay application to ensure that anticipated work is completed before payment is made, ensure that the punch list is completed, and conduct a warranty inspection slightly before a year after completion.

For more information, contact Cynthia Kitchens at 918–669–7042 or cynthia.kitchens@usace.army.mil.

4. Planning

Sustainable construction does not mean simply adding energy efficiency to individual housing units, it also means planning for long-term community development. Many tribes are already creating long-term plans with their communities to guide land purchases, housing development, and funding and site placement decisions. The Pokagon Band of Potawatomi Indians have been conducting long-term planning since 2004, whereas the Pine Ridge Oglala Lakota Sioux approved their first long-term plan in 2012. The Navajo Nation has long had planning sessions within its 10 chapters, and the chapters have developed their own plans—with varying degrees of success. During 2010 and 2013, however, the Navajo Nation, through the Navajo Housing Authority, has launched a comprehensive planning project to identify available land for construction, collect information from residents about types of housing and site uses desired, and evaluate barriers to land use and siting. The process takes time and is likely to change as chapter needs change and residents learn more about planning. In addition, without TA to support the resolution of some barriers to development, the housing so urgently needed by the community is not likely to be built.

Participants in the coordination meeting suggested that the federal government was well positioned to encourage and support long-term sustainable planning by informing tribes about available resources. These resources include Indian Community Development Block Grant funds, Economic Development Administration public works planning grants, and Administration for Native Americans grants that support long-range planning. In addition, federal agencies can let

tribes know about their own regional planning commissions, which may have technical staff available to support communities with needs such as community comprehensive planning, grant preparation and assistance, mapping services, hazard mitigation planning, and environmental assessments. They can also alert tribes to planning assistance training opportunities available through organizations including the National American Indian Housing Council and the Native Learning Center.

The Mayor's Institute on City Design is a National Endowment for the Arts initiative that helps transform communities through design by preparing mayors to be the chief urban designers of their cities. Participants suggested that federal agencies could team up to create a tribal version to bring sustainable development concepts to more tribal leaders.

5. Federal coordination.

Participants also offered some overarching recommendations to facilitate better information sharing and resource use among federal agencies.

- Identify the right contact person in other agencies to provide TA or services. Federal agency staff do not always know their counterparts in other agencies or realize who offers what services within a federal agency. Regional contact lists could help.
- Coordinate and schedule trainings and meetings jointly rather than having multiple meetings with tribes.
- In a similar way, coordinate among agencies to align agency visits to tribes.
- Support local and regional training with multiple-agency presence.
- Implement a joint project wherein agencies work together on, for example, a master plan, a green building toolkit, or a green building codes or standards toolkit.
- Develop a clearinghouse of meetings on sustainability topics relevant to tribes.
- Conduct interagency meetings or establish an interagency workgroup.

Conclusion

The Sustainable Construction in Indian Country initiative has provided education, training, and technical assistance in sustainable technologies to Native American communities both for new building and for increasing the sustainability and health of existing homes. Between 2011 and 2013, the initiative helped build relationships among tribal staff and sustainability specialists, and it promoted the use of available tools for helping Native American communities make informed decisions about which sustainable construction technologies to implement. For example, tribes received free blower-door testing and free modeling and benefit-analysis software, which enabled them to make the most cost-effective choices. Further, the initiative supported and highlighted regional best practices in case studies that will inspire and educate tribes.

Key findings identify both impediments to and supports for sustainable construction in Indian Country. Many obstacles to sustainable development in Indian Country are the same as the obstacles to conventional development in Indian Country, including an often short building cycle, staff turnover, land ownership and usage issues, rural location, and political roadblocks.

Some obstacles are specific to sustainable construction. Of potential concern is that the upfront costs will result in the construction of fewer units in areas with housing shortages and pent-up demand. Tribal housing authority staff and local planners and architects may not be familiar with sustainable construction techniques or have the capacity to adequately maintain sustainable homes. Further, local construction teams may not have expertise or experience in building with the new technologies. Finally, although more options are becoming available, at present, funding is still mostly limited to federal resources.

The initiative also identified supports and rewards for sustainable construction. Strong enthusiasm exists among tribes that already have implemented sustainable technologies, and they are eager to share their experiences with other tribes. Several organizations are providing training and TA for sustainable building in Indian Country, as are several colleges and universities serving substantial American Indian and Alaska Native populations.

Although these types of supports tend to focus in certain regions of the country—primarily Alaska, the Southwest, and the Pacific Northwest—they represent a major step in building capacity for funding, selecting, designing, and building sustainable projects. In addition to providing more affordable and healthy housing, sustainable construction is integral to many Native American communities. Not only do most tribes value and respect the environment, sustainable construction enables them to incorporate culturally relevant features in their designs.

The findings of the initiative have resulted in recommendations for continuing support for sustainable construction. One set of recommendations is to encourage tribes to adopt sustainable construction by having experts champion sustainable strategies in conferences, trainings, blogs, and other outreach efforts. Financial recommendations include leveraging available federal resources and materials to support tribes and tribally designated housing entities, encouraging green building within federal programs and funding sources, and supporting funding for and partnerships with local tribal colleges and other colleges and universities with a strong Native presence in their efforts to create sustainable construction programs.

The results of this initiative also recommend supporting tribes in making informed decisions about the cost-effectiveness of different sustainable strategies by providing software and analyses that give them concrete information about anticipated outcomes and costs.

Increasing the use of sustainable construction technologies in Indian Country, as in the rest of the country, carries an appeal for additional financial incentives to support the incorporation of these technologies.

A change in perspective, however, may be equally critical to encouraging acceptance of and desire for sustainable construction technologies. This new perspective includes the following insights.

- Sustainable housing does not have to be in conflict with issues of overcrowding or the replacement of substandard housing. As one meeting participant framed it, "Housing development that is not sustainable perpetuates the current problem. It impoverishes families with high energy costs, high maintenance costs, and health issues."

- Sustainable housing does not have to be more expensive over the life of the housing unit. The inclusion of cost-effective sustainable technologies does require making informed choices based on the availability of materials, the suitability of materials to climate and housing unit, the return on investment, and budget considerations.

- Sustainable housing offers health and financial benefits for residents. The savings from reduced energy costs or doctors' visits—in the case of decreased asthma attacks, for example—can be redirected to other family needs.

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HUD, Office of Public and Indian Housing. 2007. *Office of Native American Programs: Report to Congress, Fiscal Year 2006*. Washington, DC: Government Printing Office.

United Association of Higaonon Tribes. n.d. "Native American Quotes About Nature." Available at http://www.unahi.org/quotes/native-american-quotes.htm (accessed August 15, 2012).

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Appendix A:
Review of Current Activities

(July 18, 2011)

Sustainable Construction in Indian Country

Contract: C-DEN-02370; Task Order DEN-T00006

Sustainable Construction in Indian Country
Task 1a - Current Demonstration, Technical Assistance and Training Activities Letter Report

Submitted
July 18, 2011

Submitted to:

Mike Blanford, GTM
Anna Lloyd, GTR
Millie Egan, CO

Submitted by:

FirstPic, Inc.
2614 Chapel Lake Drive
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Sustainable Construction in Indian Country
Task 1a - Current Demonstration, Technical Assistance and Training Activities
Executive Summary

Description of Work

FirstPic, Inc. completed Task 1a and produced a letter report consisting of an executive summary and two products. The first is a comprehensive list of key informants with extensive knowledge about sustainable residential construction projects in American Indian and Alaska Native (AIAN) communities. This listing was developed in consultation with the Government Technical Monitor Mike Blanford, Eastern/Woodlands Office of Native American Programs Administrator Kevin Fitzgibbons, and members of the FirstPic, Inc. team.[1] There was a systematic effort to include key informants from diverse sectors, and to contact not only organizations that provide training, technical assistance and/or funding, but also who are highly knowledgeable about other, less visible entities working in Indian Country, and about sustainable construction projects that currently are underway or recently have been completed.

Key informants represent federal and regional government (for example, the U.S. Department of Housing and Urban Development (HUD) Office of Native American Programs (ONAP) Area Offices, U.S. Environmental Protection Agency (EPA), and Department of Energy), non-governmental organizations (for example, regional housing associations and housing councils), research centers (for example, Cold Climate Housing Research Center and Construction in Indian Country), tribal colleges, and a range of other affiliations.

The key informants, in turn, provided many additional contacts and organizations which are catalogued on the second product: a list of organizations that provide training, technical assistance, and/or funding to support sustainable construction activities in Indian Country. It was compiled from the information obtained in the key informant interviews, augmented by the material on their organizations' Web sites, FirstPic's follow-up research, and the 2011 Healthy Homes Summit. The list consists of two categories: organizations that provide funding for sustainable construction, and organizations that offer training and/or technical assistance to support sustainable construction. Entities that offer both funding and training are listed in both sections to facilitate identifying which organizations supply each of these services.

In order to provide the most useful picture of the services being offered in Indian Country, each of the two listings includes:

- Contact information
- General description of services
- Region served (if known)
- Tribes served – note that an entity may serve more tribes than we were able to name
- Other information –more details about the services offered and/or key informants' perspectives on sustainable construction in Indian Country

[1] FirstPic, Inc. team members involved in development of the initial informant list included Kate Brown, Daniel Glenn, Jim Anderson, Robert Nemeth, Lynda Lantz, Christine Velez, Laura Appelbaum, and Mindi D'Angelo.

Overview of Findings

There appear to be fewer "green" building services targeted toward AIAN communities for new resident construction projects as compared to existing home projects. There are a limited number of organizations providing training and technical assistance on new construction in Indian Country. Key informants often mentioned the same entities in a given region: for example, Cascadia Green Building Council in Alaska and the Pacific Northwest, Cold Climate Housing Research Center in Alaska, and the Enterprise Green Communities program for Native Americans in the Southwest.

A greater number of organizations provide training and technical assistance for increasing the sustainability of existing homes. For example, the EPA does a lot of training on assessment and remediation of indoor air quality and mold on existing homes. HUD conducts 12 energy assessments annually as well as regional workshops which focus on energy efficiency and rehabilitation. The federal Bonneville Power Administration has a low-income weatherization program for tribes in the Pacific Northwest.

Educational entities such as tribal colleges are a good way for tribes to increase the number of members with professional green building skills, but tribal colleges primarily are clustered in the Great Lakes, the Dakotas, Montana and the Southwest. Red Feather Development Group and Zuni Housing Authority both have implemented successful models for increasing the capacity of housing authorities to carry out their own construction projects, but this is not common in Indian Country. Most tribes work with the construction firms that are available in their area, and when they use tribal members it is usually in relatively unskilled capacities. In at least one region, tribes have had difficulty accessing construction firms with experience in sustainable construction technologies. This is especially true when they are required to use the lowest bidder

While there are regional funding sources such as the Alaska Finance Corporation and the Greater Minnesota Housing Fund, most of the funding for residential construction in Indian County comes from government sources such as Indian Housing Block Grant (IHBG), Indian Community Development Block Grants (ICDBG), and American Recovery and Reinvestment Act (ARRA) funds. Occasionally, funding for residential housing construction is tied into a larger Community Development Plan; this is the case with the Thunder Valley Project in the Pine Ridge Reservation. Housing Authorities and tribally designated housing entities (TDHEs) typically combine funding from several or all these sources in conjunction with state or private financing (for example, the New Mexico Mortgage Finance Authority).

Other Information

As part of the data collection process for Task 1a, we compiled a list of sustainable residential construction projects that tribes recently have completed, are currently underway with, or are planning. Although this is not intended to be a comprehensive inventory, it does provide a good indication of the scope of sustainable construction activities taking place in Alaska and the lower 48 states. This list will be provided this week.

KEY INFORMANTS ON SUSTAINABLE CONSTRUCTION IN INDIAN COUNTRY
JULY 18, 2011

Federal Organizations

Organization: Alaska ONAP
Contact Name: David Vought
Title: Native American Program Specialist
Phone: 907-677-9862
Email: david.vought@hud.gov

Organization: Bonneville Power Administration
Contact Person: Nathan Dexter, Tribal Affairs Manager or
Carrie Nelson, Low-Income Weatherization for Tribes
Phone: 503-230-7306; 503-230-4125
Email Address: nldexter@bpa.gov
Both out spoke with: Molly Moreland at 503-230-7685

Organization: Department of Energy Tribal Energy Program
Contact Name: Lizana Pierce
Title: Director
Phone: 303-2754727
Web Address: http://apps1.eere.energy.gov/tribalenergy/about.cfm

Organization: Eastern Woodlands ONAP
Contact Name: Brian Gillen
Title: Native American Program Specialist
Phone: 800-735-3239 or 312-913-8626
Email: Brian.Gillen@HUD.gov

Organization: Environmental Protection Agency, Region 8
Contact Name: Alfreda Mitre
Title: Region 8, EPA Director, Tribal Assistance Programs
Phone: 303-312-6343

Organization: Northern Plains ONAP
Contact Name: Randall Akers
Title: Administator
Phone: 303-672-5160
Email: Randall.R.Akers@hud.gov

Organization: Northwest ONAP
Contact Name: Tom Carney
Title: GM Director
Phone: 206-220-6204
Email: tom.carney@hud.gov

Organization: Southern Plains ONAP
Contact Name: Michelle Tinnin
Title: Native American Program Specialist
Phone: 405-609-8532
Email: Michelle.K.Tinnin@hud.gov

Organization: Southwest ONAP
Contact Name: Carolyn J. O'Neil
Title: Administator
Phone: 602-379-7235
Email: Carolyn.J.O'Neil@hud.gov

Organization: ONAP, U.S. Department of Housing and Urban Development
Contact Name: Robert Lamp
Title: Title VI Loan Guarantee Specialist
Phone: 202-402-4134
Email: Robert.A.Lamp@hud.gov

National Non-profit Organizations

Organization: Enterprise Green Communities
Contact Name: Rose Marquez
Phone: 505-216-0928
Email: rmarquez@enterprisecommunity.org
Web Address: http://www.enterprisecommunity.org/programs/native_american/

Organization: National American Indian Housing Council (NAIHC)
Contact Name: John D. Siegnemartin
Title: Training and Technical Assistance Program Director
Phone: 850-939-4256
Email: jseignemartin@naihc.net
Web Address: http://www.naihc.net/

Organization: National Tribal Healthy Homes Assessment, Training and Technical Assistance Support Center
Contact Name: Mike Vogel
Title: Executive Director
Phone: 406-581-2432 or 406-994-5417
Email: mvogel@montana.edu
Web Address: http://tribalhealthyhomes.org/

Regional Non-profit Organizations

Organization: Association of Alaska Housing Authorities
Contact Name: Dan Duame
Title: President
Phone: 907-563-2146 (work); 907-441-9313 (cell)
Email: dan.duame@aleutian-housing.com

Organization: Cold Climate Housing Research Center (CCHRC)
Contact Name: Jack Hebert
Title: President and CEO
Phone: 907-457-3454
Email: jack@cchrc.org
Web Address: http://www.cchrc.org/

Organization: Corporation for Supportive Housing, American Indian Supportive Housing Initiative
Contact Name: Zoe LeBeau and Leah Lindstrom
Title: Senior Program Managers
Phone: 612- 418-0769 (cell)

Organization: Nevada-California Indian Housing Association
Contact Name: Phil Bush
Title: President
Phone: 530-596-4127
Email: bushconsulting@thegrid.net or modoclasseniaj@thegrid.net

Organization: Northwest Indian Housing Association (NWIHA)
Contact Name: Joe Diehl
Title: Executive Director
Phone: 206-290-5498
Email: nwiha@aol.com
Web Address: http://www.nwiha.org/index.html

Organization: Southern Plains Indian Housing Association
Contact Name: Billy E. Komahcheet
Title: President
Phone: 405-547-2402 ext 231-work; 405-334-2184-cell
Email: bkomahcheet@iowanation.org
Web Address: http://www.spiha.org/default.aspx

Organization: Southwest Tribal Housing Alliance
Contact Name: Michael Chavez
Title: President
Phone: 505-782-4550 or 505-782-4564
Email: mchavez@pozha.org

Organization: United South and Eastern Tribes (USET) Environmental Liaison Office
Contact Name: Steve Crawford
Title: Natural Resources Chairman
Phone: 207-853-2600 x 238
Web Address: http://www.usetinc.org/Programs/USET-Environmental/HomeELO.aspx

Educational Organizations

Organization: College of Menominee Nation
Contact Name: Dr. Holly YoungBear-Tibbetts
Title: Dean of External Relations
Phone: 505-466-3206
Email: Tangram@hughes.net
Web Address: http://www.menominee.edu

Organization: Construction in Indian Country (CIIC) in partnership with the Arizona State University, Del E. Webb School of Construction
Contact Name: Kim Silentman-Kanuho
Title: Senior Coordinator
Phone: 480-727-3105
Email: ciic@asu.edu
Web Address: http://construction.asu.edu/ciic/index.html

ORGANIZATIONS CONDUCTING TRAINING AND TECHNICAL ASSISTANCE ON SUSTAINABLE CONSTRUCTION IN INDIAN COUNTRY

JULY 18, 2011

Organization: Alaska Building Science Network (ABSN)

Contact Person: Scott Anaya, Executive Director

Phone: 907-562-9927

Email Address: absn@alaska.net

Web Address: http://www.absn.com/

Type of Activity: Training and technical assistance

Region Served: Alaska

Tribes Served: Under Village End Use Efficiency Measures (VEUEM), ABSN worked in Arctic Village, Atmautluak, Brevig Mission, Chignik, Chitina, Crooked Creek, Ekwok, False Pass, Hughes, Kipnuk, Kwethluk, Lower Kalskag, Levelock, New Stuyahok, Nightmute, Nikolski, Pedro Bay, Saint Michael, Stebbins, Steven's Village, Stoney River, Takotna, Tooksook Bay, Tuluksak, Tuntutuliak, Unalakleet, Upper Kalskag, White Mountain

General Description of Services: Each year, ABSN conducts over 100 trainings all throughout Alaska for a variety of audiences such as residential contractors, housing authority staff, mechanical contractors, energy raters, home owners, vocational technical students, rural facility and maintenance managers, Real Estate agents, home inspectors, carpenters, and other groups who request trainings. In addition to fee classes, ABSN gets funding from Alaska Housing Finance Corporation, Alaska Eenergy Authority, Denali Commission, and the Environmental Protection Agency to help facilitate many of their classes, especially those they conduct in rural Alaska. Each year ABSN also provides technical assistance to dozens of individuals and entities on a variety of building science topics.

ABSN's Community Energy Efficiency Program (CEEP) consists of energy efficiency audits, training and upgrades performed primarily in rural Alaskan community buildings. ABSN's CEEP Program started in January 2005. ABSN conducted work under an AEA's VEUEM with funding from the Denali Commission. From January 2005 to December 2010, ABSN completed work in 49 villages throughout Western and Interior Alaska to help them achieve energy savings by replacing or installing energy-efficient lighting, switch boxes, motion sensors, set back thermostats, weather stripping and low mass boilers.

Other Information: With high fuel prices, villages are working in cooperation with ABSN to expand their work, providing in-kind labor, free housing, and additional supplies. As a result, significant progress toward community energy efficiency is being achieved. Whenever possible, ABSN hires local labor and provides project-specific training along with boiler maintenance training (from Web site). ABSN publishes a quarterly newsletter, provides technical training workshops, continuing education credits, can perform energy audits, make energy efficiency recommendations, and train construction crews, building owners, maintenance workers and occupants.

Their technical assistance ranges from simply answering an email or phone call, to proofing building plans and energy systems, to providing hands-on technical training or inspection of the building envelope or mechanical systems. For the most recent completed fiscal year, ABSN provided technical assistance on approximately 175 occasions. Sample clients include: AHFC, Energy Raters, Housing Authorities, Building America project in Hydaburg, Tribal Governments, Habitat for Humanity, homeowners, Residential Contractors, and a variety of other professions and entities.

Sample topics include: boiler sizing, vapor retarders, green building products, XPS foam, ice dams, AkWarm, non VOC paint, energy savings, lighting, tax credits, Remote Wall Systems and Outside Insulation Techniques, wet spray cellulose, ground source heat pumps, windows, attic and crawlspace ventilation, water heaters, soy-based insulation, Building Energy Efficiency Standards (BEES), duct leakage testing, EnergyGauge, blower door testing questions, thermal loss for heated sidewalks, blueboard, caulks and foams, radiant heat, heat recovery ventilators, boiler fuel use, green design, and a whole host of other building related topics.

2010 - 2012 Update: ABSN has new funding, over $3.4mil for work in 48 communities across Alaska. In the next two years they will train approximately 175-200 local workers in these 48 Villages to conduct lighting and weatherization upgrades on their community buildings. Part of this program is also funded through a partnership with the Bristol Bay Native Association and they will conduct the same efforts in 14 communities in the Bristol Bay Region. ABSN also will work in partnership with the Alaska Works Partnership and AHFC to develop a trained work force in these communities that can conduct the energy efficiency upgrade work thoroughly and safely. The communities ABSN will be working with include: Aleknagik, Chignik Lake, Clark's Pt., Ekuk, Ekwok, Koliganek, Levelock, Manokotak, Naknek, New Stuyahok, Nondalton, Portage Creek, Togiak, Twin Hills, Deering, Kiana, Shishmaref, Teller, Chignik, King Cove, Kokhanok, Akutan, Cold Bay, False Pass, Port Heiden, Buckland, Elim, Kobuk, Koyuk, noorvik, Saint Michael, Selawik, Shakoolik, Shungnak, White Mountain, Houston, Kachemak, Seldovia, Gustavus, Hydaburg, Klawock, Pelican, Petersburg, Tenakee Springs, Thorne Bay, Aleknagik, Clark's Pt., Dillingham, Egegik, and Newhalen.

Organization: Alaska Craftsman Home Program (ACHP)

Contact Person: Rob Jordan, Executive Director

Phone: 907-258-2247

Email Address: achp@alaska.net

Web Address: http://www.achpalaska.com/index.html

Type of Activity: Training

Region Served: Alaska

General Description of Services: Since its beginnings, ACHP has and continues to provide education in energy-efficient building technology throughout the State of Alaska. All ACHP workshops, publications, and projects are designed specifically for Northern regions. They offer workshops for professionals, as well as free workshops for the public to do or direct energy efficient improvements.

Other Information: The Alaska Craftsman Home Program, Inc. is an educational building industry alliance that promotes energy-efficient housing that is cost-effective, healthy, and durable . ACHP is the first program of its kind in the United States. It was formed in 1987 with the assistance of the State of Alaska Office of Energy Programs, in conjunction with the University of Alaska Cooperative Extension service, Energy Rated Homes of Alaska, and the Alaska State Home Builders Association. ACHP was formed in 1987 (from Web site). It offers Building Performance Institute Analyst Training, professional workshops, and classes.

Organization: Alaska Housing Finance Corporation (AHFC)

Contact Person: Mimi Burbage, Energy Specialist ; Scott Waterman, Energy Specialist

Phone: 907-330-8192 (Mimi); 907-330-8195 (Scott)

Email Address: mburbage@ahfc.us ; swaterma@ahfc.us

Web Address: http://www.ahfc.state.ak.us

Type of Activity: Training and funding

Region Served: Alaska

General Description of Services: AHFC is a self-supporting public corporation with offices in 16 communities statewide. It provides free classes for potential homebuyers and statewide financing for multi-family complexes, congregate facilities, and single-family homes, with special loans for first-time home buyers, low- and moderate-income borrowers, veterans, teachers, nurses, public safety officers, and those living in rural areas of the state. AHFC is also a key provider of energy and weatherization programs in the state. According to David Vought, they are a "very significant housing partner throughout the state."

Organization: Bonneville Power Administration

Contact Person: Nathan Dexter, Tribal Affairs Manager

Phone: 503-230-7306

Email Address: nldexter@bpa.gov

Web Address: http://www.bpa.gov/corporate/About_BPA/tribes/

Type of Activity: Funding, training and technical asistance

Region Served: Northwest

Tribes Served: Colville, Coeur d'Alene, Kalispel, Kootenai, Nez Perce, Spokane, Umatilla, Upper Columbia United Tribes, Warm Springs, Yakama, Blackfeet, Burns Paiute, Ft. McDermitt, Confederated Salish and Kootenai, Shoshone Bannock, Shoshone-Paiute Tribes, Cedarville, Chehalis, Confederated Coos Lower Umpqua & Siuslaw, Coquille, Cow Creek, Cowlitz, Ft. Bidwell, Grand Ronde, Hoh, Jamestown S'Klallam, Klamath, Lower Elwha, Lummi, Makah, Muckleshoot, Nisqually, Nooksack, Pit River, Port Gamble S'Klallam, Puyallup, Quileute, Quinault, Samish, Sauk-Suiattle, Siletz, Shoalwater Bay, Skokomish, Snoqualmie, Squaxin Island, Stillaguamish, Suquamish, Swinomish, Te-Moak of Western Shoshone, Tulalip, Upper Skagit

General Description of Services: Bonneville Power Administration (BPA) has a Tribal Energy Group that provides training and funding for energy audits and whole house assessments. They work with Tribes in Oregon, Idaho, and Washington. The local power company has to be affiliated with Bonneville in order for the community to receive training and/or funds.

Other Information: BPA, a nonprofit federal agency, has two types of programs. It funds energy efficiency measures through its public utilities. The public utilities select projects in their service areas. There are also set asides for low-income weatherization projects for tribes. This was how the Lower Elwha Klallam Tribe installed ductless heat pumps in 30 percent of their housing units. These were installed by the Clallam power utility district. The program was so popular that the tribe funded the installation of additional units through its general fund.

Organization: Building Science Academy (BSA)

Phone: 616-887-2311

Web Address: http://www.buildingscienceacademy.com

Type of Activity: Training

Region Served: Michigan

Tribes Served: Keweenaw Bay Indian Community

General Description of Services: Building Science Academy is a licensed Michigan Proprietary School with the State of Michigan that is committed to providing every individual with the skills to enter the energy efficiency and green jobs work force. This includes entry level workers with no experience in construction or energy auditing. They are committed to not just preparing students for certification but with giving them the knowledge and hands-on experience and capabilities to put their certification to work.

BSA students have access to over 300 hours of building science curriculum preparing them for careers in the energy efficiency and the new green job economy. BSA is an affiliate training organization of the Building Performance Institute (BPI) to provide Building Analyst and Envelope Professional training courses for individuals who want to pursue a career related to utility programs, weatherization programs or with contractors as energy auditors. In addition, they offer Air Sealing and Insulation and Contractor Installation training courses. Their Web site provides detailed information about all of the training that they offer.

BSA has a Tribal Training Director.

Other Information: BSA assists community colleges and universities in implementing energy efficiency programs. In addition, BSA can accommodate the needs of many non-profits specializing in renewable energy, recycling, and the environment by conducting specialized training or expanding their existing training programs. They also partner with government agencies and non-profits who are seeking federal grants in energy efficiency.

Organization: Cascadia Green Building Council, a chapter of the U.S. Green Building Council

Contact Person: Mark Mastellar, Alaska Director

Phone: 907-373-2723

Email Address: mark@cascadiagbc.org

Web Address: http://www.cascadiagbc.org

Type of Activity: Training

Region Served: Oregon, Washington, British Columbia and Alaska, but also includes members from as far away as Idaho and Montana. Helps the U.S. and Canada Green Building Councils meet their goals in the Pacific Northwest

General Description of Services: Sponsors trainings and seminars. They are running a competition for the Association of Alaska Housing Authorities, which wants to encourage green building and reduce housing costs. The contest is for Living Aleutian Home Design Competition. The competition will begin at the end of 2011 in partnership with the Aleutian Housing Authority. The contest will be open October 1, 2011-January 18, 2012. They are seeking a "practical, affordable and replicable" design that is suited to the harsh landscape and high energy and materials costs in the Aleutian tribal communities.

Cascadia does advocacy, research and technical consulting, outreach, education and training (through lecture series and workshops).

Organization: Cold Climate Housing Research Center

Contact Person: Jack Hebert; Michele Doyle

Phone: 907-457-3454

Email Address: jack@cchrc.org; michele@cchrc.org

Web Address: http://www.cchrc.org

Type of Activity: Research and housing design; education; training available in the future

Region Served: Alaska

Tribes Served: Anaktuvuk Pass, Native Village of Kwinhagek, Atqasuk

General Description of Services: The Cold Climate Housing Research Center (CCHRC) is an industry-based, nonprofit corporation created to facilitate the development, use, and testing of energy-efficient, durable, healthy, and cost-effective building technologies for people living in circumpolar regions around the globe. Located in Fairbanks, Alaska, the Research Center was conceived and developed by members of the Alaska State Home Builders Association and represents more than 1,200 building industry firms and groups. Ninety percent of CCHRC's charter members are general contractors from across the state.

CCHRC has its own architectural team to do housing design, and the Sustainable Northern Communities program focuses on green building. CCHRC has sponsored prototype homes in a number of communities (see Alaska ONAP and other information). CCHRC provides information and education on solar power, solar thermal, wind power, heating systems and energy efficiency. David Vought reported that they are trying to get funding to create designs for tribes, because one design won't meet the needs of every part of Alaska.

Other Information: The Sustainable Northern Shelter project was initiated in 2008 to address the needs for sustainable rural housing in northern climates. The project investigates, develops and incorporates many sustainable solutions that will benefit northern communities by demonstrating a culturally designed, affordable, replicable and simply constructed home that uses very little water or energy. As interest in the program grew, the title was changed to Sustainable Northern Communities to reflect the many projects now being done in different areas of the state. The Tagiugiullu Nunamiullu Housing Authority (TNHA) is partnering with CCHRC to develop a design for affordable, energy efficient, healthy, homes in six North Slope villages. The homes feature a unique foundation system adapted to the permafrost conditions in the high arctic. Up to four homes will be constructed in the community of Atqasuk, with plans to expand design and construction in the communities of Wainwright, Point Lay, Nuiqsut, and Kaktovik. This project includes the prototype homes that were built in Anaktuvuk Pass and Kwinhagek.

Organization: College of Menominee Nation

Contact Person: Dr. Holly Youngbear-Tibbetts

Phone: 505-466-3206

Email Address: Tangram@hughes.net

Web Address: http://www.menominee.edu

Type of Activity: Research and education

Region Served: National

Tribes Served: All

General Description of Services: Menominee is internationally recognized for their work in sustainable construction. They have a sustainable residential building systems technical diploma. They partner with the U.S. Forest Service to do sustainable forestry research and education, and they have an extension center (with the Forest Products Lab).

Other Information: Tribal colleges are a good way to move the message of sustainable construction forward for two reasons: (1) Campuses are using green materials and design in the construction of their buildings and are excellent demonstration sites, and (2) Tribal colleges offer a building trade program that includes application of green materials, technology, and design. There are 36 tribal colleges clustered in few areas: Great Lakes (11), New Mexico (1), Arizona (2), Montana (7), North Dakota (4), South Dakota (5), Pacific Northwest (1). A list of tribal colleges can be found at: http://www2.ed.gov/about/inits/list/whtc/edlite-tclist.html

Organization: Construction in Indian Country (CIIC), Arizona State University, Del Webb School of Construction

Contact Person: Kim Kanubo

Phone: 480-727-3105

Email Address: ciic@asu.edu

Type of Activity: Training

Region Served: Southwest

Tribes Served: Navajo

General Description of Services: Mission is to promote positive construction in native communities and to educate Native Americans. Offer workshops through annual construction convention held each April or May. Completed 8th annual conference this past April. This year adding mobile seminars -- go to communities and provide information on "Construction 101" -- they teach people about the construction process. They provide training to tribes and contractors.

Other Information: (1) They are working on becoming a clearinghouse for all the construction needs in Indian Country -- want to be a one-stop shop, the go-to place for Indian construction. (2) They have not focused on sustainable construction training, but Kim stressed that they have the capacity to put together training on any construction issue. They tailor their seminars to the needs of their audience. They use a network of speakers who can train in the areas of interest. (3) They will be charging for workshops and training, with cost starting at $5,000.

Their annual conference included one session titled *Indigenous Materials and Sustainable Practices*. The panel featured a construction company which uses sustainable design and construction practices; an overview by a company which uses geothermal energy for commercial scale projects on tribal lands leading to cost and water saving and other environmental benefits; and a Native-owned photovoltaic solar development company which specializes in turnkey solar solutions in Indian Country.

Organization: Denali Commision (The)

Contact Person: Karen Johnson, Program Manager

Phone: 907-271-3036

Email Address: karenj@denali.gov

Web Address: http://www.denali.gov

Type of Activity: Training and funding

Region Served: Alaska

General Description of Services: The Denali Commission has placed job training at the center of its comprehensive plan for economic growth in Alaska. This includes construction. In just a few short years, the Commission has made significant strides in assisting rural communities with their workforce development needs. As the Commission funds projects for new clinics, roads, and tank farms, it also builds sustainability into those projects by providing training for local residents to maintain and operate the new facilities.Types of projects funded include infrastructure related energy cost reduction and renewable and alternative energy.

Other Information: Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplify effective and efficient partnership between federal and state agencies, and the private sector. Under "project database" on their Web site, can click on the State of Alaska icon to view an interactive map of all Denali Commission projects by funding year, location, and program area.

Organization: Development Center for Appropriate Technology

Contact Person: David Eisenberg, Executive Director

Phone: 520-624-6628

Email Address: strawnet@gmail.com

Web Address: www.dcat.net

Type of Activity: Training and technical assistance

General Description of Services: Education through publications, presentations at conferences, universities, and speaker series; Web-based resources, including: Forum for information, referral, and communication for sustainable building issues; Referrals to human and technical resources on alternative technologies, natural building, and code issues; Consulting services on alternative building systems, such as straw bale construction and on integrated design processes; Technical workshops on alternative building materials & methods for local, regional, state, and national building code organizations; Training for the building and design communities on code-related issues.

Other Information: Tribal building codes specialist

Organization: Enterprise Green Communities, National Rural and Native American Initiative

Contact Person: Rose Marquez

Phone: 505-216-0928

Email Address: rmarquez@enterprisecommunity.org

Type of Activity: Funding and training

General Description of Services: The National Rural and Native American Initiative funded the Sustainable Native Communities Collaborative. Some of their other rural projects, (like Chuska Apartments in Gallup, NM), may benefit Native Americans but are not developed with tribes. They conduct some training sessions at conferences.

Organization: Environmental Protection Agency, Region 5 (construction waste)

Contact Person: Ms. Dolly Tong

Phone: 312-886-1019

Email Address: Tong.Dolly@EPA.gov

Type of Activity: Training

Region Served: Eastern/Woodlands

General Description of Services: Dolly Tong heads-up the Region V Tribal Solid Waste and Pollution Prevention initiative, which includes construction waste. She has conducted numerous presentations and training for tribes including recycling and reuse, waste reduction, and funding sources.

Organization: Environmental Protection Agency (EPA), Regions 8 and 9

Contact Person: Michelle Baker, EPA Region 9; Alfreda Mitre, EPA Region 8

Phone: 415-972-3206

Email Address: baker.michelle@epa.gov

Web Address: http://www.epa.gov/region4/recycle/green-building-toolkit.pdf

Type of Activity: Training and funding

Region Served: National

General Description of Services: EPA Region 9 provides grants for pilot projects. They have developed a training workshop, fostered partnerships with other federal agencies such as HUD and DOT, and coordinated with non- governmental agencies such as Green Building Council. They work to respect tribal sovereignty and support tribal vision for sustainable construction. They have developed a Sustainable Design and Green Building Toolkit that is available for download from the Web (not tribal specific). Region 8 has partnered with HUD to provide training on Green Building Codes.

Organization: Fond du Lac Tribal and Community College

Web Address: http://www.fdltcc.edu/academics/departments/certificate/clean-energy-technology.shtml

Type of Activity: Training

General Description of Services: Clean Energy Technology Certificate emphasizes alternative and renewable energy systems paired with conventional electrical courses. Offers students the ability to work in the field of clean energy in a residential, tribal community, or business setting.

Organization: Greater Minnesota Housing Fund

Contact Person: Janne Flistrand

Web Address: www.mngreencommunities.org/about/index.htm

Type of Activity: Funding and technical assistance

Region Served: Minnesota

General Description of Services: Green charettes and technical assistance to Minnesota projects.

Organization: Green Native Council

Contact Person: Tony Monroe

Phone: 509-575-3898

Email Address: tmonroe@northwestnativearchitecture.com

Web Address: http://www.greennativecouncil.com/

Type of Activity: Technical Assistance, training, education

Region Served: National

Tribes Served: Yerington Paiute, Yurok, Yakama

General Description of Services: Green Native Council provides technical assistance, training, and consulting services to assist AIAN communities to create sustainable housing solutions. It teaches affordable, replicable, and sustainable approaches to commercial and home design and construction. Green Native Council organizes programs and works alongside tribal members to design and build needed sustainable homes. The Council provides technical expertise to help local tribes, government designers, and builders implement requirements; administers impartial third-party inspection and verification, which ensures the program requirements have been met; and issues certification that projects have been constructed to the green building requirements.

Green Native Council has developed a reviewer and inspector certificaton training program. This training program certifies local area reviewers and inspectors in quality assurance methods designed for construction. This includes either online or classroom training and passing the Green Native Council exam. Green Native Council can also provide custom training. (Web site)

Other Information: Prior to any project, Green Native Council staff conducts informational and educational seminars on the Reservation to educate tribal members about sustainable construction techniques and community planning. In addition, Green Native Council can assist tribal members with the complicated mortgage process and collaborates with Indian Housing Authorities to facilitate individual homeownership. Once a project is complete, there is ongoing collaboration between tribal homeowners, TDHEs, and Green Native Council, as each home or facility serves as an example for the rest of the Reservation Community of how to create a beautiful, super-insulated, affordable home. Green homes incorporate environmental considerations and resource efficiency into every step of the building and development process to minimize environmental impact. The design, construction and operation of a home must focus on energy and water efficiency, resource efficient building design and materials, indoor environmental quality, and must take the home's overall impact on the environment into account. However, many of the processes and technologies that go into a green home happen behind the scenes and behind the walls. (Web site)

Organization: ONAP, U.S. Department of Housing and Urban Development

Type of Activity: Training

Region Served: National

Tribes Served: All

General Description of Services: Greener Homes Summit. Planning for third year. Provides overview of sustainable technologies and renewable energy. Presenters include communities with sustainable residential projects.

ONAP also conducts energy audits in each of the six regions and regional training workshops on improving air quality and energy efficiency in tribal housing. These sessions focus more on rehabilitation rather than new construction.

Organization: Intertribal Council of Arizona (ITCA)

Phone: 602-258-4822

Web Address: http://www.itcaonline.com/program_weather.html

Type of Activity: Technical assistance and training

Region Served: Arizona

General Description of Services: The ITCA Weatherization Assistance Program (WAP) coordinates weatherization upgrades for low income households on tribal lands with the goal of lowering the annual utility bills for low income families. Tribes may coordinate the entire program with reimbursement provided for work completed on each eligible home or choose to have the ITCA coordinate and manage the program, with ITCA directly contracting the weatherization work. ITCA will train the tribe to do its own weatherization.

Organization: Lac Courte Oreilles Ojibwa Community College

Contact Person: Dan Owens

Phone: 715-634-4790

Email Address: dowens@lco.edu

Web Address: http://www.lco.edu/catalog/deg/gbc.html

Type of Activity: Training

Region Served: National

Tribes Served: All

General Description of Services: Has a Green Building Carpentry Certificate Program that includes classroom and on-site activites. The Green Building Carpentry Certificate is designed for students to develop skills needed to perform carpentry tasks in compliance with green residential construction. The courses are taught in classroom, lab, and actual building sites so students are more fully prepared to gain sustainable employment.

Also has a Renewable Energy Certificate that offers coursework on the installation and maintenance of renewable enrgy systems. This program is designed to introduce students to the field of renewable energy (RE) and also provide a means to develop hands-on skills for installing and maintaining RE systems. The program provides a foundation for students preparing for employment in the RE industry. When coupled with business training, this program can prepare the graduate for a career as a RE self-employed business owner.

Organization: Leech Lake Tribal College

Contact Person: Saul Saucedo

Phone: 218-335-4287

Email Address: saul.saucedo@lltc.edu

Web Address: http://lltc.edu/academics/degreeprograms/carpentryelectrical.htm

Type of Activity: Training

Region Served: National

Tribes Served: All

General Description of Services: Provides 1-year Construction Trades or 2-year Electrical Trades Diplomas with some coursework in sustainable design, interior and exterior environmental design. Students participate in building an Eco-Affordable house which is sold and transported to a local homebuyer.

Organization: National American Indian Housing Council (NAIHC)

Contact Person: John Siegnemartin, Training and Technical Assistance Program Director; Dennis Daniels, Deputy Director

Phone: 850-939-4256 (John); 202-454-0912 (Dennis)

Email Address: jseignemartin@naihc.net; ddaniels@NAIHC.NET

Web Address: http://www.naihc.net/

Type of Activity: Training

Region Served: National

Tribes Served: All

General Description of Services: NAIHC recieves set-aside money from Indian Housing Block Grant program. The bulk of NAIHC's training and technical assistance is provided through a cooperative agreement with IHBG for training in how to run a housing program, financial management, board development, etc. NAIHC does very little work on sustainable development. Most of their sustainable development training is classroom training delivered through subcontractors. This year, they are working with a new contractor (see TRAVOIS) to provide an introduction to the concept of sustainable construction.

Organization: Native American Housing Services (NAHS)

Contact Person: Sharon Wise

Phone: 405-990-0066

Type of Activity: Funding, technical assistance and can put trainings together

General Description of Services: (1) Sharon doesn't do training but she knows who can, and she can put trainings together. (2) She is a certified CDHO. (3) Her organization administers HOME funds, tax credits and leveraging. Based on mission, works with other groups to develop affordable housing. (4) Specifically, according to NAHS' mission statement, they provide technical assistance to TDHEs to strengthen organizational and individual capacity; create Homebuyer Education curriculum; and provide property management and "lease to own" programs to create avenues to homeownership.

Other Information: Based on the mission statement, they may not do training in sustainable construction; however, they help put together and fund affordable housing projects and do homebuyer education.

Organization: Native Learning Center

Contact Person: Holly Tigers Bowers

Phone: 954-966-6300

Email Address: Htiger@SemTribe.com

Web Address: http://www.nativelearningcenter.com/

Type of Activity: Training

General Description of Services: The Native Learning Center strives to strengthen the Native American tradition of living in harmony with nature through supporting planet-friendly and sustainable practices by using today's newest tools. The Housing Strategies curriculum offers a variety of courses on ways in which tribes can build and maintain sustainable and affordable housing within their communities, including an introduction to LEED.

Organization: Nevada-California Indian Housing Association

Contact Person: Phil Bush, President

Phone: 530-596-4127

Email Address: bushconsulting@thegrid.net

Web Address: http://nv-cal.org

Type of Activity: Education and training, project management

Region Served: Nevada and California

General Description of Services: The Nevada-California Indian Housing Association represents member Indian Tribes, Indian Housing Authorities, and TDHEs from Nevada and California. The association seeks to accomplish its objectives through exchanging information and providing education and training opportunities for its membership. Because a number of its member tribes are very small, the housing association provides project management from start to finish on the projects of some of their members. They get the funding for the project and make sure the project is completed and gets Energy Star certified. They do all the contract administration. "We do it all." While Phil Bush said that green building was too expensive for tribes, he does work with tribes to get Energy Star certification. They work with architects, engineers and tribes to ensure that their projects get Energy Star Certification. This certification affects the entire structure – foundation, windows, doors, insulation, vapor barriers, attics, ductwork, light fixtures, appliances, etc.

Organization: Northwest Inupiat Housing Authority and the Chukchi Campus of the College of Rural and Community Development, University of Alaska, Fairbanks

Contact Person: Dan Duame, Association of Alaska Housing Authorities

Phone: 970-563-2146

Email Address: dan.duame@aleutian-housing.com

Type of Activity: Training

Region Served: Alaska

Tribes Served: Northwest Inupiat

General Description of Services: Have a joint project funded by HUD to construct a prototype super energy efficient house as part of the Campus's Construction Technology Trades program. It is in the design stage this summer (2011) and will be built next summer.

Organization: Red Feather Development Group

Contact Person: Cindy Owings, Executive Director

Phone: 406-585-7188

Web Address: https://www.redfeather.org/

Type of Activity: Training and construction

Region Served: Southwest and Northern Plains

Tribes Served: Hopi, Northern Cheyenne, and neighboring tribes who want to participate in the Indigenous Builders Exchange.

General Description of Services: Red Feather's American Indian Sustainable Housing Initiative combines community outreach with hands-on, volunteer friendly straw bale home construction, as a feasible means for communities to use their own resources to improve housing. Red Feather homes are used as a training site for individuals to learn about construction practices utilizing three educational components, comprised of: Red Feather's Straw Bale Construction emphasis, which promotes a construction technique focused on economic and environmental sustainability; the Solar Energy Initiative, which brings energy efficiency and long-term affordability to the homes they build; and the Indigenous Builders Exchange, which provides paid training for American Indians from their partner communities to learn and utilize construction skills.

Other Information: The Indigenous Builders Exchange (IBE) brings tribal members into one another's reservations to build homes for native families in need. IBE introduces participants to sustainable straw bale home construction in a mentorship situation and offers a cultural exchange among participating tribal members and Red Feather's volunteers. Red Feather's ultimate goal is to empower individuals, families and communities through meaningful projects that teach skills in sustainable construction and introduce understanding of how to organize and motivate a volunteer-based organization.

Organization: Rural Community Innovations (RCI)

Contact Person: Michael Utter, Chief Executive Officer

Phone: 406-587-0783

Email Address: michael@rci-usa.org

Web Address: http://www.rci-usa.org/index.html

Type of Activity: Training and funding

General Description of Services: Non-profit organization that provides solar, wind and waste energy development, and grant funding at the community level, not necessarily the individual residential level.

Organization: Southern Plains ONAP

Contact Person: Michelle Timmin

Phone: 405-609-8532

Email Address: Michelle.K.Tinnin@hud.gov

Type of Activity: Training

Region Served: Southern Plains

General Description of Services: With a non-profit, did training for the Southern Plains Indian Housing Group -- talked about LEED training.

Organization: Stardust Center for Affordable Homes and the Family, Arizona State University (ASU)

Phone: 602-496-1460

Type of Activity: Technical Assistance

Tribes Served: Navajo

General Description of Services: ASU (and Daniel Glenn) worked with the Navajo Nation Housing Authority in 2005 to develop a sustainable demonstration LEED house using Navajo flexcrete and cultural design features.

Organization: Sustainable Native Communities Collaborative, Enterprise Green Communities' National Rural and Native American Initiative

Contact Person: Rose Marquez

Phone: 505-216-0928

Email Address: rmarquez@enterprisecommunity.org

Web Address: http://www.sustainablenativecommunities.org/Projects-Database.html

Type of Activity: Technical Assistance

Region Served: Southwest and Northwest

Tribes Served: Doing six case studies. They will provide design and planning assistance to case study teams and work with tribal developers to create and implement a long-term, sustainable development plan. Tribes: Ohkay Owingeh, Santo Domingo, Navajo, Northwest Band of Shoshone, Jicarilla -- sixth tribe will be added.

General Description of Services: Sustainable Native Communities Collaborative is a group of community designers, architects, development leaders and sustainability advocates who work with communities to develop "a road map to sustainable development." They provide technical assistance with planning and development during the design phase. They focus on green affordable housing in rural tribal communities. They are working with six tribes that have housing developments in the design and planning stage. They will provide training in particular aspects of sustainability that tribes want to include in their construction projects. At this time, they also are doing two other projects in Indian Country -- (1) working with Indigenous Community Enterprises, a non-profit housing developer, in Flagstaff, Arizona, on constructing permanent supportive housing for urban Indians (Navajo) using tax credits. (2) Working with the First Nations Community Health Source in Albuquerque, New Mexico on constructing permanent supportive housing for urban Indians. Both projects are green.

Other Information: (1) Created a green project database for tribal housing projects currently under development or recently completed in the southwest region. The database has extremely useful descriptiojns of projects by tribe; (2) Next, will do six case studies of housing developments that are in the design and planning stage.

Organization: Travois

Contact Person: Greg Bland, Director of Travois Environmental Services

Phone: 816-994-8970

Email Address: gregb@travois.com

Web Address: http://www.travois.com/default.asp?page=about

Type of Activity: Technical Assistance

Region Served: National

Tribes Served: Red Lake, Standing Rock Sioux, San Carlos Apache, Wichita, Yavapai-Apache, Nex Perce, Menominee, and Pleasant Point Passamaquoddy.

General Description of Services: Travois is a for-profit consulting firm that provides housing and economic development services in Indian Country. Travois provides the sustainable construction training offered by National American Indian Housing Council (NAIHC). Their environmental services for tribes and TDHEs include Environmental Site Assessments by employees qualified under ASTME 1527-05 guidelines, consulting on sustainability improvements (solar, geothermal, biomass, biofuels, wind and other renewable and sustainable energy sources on or near Indian reservations), inspections and testing of mold, lead, asbestos and vapor intrusion, sampling and handling of hazardous materials. They also provide technical assistance on the Low Income Tax Credit Program.

Other Information: Subcontractor to NAIHC to deliver basic training on sustainable construction, e.g. materials and product availability, resources, etc.

Organization: Tribal Healthy Homes Project, Montana State University

Contact Person: Mike Vogel

Phone: 406-581-2432; 406-994-5417

Email Address: mvogel@montana.edu

Web Address: http://tribalhealthyhomes.org/

Type of Activity: Training and technical assistance

Region Served: National

General Description of Services: Offers training and technical assistance on existing homes. Work nationally with all 500+ federally-recognized tribes. (1) capacity building -- enhance tribe's capacity to conduct healthy homes assessments; (2) conduct 3-day regional training sessions with technical assistance follow-up for tribal leaders from housing program, environmental health program, tribal extension department and Indian Health Services. "This Center will enable tribal communities to assess homes for common indoor health hazards such as mold and moisture, carbon monoxide, household chemicals, unsafe drinking water, lead, asbestos, pesticides, radon, dust and dust mites, common allergens, asthma triggers, and fire and safety hazards and septic systems" (from organization Web site).

Other Information: Mike Vogel thinks that building new sustainable construction is a good fit with their current assessment training.

Organization: U.S. Department of Energy, National Tribal Energy Program Training Workshops

Contact Person: Lizana Pierce

Phone: 303-275-4727

Web Address: http://apps1.eere.energy.gov/tribalenergy/upcoming_events.cfm

Type of Activity: Training and funding

Region Served: National

Tribes Served: All

General Description of Services: The Tribal Energy Program promotes tribal energy sufficiency and fosters economic development and employment on tribal lands through the use of renewable energy and energy efficiency technologies. The program, part of DOE's Office of Energy Efficiency and Renewable Energy, provides financial and technical assistance to tribes to evaluate and develop their renewable energy resources and reduce their energy consumption through efficiency and weatherization. The program also offers education and training opportunities to help build the knowledge and skills essential for sustainable energy projects. The 2-day annual training covered energy efficiency and weatherization in housing as well as renewable resources.

Other Information: They put on a big conference with the Intertribal Environmental Council in June 2011. Discussed solar, wind, photovoltaix and biomass energy. (2) Had a Tribal Roundtable to discuss issues of environmental quality in Indian Country. The Tribal Energy Program is small but it is flexible enough to provide training based on need. The program has focused mostly on renewable energy. The Tribal Energy Program has funded feasibility and other studies with tribes for years.

Organization: U.S. Department of Housing and Urban Development, Community Planning and Development

Web Address:
http://www.hud.gov/offices/cpd/affordablehousing/training/web/energy/help/courses.cfm

Type of Activity: Training

Region Served: National

General Description of Services: Resource to annual conferences including sustainable construction training. A list of energy efficiency courses and conferences offered by agencies external to HUD can be found on the HUD Community Planning and Development Web site.

Organization: U.S. Green Building Council (USGBC)

Phone: 800-795-1747

Web Address: http://www.usgbc.org

Type of Activity: Training

Region Served: National

General Description of Services: The U.S. Green Building Council is a 501(c)(3) non-profit community of leaders working to make green buildings available to everyone within a generation. They focus on the certification process for LEED building, and develop all the rating systems that buildings use to go through the LEED certification process. "Leadership in Energy & Environmental Design (LEED) is an internationally recognized green building certification system, providing third-party verification that a building or community is environmentally responsible, profitable and a healthy place to live and work... USGBC is the source for LEED and green building knowledge – whether a professional is preparing for a LEED exam, maintaining their credential, seeking support while working on a LEED project, or simply looking to expand their LEED and green building knowledge. With the most innovative and highest-quality LEED and green building knowledge and training, a USGBC education helps green building professionals across all market sectors build the capacity to build their careers." (USGBC Web site). The Green Building Council provides lots or workshops, webinars and online courses. Participants learn how to become LEED accredited professionals, and also how to do LEED-certified projects.

Does not have any tribal focus.

Organization: University of Illinois at Urbana-Champaign (UIUC), School of Architecture

Contact Person: Lynne Dearborn or Kevin Hinders

Email Address: dearborn@illinois.edu

Type of Activity: Technical Assistance

Tribes Served: Pokagon Band of the Potawatomi Indians

General Description of Services: UIUC provided design expertise to assist the Pokagon Band of the Potawatomi Indians in realizing their vision of sustainability in single family homes and prototypes for construction.

Organization: University of Wisconsin at Madison

Contact Person: Sue D. Thering

Phone: 608-263-6506

Email Address: SAThering@wisc.edu

Type of Activity: Training

Region Served: Eastern/Woodlands

General Description of Services: Sue Thering, University of Wisconsin, has a Cooperative Extension Program. She pulls teams together to deliver training in sustainable construction.

Organization: Washington State, Department of Commerce

Contact Person: Eunice Herron, Tribal Weatherization Project

Phone: 360-725-5083

Email Address: eunice.herron@commerce.wa.gov

Web Address: http://www.commerce.wa.gov/site/506/default.aspx

Type of Activity: Funding and training

Region Served: Washington

General Description of Services: Funding, training and oversight of weatherization, energy audits, and training of tribal staff to do assessments and weatherization.

ORGANIZATIONS PROVIDING FUNDING
FOR SUSTAINABLE CONSTRUCTION IN INDIAN COUNTRY

JULY 18, 2011

Organization: Alaska Housing Finance Corporation (AHFC)

Contact Person: Mimi Burbage, Energy Specialist ; Scott Waterman, Energy Specialist

Phone: 907-330-8192 (Mimi); 907-330-8195 (Scott)

Email Address: mburbage@ahfc.us; swaterma@ahfc.us

Web Address: http://www.ahfc.state.ak.us

Type of Activity: Training and funding

Region Served: Alaska

General Description of Services: AHFC is a self-supporting public corporation with offices in 16 communities statewide. It provides free classes for potential homebuyers and statewide financing for multi-family complexes, congregate facilities, and single-family homes, with special loans for first-time home buyers, low- and moderate-income borrowers, veterans, teachers, nurses, public safety officers, and those living in rural areas of the state. AHFC also provides energy and weatherization programs, low-income rental assistance in 17 communities, and special programs for the homeless. According to David Vought, they are a "very significant housing partner throughout the state.

Organization: Alaska ONAP

Contact Person: David Vought

Phone: 907-677-9862

Email Address: david.vought@hud.gov

Type of Activity: Funding and partnering

Region Served: Alaska

General Description of Services: Developed two demonstration homes that are affordable, durable and highly energy efficient. (1) Anaktuvuk Pass -- partnered with the Cold Climate Housing Research Center (CCHRC) to build this home, which received a national ONAP award at the Greener Home Conference. The Anaktuvuk Pass Housing Authority is working on putting this home into production. They want to use the design to build 42 houses, beginning this summer. (2) Native Village of Kwinhagek, which has 700 residents. There is an extreme housing crisis in the community because one-third of the housing stock is structurally unsound because of moisture problems. They paid CCHRC $60,000 to design the home and $40,000 to manage construction. There is detailed information on this home on CCHRC's Web site under "sustainable northern shelter." According to the CCHRC Web site, energy costs dropped by 80 percent at the two demonstration houses. Because the two houses were built at half the cost and use 80 percent less energy, they can build a lot more of these houses.

Other Information: David especially works with Alaska native villages and small communities that are off the grid in terms of energy and transportation, so the costs of development are extremely high, particularly in subsistence communities. There are tremendous challenges in developing sustainable housing in Alaska because they need to reduce construction costs while increasing the quality of housing. Houses have to be highly energy efficient so people can afford to live in them.

Organization: Bonneville Power Administration

Contact Person: Nathan Dexter, Tribal Affairs Manager

Phone: 503-230-7306

Email Address: nldexter@bpa.gov

Web Address: http://www.bpa.gov/corporate/About_BPA/tribes/

Type of Activity: Funding, training and technical asistance

Region Served: Northwest

Tribes Served: Colville, Coeur d'Alene, Kalispel, Kootenai, Nez Perce, Spokane, Umatilla, Upper Columbia United Tribes, Warm Springs, Yakama, Blackfeet, Burns Paiute, Ft. McDermitt, Confederated Salish and Kootenai, Shoshone Bannock, Shoshone-Paiute Tribes, Cedarville, Chehalis, Confederated Coos Lower Umpqua & Siuslaw, Coquille, Cow Creek, Cowlitz, Ft. Bidwell, Grand Ronde, Hoh, Jamestown S'Klallam, Klamath, Lower Elwha, Lummi, Makah, Muckleshoot, Nisqually, Nooksack, Pit River, Port Gamble S'Klallam, Puyallup, Quileute, Quinault, Samish, Sauk-Suiattle, Siletz, Shoalwater Bay, Skokomish, Snoqualmie, Squaxin Island, Stillaguamish, Suquamish, Swinomish, Te-Moak of Western Shoshone, Tulalip, Upper Skagit

General Description of Services: Bonneville Power Administration (BPA) has a Tribal Energy Group that provides training and funding for energy audits and whole house assessments. They work with Tribes in Oregon, Idaho, and Washington. The local power company has to be affiliated with Bonneville in order for the community to receive training and/or funds.

Other Information: BPA, a nonprofit federal agency, has two types of programs. It funds energy efficiency measures through its public utilities. The public utilities select projects in their service areas. There are also set asides for low-income weatherization projects for tribes. This was how the Lower Elwha Klallam Tribe installed ductless heat pumps in 30 percent of their housing units. These were installed by the Clallam power utility district. It was so popular that the tribe funded the installation of additional units through its general fund.

Organization: Denali Commision (The)

Contact Person: Karen Johnson, Program Manager

Phone: 907-271-3036

Email Address: karenj@denali.gov

Web Address: http://www.denali.gov

Type of Activity: Training and funding

Region Served: Alaska

General Description of Services: The Denali Commission has placed job training at the center of its comprehensive plan for economic growth in Alaska. In just a few short years, the Commission has made significant strides in assisting rural communities with their workforce development needs. As the Commission funds projects for new clinics, roads, and tank farms, it also builds sustainability into those projects by providing training for local residents to maintain and operate the new facilities.

Other Information: Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplify effective and efficient partnership between federal and state agencies, and the private sector. Under "project database" on their Web site, can click on the State of Alaska icon to view an interactive map of all Denali Commission projects by funding year, location, and program area.

Organization: Database of State Incentives for Renewables and Efficiency (DSIRE)

Web Address: http://www.dsireusa.org/

Type of Activity: Funding

Region Served: National

General Description of Services: Project of the North Carolina Solar Center and the Interstate Renewable Energy Council (IREC), DSIRE provides searchable information on national, state, and local utility incentives and rebates for energy efficiency and renewable energy. Entries can be separated into residential and commercial. There are no tribal specific searches, but tribes may qualify for state or local utility company incentives.

Organization: Enterprise Community Partners, an initiative of Enterprise Green Communities

Contact Person: Trisha Miller, Director

Phone: 410-964-1230

Web Address: http://www.greencommunitiesonline.org/tools/funding/grants/

Type of Activity: Funding

General Description of Services: Provides funds and expertise to enable affordable housing developers to build and rehabilitate homes that are healthier, more energy efficient, and better for the environment. In addition to loans and other funding options, Green Communities offers Charrette and Sustainability grants to help cover the costs of planning and implementing green components of affordable housing developments, as well as tracking their costs and benefits.

Organization: Enterprise Green Communities, National Rural and Native American Initiative

Contact Person: Rose Marquez

Phone: 505-216-0928

Email Address: rmarquez@enterprisecommunity.org

Type of Activity: Funding and training

General Description of Services: The National Rural and Native American Initiative funded the Sustainable Native Communities Collaborative. Some of their other rural projects (like Chuska Apartments in Gallup, NM), may benefit Native Americans, but are not developed with tribes. They conduct some training sessions at conferences.

Organization: Environmental Protection Agency (EPA), Regions 8 and 9

Contact Person: Michelle Baker, EPA Region 9; Alfreda Mitre, EPA Region 8

Phone: 415-972-3206

Email Address: baker.michelle@epa.gov

Web Address: http://www.epa.gov/region4/recycle/green-building-toolkit.pdf

Type of Activity: Training and funding

Region Served: National

General Description of Services: EPA Region 9 provides grants for pilot projects. They have developed a training workshop, fostered partnerships with other federal agencies such as HUD and DOT, and coordinated with non- governmental agencies such as Green Building Council. They work to respect tribal sovereignty and support tribal vision for sustainable construction. They have developed a Sustainable Design and Green Building Toolkit that is available for download from the Web. Region 8 has partnered with HUD to provide training on Green Building Codes.

Organization: Greater Minnesota Housing Fund

Contact Person: Janne Flistrand

Web Address: www.mngreencommunities.org/about/index.htm

Type of Activity: Funding and technical assistance

Region Served: Minnesota

General Description of Services: Green charettes and technical assistance to Minnesota projects.

Organization: Indigenous Communities Enterprises (ICE)

Contact Person:

Phone: 928-522-6162

Web Address: http://www.franke.nau.edu/ice/

Type of Activity: Funding

Region Served: Southwest

Tribes Served: Navajo

General Description of Services: ICE was created in 2001 as a non-profit organization that specializes in providing affordable and culturally appropriate housing for low-income elders and single families in the Navajo Nation area. ICE utilizes NAHASDA grants. These federal funds are restricted to low- to moderate-income families. Clients are required to provide additional funds to match ICE NAHASDA funds. ICE collaborates with Navajo Partnership for Housing (NPH). NPH conducts client financial assessments. These assessments help to determine the loan amount and the type of home the client qualifies for. ICE also collaborates with other entities such as USDA Rural Development, Navajo Nation Chapters and Veterans Affairs, etc. These entities have their own clients with funding sources that can be matched with ICE NAHASDA funds for new home construction. They refer their clients to ICE for collaboration.

Other Information: Ongoing Straw Bale project and work with the U.S. Forest Service, using small diameter ponderosa logs to make traditional hogans.

Organization: Native American Housing Services (NAHS)

Contact Person: Sharon Wise

Phone: 405-990-0066

Type of Activity: Funding, technical assistance and can put trainings together

General Description of Services: (1) Sharon doesn't do training but she knows who can, and she can put trainings together. (2) She is a certified CDHO. (3) Her organization administers HOME funds, tax credits and leveraging. Based on mission, works with other groups to develop affordable housing. (4) Specifically, according to NAHS' mission statement, they provide technical assistance to TDHEs to strengthen organizational and individual capacity; create Homebuyer Education curriculum; and provide property management and "lease to own" programs to create avenues to homeownership.

Other Information: Based on the mission statement, they may not do training in sustainable construction; however, they help put together and fund affordable housing projects and do homebuyer education.

Organization: Rural Community Innovations (RCI)

Contact Person: Michael Utter, Chief Executive Officer

Phone: 406-587-0783

Email Address: michael@rci-usa.org

Web Address: http://www.rci-usa.org/index.html

Type of Activity: Training and funding

General Description of Services: Non-profit organization that provides solar, wind and waste energy development, and grant funding at the community level, not necessarily the individual residential level.

Organization: U.S. Department of Energy, National Tribal Energy Program Training Workshops

Contact Person: Lizana Pierce

Phone: 303-275-4727

Web Address: http://apps1.eere.energy.gov/tribalenergy/upcoming_events.cfm

Type of Activity: Training and funding

Region Served: National

Tribes Served: All

General Description of Services: The Tribal Energy Program promotes tribal energy sufficiency and fosters economic development and employment on tribal lands through the use of renewable energy and energy efficiency technologies. The program, part of DOE's Office of Energy Efficiency and Renewable Energy, provides financial and technical assistance to tribes to evaluate and develop their renewable energy resources and reduce their energy consumption through efficiency and weatherization. The program also offers education and training opportunities to help build the knowledge and skills essential for sustainable energy projects. The 2-day annual training covered energy efficiency and weatherization in housing as well as renewable resources.

Other Information: (1) Put on a big conference with the Intertribal Environmental Council in June 2011. Discussed solar, wind, photovoltaix and biomass energy. (2) Had a Tribal Roundtable to discuss issues of environmental quality in Indian Country. The Tribal Energy Program is small but it is flexible enough to provide training based on need. The program has focused mostly on renewable energy. The Tribal Energy Program has funded feasibility and other studies with tribes for years.

Organization: U.S. Department of Agriculture Rural Development, Housing and Community Facilities Programs (HCFP)

Phone: Housing programs national office: 202-720-4581

Web Address: http://www.rurdev.usda.gov/RD_Loans.html

Type of Activity: Funding and technical assistance

Region Served: National

General Description of Services: Housing and Community Facilities Programs helps rural communities and individuals by providing loans and grants for housing and community facilities. Provide funding for single family homes and apartments for low-income persons or the elderly. In partnership with non-profits, Indian tribes, state and federal government agencies and local communities, HCFP creates packages of technical assistance and loan and grant funds to assist more rural communities and individuals. More specifically, they offer loans and grants to provide homeownership opportunities, and they finance improvements to make homes decent, safe and sanitary. They also have residential energy programs.

Organization: Washington State, Department of Commerce

Contact Person: Eunice Herron, Tribal Weatherization Project

Phone: 360-725-5083

Email Address: eunice.herron@commerce.wa.gov

Web Address: http://www.commerce.wa.gov/site/506/default.aspx

Type of Activity: Funding and training

Region Served: Washington

General Description of Services: Funding, training and oversight of weatherization, energy audits, and training of tribal staff to do assessments and weatherization.

INDIAN TRIBES WITH SUSTAINABLE CONSTRUCTION PROJECTS
JULY 21, 2011

Tribe: Aleut Corporation

Contact: Dan Duame, Executive Director, Aleutian Housing Authority
520 East 32nd Ave., Anchorage, AK 99503

P: 907-563-2146 (work); 907-441-9313 (cell) **email:** dan.duame@aleutian-housing.com

Project Description: Sponsoring the Aleutian Living Home competition. Also completing Alaska Housing Finance Corporation professional single-family home and completion of another single family home in the Nelson Lagoon.

Tribe: Anaktuvuk Pass Village

Contact: Jack Hebert, Cold Climate Housing Research Center, 907-457-3454

P: Nunamiut Corporation 907-661-3220; Village of Anaktuvuk Pass 907-661-2575

Project Description: With Cold Climate Housing Research Center (CCHRC), built affordable, durable and highly energy efficient demonstration home. It received a national ONAP award at the Greener Home Conference. The Tagiugmiullu Nunamiullu Housing Authority is working on putting this house into production. They want to use the design to build 42 houses, beginning this summer. There is detailed information on this home on CCHRC's Web site (http://www.cchrc.org) under "sustainable northern shelter."

Timeline: June-July 2009

Contractors: CCHRC

Other Information: Part of Sustainable Northern Communities Program, which focuses on green building.

Tribe: Bishop Paiute Tribe

Contact: Robert Vance, Executive Director, Community Development Office
270 N. See Vee Lane, Suite 5, Bishop, CA 93514

P: 760-872-4172

Project Description: Production and use of Structurally Insulated Panels. The panels are constructed off-site in a protected environment and then moved to the building site. They are incorporating as many energy saving methods as possible. Under current construction is a housing site with six two-story, four-plex buildings, two- and three-bedroom apartments, a meeting room, laundry facilities, a basketball court and a fenced playground. There will be some handicapped-accessible apartments. The apartments are intended for low- to moderate -income tribal members.

Tribe: Coeur D'Alene

Contact: Tim Negri, Facilities Construction Director, Coeur D'Alene Housing Authority

850 A Street, Plummer, ID 83851

P: 208-686-1600

Project Description: The Coeur d'Alene Tribe of Idaho has received a $500,000 Indian Community Block Grant from the Department of Housing and Urban Development. The tribe will use the money to renovate and install energy-saving upgrades and rehabilitate 35 rental homes. The new family housing development is called the Gathering Place. The 20-unit subdivision, which is located off Agency Road near the old tribal headquarters, uses straw bale construction techniques (which is a "green" building method) built with native workforce.

Funding Source: ARRA, Indian Community Block Grant from HUD

Amount: $2,000,000 ARRA Competitive; $500,000 ICDBG

Tribe: Colville Indian Tribe

Contact: Elena Bassett, Executive Director, Colville Indian Housing Authority
P. O. Box 528, Nespelem, WA 99155

P: 509-634-2162 **email:** Elena.bassett@colvilletribes.com

Project Description: Inchelium, WA: Constructed 27 single-family homes and a community building. The construction incorporated passive solar design, surface water management, reduced heat-island effect, and included a walkable neighborhood and construction waste management

Funding Source: $3 million in stimulus funds, $7 million project cost. The remaining financing came through a complicated investment tax credit program with Key Bank as the principal participant.

Amount: $877,253 ARRA Formula; $3,000,000 ARRA Competitive; $240,000 AHP Grant; $1,500,000 LIHTC; $1,625,000 IHBG

Timeline: Project opened June 1, 2011 and took 18 months to complete

Other Information: The low-income housing project has homes in the $160,000 to $180,000 range. Twenty of the units will be rentals, with four units going to qualified owners. Three units will be used to house professional staff who work on the reservation. Qualified tribal members will pay rental fees based on their incomes.

Tribe: Confederated Tribes of Siletz Indians

Contact: Sami Jo Difuntorum, Executive Director, Tribal Housing Department
555 Tolowa Court, P.O. Box 549, Siletz, OR 97380

P: 541-444-8312 **email:** samijod@ctsi.nsn.us

Project Description: Siletz Tribal Energy Program (STEP): The Confederated Tribes of Siletz Indians was awarded a grant in the fall of 2009 from the Administration for Native Americans to create an energy management program. Tribal staff are working with federal, state, and local partners, tribal member partners and others to learn about and implement the conservation of natural resources. They are providing education and assistance for home weatherization, energy conservation and lead poisoning prevention.

Tribe: Coos Bay Confederated Tribes

Contact: Linda Malcomb, Tribal Housing Department
Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians
1245 Fulton Ave, Coos Bay, OR 97420

P: 541-888-7510 **email:** lmalcomb@ctclusi.org

Project Description: Qaxas Heights: Construction of 17 new units and rehabilitation of 3 units using green and energy efficient features. Construction incorporated solar tubes and sun tunnels for each unit to maximize the use of natural sunlight and reduce use of electricity; reuse of maple wood flooring from the Coos Head Naval facility gym; high efficiency water heaters (compact, tankless water heater provides instant hot water and lower energy bills); insulated house wrap installed under siding which prevents energy loss through walls; insulated hot water pipes; energy efficient household appliances and Low-E double paned windows.

Funding Source: ARRA, IHBG, USDA/RBEG

Amount: $280,824 ARRA Formula; $1,998,800 ARRA Competitive; $500,000 IHBG; $200,000 USDA/RBEG

Tribe: Cowlitz Tribe

Contact: Jerry Hause, Weatherization Manager, Cowlitz Tribe
P.O. Box 2547, Longview, WA 98632

P: 360-864-7002 or 360-864-8720 ext. 102 **email:** jhause@toledotel.com

Project Description: The Cowlitz Indian Tribal Weatherization Assistance Program provides energy savings measures to help conserve energy and save on electricity and heating costs. The program will insulate walls, ceilings, attics and crawl spaces; weather strip, caulk and seal windows and doors; install ventilation fans in kitchens and bathrooms; replace windows and doors; replace refrigerators and water heaters; and fix or replace heating source.

Tribe: Fond du Lac Band of Minnesota Chippewa Tribe

Contact: Ms. Amy Wicklund, Economic Development Planner
1720 Big Lake Road, Cloquet, MN 55720

P: 218-878-2631 **email:** AmyWicklund@FDLRez.com

Project Description: (1) Built 24 units, including an apartment building, 2 townhomes and a small community building. The units are senior supportive housing, which includes both housing and social services. They used the Minnesota Green Building Communities standards. (2) Completing a 10-unit assisted living building for elders which meets Minnesota Green Building Communities standards. Green features include: energy efficient buildings that exceed HERS minimum requirements; Energy Star rated appliances, HVAC equipment and light fixtures; low VOC adhesive and sealants; insulated cold water piping; concrete slabs on grade with a vapor barrier; and Green Label flooring of hard surface marloleum to reduce dust and mold.

Funding Source: (1)Minnesota Green Communities and approximately 15 other funding sources; (2) ARRA competitive grant

Timeline: (1)Opened July 1, 2010; (2) Opening August 1, 2011

Contractors: (1)Architect: DSGW; Contractor: Shingobee; (2) Architect: DSGW; used different contractor than (1)

Tribe: Isleta Pueblo

Contact: Isleta Pueblo Housing Authority, Po Box 1290 Isleta NM, 87022

P: 505-869-4153

Project Description: Lava Rock construction is done on site.

http://www.bizjournals.com/albuquerque/stories/2010/08/23/story4.html

Edward P. Torres recently left as executive director.

Tribe: Jicarilla Apache

Contact: Ronald Garcia, Planning Development Coordinator
42 Hawks Drive, Dulce, NM 87528

P: 575-759-3459

Project Description: Building 10 homes. They will be Energy Star rated manufactured housing. These are high performance building envelopes using water conservation methods such as low flow plumbing fixtures and rain water harvesting.

Tribe: Little Traverse Bay Bands of Odawa Indians

Contact: Ken Harrington, Tribal Chairman
7500 Odawa Circle, Harbor Springs, MI 49740

P: 231-242-1400

Project Description: LEED for Homes Gold certified multifamily project in Michigan. Uses ICF, recycled cellulose insulation at high density, Low E-windows, CFLs, high efficiency heat pumps and water heaters, and rain gardens.

Funding Source: ARRA, Tribal Funds, BIA

Tribe: Lower Elwha Klallam Tribe

Contact: John Williamson, Director, Lower Elwha Housing Authority
2851 Lower Elwha Road, Port Angeles, WA 98363

P: 360-457-5116 ext. 304

Project Description: Installed ductless heat pumps in existing housing with a grant from the Department of Energy and Clallam County Public Utility District. Forty-two heat pumps were installed under the grant but the program has been so popular that the Tribe has funded an additional 15 installations. About one-third of tribal homes now have the heat pumps.

Funding Source: Department of Energy and Clallam County Public Utility District

Tribe: Lumbee Tribe of North Carolina

Contact: Celen Pasalar, PhD
NC State University, College of Design, Campus Box 7701, Raleigh, NC 27695-7701

P: 919-515-8952 **email:** celen_pasalar@ncsu.edu

Project Description: North Carolina State University's College of Design, Laboratory for the Design of Healthy and Sustainable Communities, developed Lumbee home design guidelines and designed three prototype houses as part of the Home Environments Design Initiative. The partnership has produced a set of home design guidelines and four prototype home designs. Six Lumbee Home Designs are now under construction or complete.

Other Information: http://www.ncsu.edu/extension/engaging_with_comm-1.html

Tribe: Lummi Nation

Contact: Diana Phair, Executive Director, Lummi Nation Housing Authority
2828 Kwina Road, Bldg. X, Bellingham, WA 98226

P: 360-312-8407

Project Description: The Evergreen Standard requires all Tribes in Washington to incorporate sustainable activities into their construction. This tribe is on the list because they actually had very quick turn around with their ARRA funds. Kwina Village construction included 72 multi-family units and a community building.

Funding Source: ARRA, IHBG, Community Center built by youth apprenticeship

Amount: $7,000,000; $1.2 million Department of Labor (DOL) YouthBuild Grant provides salary and hands-on construction training.

Tribe: Makah Tribe

Contact: Wendy Lawrence, Executive Director, Makah Housing Authority
PO Box 115, Neah Bay, WA 98357

P: 360-645-2864

Project Description: The Sail River Heights project is in the planning/pre-construction stage for nine charettes.

Funding Source: Some HUD funding and Washington State Funding

Tribe: Menominee Indian Tribe of Wisconsin

Contact: Betty Jo Wozniak, Director, Menominee Indian Tribe Housing Department
Day Care Road, PO BOX 910, Keshena, WI 54135

P: 715-799-3236 ext. 1516 **email:** bwozniak@mitw.org

Project Description: The Tribe is planning a sustainability redevelopment of approximately 300 units.

Tribe: Mescalero Apache

Contact: Timothy E. Horan, Executive Director, Mescalero Apache Housing Authority
101 Central, P.O. Box 227, Mescalero, NM

P: 505-464-9235

Project Description: The tribe built a new community called I-Sah'-din-dii, which was designed and constructed to reduce impact on the environment. The project is a 30 unit, green, single-family subdivision for very low-income families. The subdivision will have a community center and childcare, employment and health services. The project utilized passive solar and lighting, is energy efficient, utilizes water conservation methods, and materials designed to improve indoor air quality. Specifically, the project's features include rainwater collection, energy-efficient windows, doors and appliances, low-impact building materials and solar placement.

Funding Source: New Mexico Mortgage Finance Authority provided tax credits and other funds, and the tribe used IHBG funds

Timeline: Broke ground July 2008; project has been completed

Tribe: Native Village of Kwinhagak

Contact: Jack Ebert, Cold Climate Housing Research Center

P: 907-457-3454

Project Description: Native Village of Kwinhagek has 700 residents. There is an extreme housing crisis in the community because one-third of the housing stock is structurally unsound because of moisture problems. They paid Cold Climate Housing Research Center (CCHRC) $60,000 to design the home and $40,000 to manage construction. There is detailed information on this home on CCHRC's Web site (http://www.cchrc.org) under "sustainable northern shelter."

Amount: Targeted cost of $220,000

Timeline: Started in September 2010

Contractors: CCHRC designed the home and managed the construction.

Other Information: Part of Sustainable Northern Communities Program, which focuses on green building.

Tribe: Navajo

Contact: Aneva J. Yazzie, CEO
P.O. Box 4980, Window Rock, AZ 86515

P: 928-871-2600

Project Description:

(1) Constructing permanent supportive housing for urban Indians in Flagstaff, Arizona and Albuquerque, New Mexico. Use of FlexCrete Building Systems. Navajo Housing Authority has identified new construction being done with ARRA funds and housing will be LEED certified.

(2) The Nageezi House is the Stardust Center's first Affordable and Sustainable Demonstration Home. It is featured in Global Green USA's Blueprint for Greening Affordable Housing (Island Press, 2007), and was selected as part of the regional LEED for Homes Pilot program. The home was completed in July 2005. The family's dilapidated home was demolished and the new home was rebuilt on the original slab. Navajo students in the ASU College of Design were an integral part of the design and construction of the home, and the effort evolved into a partnership between the Stardust Center, the Navajo Housing Authority and Navajo FlexCrete. The home's innovative design reflects the traditional structures of the Navajo, including the hooghan (home) and the chahash'oh (shade structure), The Stardust Center monitored the house for one year to determine its thermal performance. Overall, the home exceeded performance predictions, demonstrating a 60% reduction in energy use compared to a conventionally-constructed house of the same size.

Funding Source: (2) Demonstration house: volunteer labor and donated materials

Contractors:

(1) Jonathan Robertson, CEO, Flex Crete Building Systems. http://www.navajoflexcrete.biz

(2) Stardust Center for Affordable Homes and the Family, Arizona State University, 234 N. Central Avenue, Suite 9401, Phoenix, AZ 85004-2510 p: 602-496-1469

Other Information: The Stardust Center is working with the Navajo Housing Authority to develop production versions of the Nageezi House for construction across the reservation.

Tribe: Northwestern Band of Shoshone Nation

Contact: Jon Warner, Executive Director, Northwestern Band of Shoshone Housing Authority
707 N. Main Street, Brigham City, UT 84302

P: 435-723-3013 **email:** jondsho@yahoo.com

Project Description: Rehabbed 9 units, 3 of which ensured compliance with American with Disabilities Act. Rehabbed units are Energy Star certified for windows, exterior doors, storm doors, storm windows and window film, programmable thermostats and Energy Star rated appliances

Tribe: Oglala Sioux, Pine Ridge, North Dakota

Contact: Nick Tilsen, Executive Director, Thunder Valley CDC
P.O. Box 290, Porcupine, SD 57772

P: 605-455-2700 **email:** nick@thundervalley.org

Project Description: As part of HUD's Sustainable Communities Regional Planning Grant Program, Thunder Valley Community Development Corporation received a HUD Sustainable Communities Grant. Thunder Valley has a community development project which will include a sustainable housing sector. These homeownership units will be built with renewable energy practices and use the natural elements support heating and cooling. The neighborhoods will be designed with sidewalks, bike paths, small parks and outdoor community spaces for people to gather. The majority of these homes will be three to four bedroom homes sitting on an acre or half-acre of property. Once the lots are created, they will be able to use new types of lending like the Wells Fargo Native American lending program (which uses a BIA 184 guaranteed loan). This type of lending has been successful on Pine Ridge, but many families are lacking the land to build their homes.

Funding Source: HUD grant to support more livable and sustainable communities; ARRA.

Amount: $996,100, which will be used to create a regional plan for sustainable development for Thunder Valley Community Development Corporation on the Pine Ridge Indian Reservation.

Other Information: Construction of 18 units for low income families using Energy Star rated appliances and products.

Tribe: Ohkay Owingeh

Contact: Daryl Woolems, Project Manager
P.O. Box 1059, Ohkay Owingeh, NM 87566

P: 505-852-0189

Project Description: This is a rehabilitation project within the historic core at the Pueblo established centuries ago. A historic preservation plan was developed with the Housing Authority Cultural Advisory Team and Tribal Council. The renovation work includes indigenous materials such as adobe and mud plaster. Construction is now underway for 21 homes.

Other Information: http://ohkayowingehhousingauthority.org/index.html

Tribe: Penobscot Nation

Contact: Craig Sanborn, Director Penobscot Indian Nation Housing Authority
6 River Road, Indian Island, ME 04468

P: 207-827-7776 or 207-817-7372 **email:** Craig.Sanborn@Penobscotnation.org

Project Description: 12 LEED certified single-family homeownership units.

Tribe: Pinoleville Pomo Nation

Contact: Ryan Shelby, Scholar, UC-Berkeley
450 Sutardja Dai Hall, Mail Box #17, Berkeley, CA 94720

P: 510-761-6192 **email:** ryan_shelby@berkeley.edu

Project Description: Native Community Assessment of Renewable Energy & Sustainability (CARES) is housed at Berkeley University. They partnered with Pinoleville Pomo Nation on a co-design project.

Funding Source: NativeCARES

Tribe: Pokagon Band of Potawatomi Indians

Contact: Mark Parrish, Pokagon Band of Potawatomi Indians

P: 269-782-9602 **email:** mark.parrish@pokagonband-nsn.gov

Project Description: Pokagonek Edawat is part of a master plan for the Band for creating a sustainable community. University of Illinois at Urbana Champaign worked with the Pokagon Band of the Potawatomi Indians in 2006-2007 to develop 16 single family homes and prototypes for construction. The sustainable buildings were designed to be energy efficient and healthy using passive systems, environmentally friendly materials, and strategies to improve indoor air quality.

Other Information: http://www.semcog.org/Data/lid.report.cfm?lid=132

http://www.sustainabledevelopmentinstitute.org/TribalGreenDesign/GreenDesignPDF/PokagonbandPotawatomi.pdf

Tribe: Puyallup Tribe

Contact: Annette Bryan, Executive Director of Puyullap Tribal Housing Authority

2806 E. Portland Ave., Tacoma, WA 98404

P: 253-573-7956

Project Description: Constructing 20 housing units, community building and longhouse using solar hot water and photovoltaic panels, high energy efficient heating systems, Energy Star appliances, low flow faucets and showerheads, hiqh quality windows and wildlife habitat awareness and natural landscaping. LEED Gold/Platinum certification. The longhouse project is the first tribal building to be certified LEED Platinum – a very challenging certification to achieve. In order to qualify for this high standard, the housing project is using Styrofoam insulated wall panels, geothermic ground-sourced heating and all locally created products and services.

Funding Source: ARRA, IHBG

Amount: $883,573 ARRA Formula; $3,000,000 ARRA Competitive; $1,200,000 IHBG

Timeline: Site work and construction began in October, 2010. More than halfway completed in mid-June, 2011

Contractors: Keeping employment in-house through TERO, which is Tribal Employment Rights Office, and the Puyallup Tribal Housing Authority. This means that a lot of Native Americans are working on this project and being trained in the construction field.

Other Information: The first phase of the longhouse project includes construction of 10 housing units, upgrades to the existing gymnasium, and installation of an outdoor cultural dancing circle and playground. Five of the units are one-story, one-bedroom units, and the other five are two-story, two-bedroom units, catering to individuals, couples and small families in need of affordable housing. The second phase of the longhouse project will include construction of another 10-unit building for individuals and small families, as well as renovations and weatherization upgrades to the existing 27-unit Northeast Tacoma apartment complex. Currently working on grant funding for phase two, which could start as soon as the next fiscal year.

"We want the two projects to match each other and be visually pleasant, but weatherization and energy efficiency is the primary focus." Annette Bryan, Executive Director of PTHA.

Tribe: Red Lake Band of Chippewa Indians

Contact: Jane Barrett, Executive Director, Red Lake Housing Authority
P.O. Box 219 Highway 1 East, Red Lake, MN 56671

P: 218-679-3368

Project Description: The Tribe's Division of Energy contracts with Ashland County Housing Authority to provide basic weatherization services to eligible households. The Tribe also has constructed green housing using innovative techniques.

Tribe: Sault Tribe of Chippewa Indians

Contact: Joni Talentino, Director, Sault Ste. Marie Housing Authority
154 Parkside, Kincheloe, MI 49788

P: 906-495-1454 (work), 906-440-4191 (cell) **email:** JRTalentino@SaultTribe.net

Project Description: Housing Rehabilitation

"'The home upgrades will include the installation of new Energy Star rated windows, high efficient furnaces/boilers, water heaters, vinyl siding and exterior doors. These improvements will greatly reduce the heating costs for tribal residents and prolong the useful life of the homes,' said Talentino"

http://www.sooeveningnews.com/news/x2084232057/HUD-officers-tour-tribal-housing-in-Eastern-U-P

Funding Source: ARRA

Tribe: Sicangu Wicoti Awanyakapi, Rosebud Sioux

Contact: Amos Prue, CEO, Rosebud Tribal Housing
P.O. Box 69, Rosebud, SD 57570

P: 605-747-2203 **email:** rstha@gwtc.net

Project Description: Installed 100 solar panels on individual homes on reservation.

Funding Source: The Rosebud Sioux Tribe is being provided funds to support the Solar Heat Panel Installation Training Project #2 through the American Recovery and Reinvestment Act of 2009 (ARRA)

Amount: $337,111

Timeline: Awarded 11/30/2009; as of 3/30/2011, project is less than 50% completed. The project has been operating at a slow pace due to the number of price quotes that are needed before supplies/equipment can be purchased.

Contractors: New personnel were hired to complete the installation of the solar panels; the new hires also completed the following training: carpentry, electrical, customer service, equipment inventory, and data reporting. Jobs created: 10-Solar Panel installation certified trainees: install solar panels on pre-selected homes within the Rosebud Reservation.

Tribe: Port Gamble S'Klallam Tribe

Contact: Barrett Schmanska, Executive Director, Port Gamble Housing Authority
32000 Little Boston Road NE, Kingston, WA 98346

P: 360-297-6226

Project Description: Built new Teekalet neighborhood, located next to Little Boston Creek, which feeds into Port Gamble Bay. Project includes 15 single-family homes, two apartments and a community center. Exterior design includes a series of rain gardens and filtration systems throughout the property as well as pervious pavers in the parking areas. These measures significantly limit the amount of stormwater runoff that can reach the Creek. The same environmental concerns drove the interior design: solar shades are fitted to heat the homes in the winter and keep them cool in the summer. Every unit has energy efficient lighting and appliances. Teekalet meets Washington State's Evergreen Sustainable Development standards for affordable housing.

Funding Source: Worked with the Washington State Housing Trust Fund, HUD, Indian Housing Block Grant Program and American Recovery and Reinvestment Act on grants for funding

Timeline: 2009-March, 2011

Contractors: For aspects of the design, Tribe's Natural Resources department worked with civil engineer Ahmis Loving, PE of Seattle. Tormod Hellwig Architects designed the project and J.M. Grinnell Contracts did the construction, in consultation with the Tribe's Teekalet Housing Authority Board of Commissioners.

Other Information: Goal was that Teekalet would not adversely affect the land, wildlife, or water quality of Port Gamble Bay. Teekalet Housing Development was designed to be an ecologically- and financially-friendly alternative for low-to-middle income S'Klallam Tribal residents. A dedication ceremony occurred on March 3, 2011.

Tribe: Tunica-Biloxi Tribe of Louisiana

Contact: Sylvester Joe Barbry, Director, Tunica-Biloxi Housing Authority

151 Melacon Drive, Marksville, LA 71351

P: 888-242-3115 or 318-253-9767 **email:** jbarbry@tunica.org

Project Description: Their housing code requires that all new housing on reservation must be renewable. For example, they use solar panels and Polaris for roofing because it has foil to radiate heat out of the house. On February 26, 2009, HUD staff from the Southern Plains Office of Native American programs attended the Grand Opening of a "solar home" constructed by the Tunica-Biloxi Tribe in Marksville, Louisiana. This cutting edge green construction project integrates energy-smart features. The home's construction incorporates energy efficient building materials such as 2 x 6 framing and a heat-barrier membrane along with renewable energy technology including solar panels (made of a hail resistant material to prevent damage and are designed to withstand winds in excess of 100 mph) and a solar water heater (sunlight strikes and heats an "absorber" surface within a "solar collector"). Heated water is stored in a separate preheat tank or a conventional water heater tank until needed. Roof-mounted solar panels are the primary source of electricity for the home, which will cut the monthly electricity bill from $120 to about $30, according to Sylvester "Joe" Barbry, the tribe's housing authority director. If the panels generate excess electricity, this power is returned to the power grid and may reduce the energy bill further. Should the home need power beyond that produced by the panels, standard electrical service is available.

Funding Source: Solar home funded in part by Indian Housing Block Grant.

Amount: Solar home -- 3-bedroom home cost the Tribe about $115,000 to build. Once HUD assistance is included, the home will cost about $85,000 for tribal members.

Timeline: Solar home was ready February 6, 2009.

Other Information: The tribe intends to track and evaluate the performance of its first solar home and make the future homes it builds even more energy efficient. Mr. Barbry hopes to erect a new and even greener home every year.

Tribe: White Earth Band of the Minnesota Chippewa Tribe

Contact: Mr. Ben Bement, Human Services Director
Family Investment Center, P.O. Box 70, Naytahwaush, MN 56566

P: 218-935-5554 **email:** BenB@WhiteEarth.com

Project Description: Dream Catcher Homes Project. Told that this contains sustainable elements. If a development uses MN Housing Finance Agency dollars there are green standards and then a MN Housing green overlay criteria that the development will have to meet.

http://documents.csh.org/documents/mn/A4-DreamCatcherHomes%20MN.pdf

Tribe: Wichita Tribe

Contact: Mr. Ben Hatfied, Executive Director, Wichita Housing Authority
1 Coronado Circle, Anadarko, OK 73005

P: 405-247-7470 **email:** wichitahousing@suddenlinkmail.com

Project Description: The Tribe just completed a sustainable housing project. They have designed neighborhoods using sustainable techniques.

http://www.recovery.org/projectdetails.aspx?pid=ANT:12501506&gloc=US*US (5/18/2010)

Past project:

http://www.nativetimes.com/index.php?option=com_content&view=article&id=2490:wichita-housing-project-earns-apex-award&catid=54&Itemid=30 (October 2009)

Tribe: Yerington Paiute Tribe

Contact: Mr. Jack Buchold, Tribal Manager, Yerington Paiute Tribe
171 Campbell Lane, Yerington, NV 89447

P: 775-463-3301 **email:** tribalmanager@ypt-nsn.gov

Project Description: The Green Native Council worked with the Tribe to build a new senior duplex.

Tribe: Yurok Tribe

Contact: Judith Marasco, Executive Director, Yurok Inidan Housing Authority
15540 US Hwy 101 North, Klamath CA 95548-9351

P: 707-482-1506; 800-281-4749

Project Description: Green Native Council worked with the Tribe to build new homes. In addition, the Tribe is currently working on converting two-story homes in the Klamath Townsite to be more energy efficient.

Tribe: Zuni Pueblo

Contact: Michael Chavez, Executive Director, Zuni Housing Authority
P.O. Box 710, Zuni Pueblo, NM 87327

P: 505-782-4550 or 505-782-4564 **email:** mchavez@pozha.org

Project Description: The tribe uses Quad Lock construction. They just completed several ARRA funded projects

Funding Source: ARRA, IHBG, ICDBG

Appendix B:
National Meeting Report

Impediments to Sustainable Construction in Indian Country

White Paper

Sustainable Construction in Indian Country Initiative

January 20, 2012

Table of Contents

SUSTAINABLE CONSTRUCTION IN INDIAN COUNTRY INITIATIVE

Impediments to Sustainable Construction in Indian Country
White Paper

EXECUTIVE SUMMARY

The Sustainable Construction in Indian Country initiative is a congressionally mandated effort of the U.S. Department of Housing and Urban Development (HUD) Office of Policy Development and Research (PD&R), in partnership with the HUD Office of Native American Programs (ONAP). The initiative seeks to promote and support sustainable construction practices in Native communities. One task under this initiative was to conduct a meeting to explore impediments to sustainable construction practices and solutions to these impediments. Participants from a governmental, a nongovernmental, and a tribal focus group offered observations regarding impediments to sustainable construction in Native communities. Participants in a follow-up coordination meeting ranked the impediments associated with sustainable construction and brainstormed about potential solutions. Appendix A offers the detailed notes from each focus group and the analysis meeting with participants.

Working from a wide variety of impediments identified by the focus groups, these four impediments to sustainable construction ranked most important:

- Building codes
- Costs/funding
- Capacity building
- Planning

The graphic on the next page provides a brief summary of these impediments.

Highest Ranking Impediments to Sustainable Construction in Indian Country

Building Codes:	Communities develop building codes to protect health and safety, but also to show commitment to particular issues. Minnesota and Washington States, for instance, require compliance with green building codes or standards. Tribes have the ability to adopt existing green building codes or standards, or to create their own. The balancing act with a building code is to avoid being overly strict or posing undue cost burden and, thus, inhibiting desired growth.
Cost/Funding:	Sustainable construction is perceived as more expensive, but this is not always true. Some sustainable construction technologies require more expensive upfront costs; however, the energy savings and more durable housing can offset the higher costs or lead to savings later. Some sustainable construction technologies are more expensive and lack a payoff time that is practical for communities with a strong need for affordability. Some sustainable construction technologies do not add additional construction costs. Education can change the perspective and life cycle assessments and benefit analyses can provide tools to determine the technologies that provide the greatest bang for the affordable buck.
Capacity Building:	Tribal housing authorities may have difficulty building capacity or even maintaining levels of capacity due to understaffing and staff turnover. New elections in tribal council or decreased Federal budget funds can lead to enormous changes in staffing. Some smaller tribes may not have the staffing on a regular basis to carry out the housing development their community needs to keep pace with housing need. Repeated training, onsite training, and partnerships with other organizations are ways to build lasting capacity.
Planning:	Sometimes tribes find themselves planning projects simply because Federal funds are suddenly available. This can lead to a mismatch in community need and available resources—land, staff time, housing, funds, etc. Long-term planning, on the other hand, can help rebalance that mismatch, and support a tribe's overall goals, such as creating a cohesive "place" with increased opportunity for all residents, increasing healthier housing, supporting economic development, and moving toward energy self-sufficiency.

Since the participants in the coordination meeting were primarily from Federal agencies, they developed recommendations, primarily, of what Federal agencies may do to assist in resolving these impediments. A brief summary of these recommendations follows:

Building codes
Tribes have the ability to develop building codes and standards or adapt codes such as the International Green Construction Code to their own needs. They may not have always taken up this opportunity because, historically, they have been excluded from Federal assistance for building code development. Additionally, many tribes are located in rural areas, which are less likely to have existing building codes. Federal agencies can provide incentives that encourage tribes to implement green practices/meet green standards. Federal agencies are already supporting tribes in reducing this form of barrier with their participation in the interagency Tribal Green Building Codes Workgroup.

Costs/Funding
To assist tribes in making the most of funding resources and cutting costs, Federal agencies can help tribes and the housing industry move beyond a perception of cost or luxury in sustainable housing. One strategy is to demonstrate how to calculate benefits of sustainable construction practices and link audiences to tools, such as cost benefit analyses, that can help them develop sustainable projects most effectively. Benefit analysis tools, including free software, is available at http://apps1.eere.energy.gov/buildings/tools_directory/ on the Department of Energy (DOE) Web site. Cost analyses might also be adapted to factor in social and cultural benefits of sustainable construction, which are not traditional components of cost-benefit analyses.

Federal funding programs may be diminished, but they offer the flexibility and credibility to leverage funds. Grants may be written to provide matches for sustainable construction activities. Tribes are eligible to apply for a variance to go above the total development cost (TDC), the ceiling for cost per unit construction, with Area Office approval based on the incorporation of sustainable building technologies (Notice PIH 2010-47).

Capacity building
The suggestions related to tribal capacity building focused on expanding the services provided by nongovernmental organizations (NGOs) and increasing the number and capability of community development corporations. Additional suggestions included encouraging adoption of sustainable practices through rebates and incentives, dissemination of analyses on sustainability in other communities as adapted for tribal communities and of model tribal projects. One suggestion was for a tribal college version of the solar decathlon, where college teams compete to build innovative, affordable houses—often rooted in their regional culture or meeting a specific need – e.g. homes for victims of natural disasters, southern examples featuring large porches. Additionally, Federal agencies encourage specific capacity building by incentivizing green building in existing programs and prioritizing tribal green building in program development and delivery.

Planning
Some funds are available to assist tribes in planning for long-term community development. The Federal government has relationships and methods of dissemination that can inform tribes about available planning resources and funding opportunities. Federal agencies might also partner to

create a tribal version of the Mayor's Institute on City Design, a National Endowment for the Arts initiative that helps transform communities through design by preparing mayors to be the chief urban designers of their cities.

INTRODUCTION

HUD's Sustainable Construction in Indian Country initiative, administered by PD&R, in partnership with ONAP, seeks to ensure that tribes have access to and support in using sustainable construction practices. The initiative includes four tasks:

- Identifying Native communities that are working on sustainable construction projects. This task was completed.
- Identifying impediments to sustainable construction practices and opportunities for technical assistance (TA) and training for the Native communities. This task is on-going.
- Seeking demonstration projects that can be featured in best practice case studies. These case studies will be made widely available to the Native communities, allowing others to benefit from these best practices. This task is on-going.
- Making training available to tribal communities. This task has not begun.

This report provides a summary of the comments and recommendations of participants involved the second task. HUD conducted a meeting exploring impediments to sustainable construction practices and solutions to these impediments. The meeting was held in conjunction with the 2011 HUD Greener Homes National Summit.

The meetings consisted of three focus groups and a follow-up meeting to analyze focus group findings and make recommendations. HUD invited participants to two of the focus groups: a governmental and a nongovernmental group. The third focus group, the tribal focus group, was open to any tribal member attending the Summit. To ensure that tribes were aware of this opportunity, HUD conducted outreach to the regional Indian housing associations and also to the tribal communities which were award winners at the Greener Homes National Summit.

Invited representatives attended the follow-up coordination meeting. Many of these representatives had also participated in the focus groups. As part of this meeting, participants prioritized the impediments identified by the focus group by importance based on the potential negative impact on the development of sustainable housing in Native American communities., and also sorted them into impediments to residential construction in general and impediments to green construction in particular. They also brainstormed about some areas where change could be undertaken. Appendix B contains a list of invited participants for each group.

When discussing impediments, the focus groups identified both general residential construction process and green residential construction process impediments without distinguishing between them. It is reasonable to assume that impediments to residential construction also will affect any green construction process. Nonetheless, to make the best use of their time, members of the coordination meeting, separated general construction and green concerns, and focused their discussion on the impediments to green construction.

Specific to green construction practices, participants across the focus groups identified the need for an increased availability of sustainable construction models adapted to tribal needs and tribal communities. This included not only providing access to case studies of tribal communities with sustainable construction projects, but also providing hands-on training and identifying model houses that tribes can visit and examine in the field.

This report contains an executive summary of the meeting and the detailed summary and recommendations. The appendices contain full notes from each focus group and the analysis meeting with participant lists, and a list of invited participants for each group.

FOCUS GROUP FINDINGS

The three focus groups—governmental, nongovernmental, and tribal—received similar questions to answer. Both the questions and their responses were influenced by their relationships to construction projects in tribal communities—some as funding sources and grant administrators, housing developers, housing administrators, trainers and technical assistance providers. Discussion covered many areas, reflecting the complexity of construction in Indian Country and its association with community development and community well-being.

Governmental Focus Group

Governmental focus group participants identified two major categories of impediments to developing sustainable construction projects in native communities: lack of education about the benefits of green building and internal tribal impediments.

Tribal leadership and tribal members need to be educated about the long-term benefits of green construction. While green construction is more expensive initially, it is more cost effective in the long run, over the life cycle of the homes. In addition to the energy savings, green homes can be healthier homes. Families can reduce health care costs by living in homes that are free of mold, mildew, and other health hazards – and green homes can reduce the contributing factors to those hazards. Green construction typically can be higher quality as well, so that the goal of the design and construction of the homes is to be more sustainable and longer lasting. These are important lessons to teach when working with mutual help or rental unit residents: it is difficult to gain homeowner or resident buy-in for the maintenance of energy efficient upgrades or amenities in situations where the occupant is not paying for the upgrade or amenity. Tribes and homeowners also need to be educated about what someone referred to as “presolarizing”: that there is a lot they can do in small steps and for little cost. They can implement relatively inexpensive options into new construction, and modify existing homes.

In addition to educating tribal leadership on the long-term benefits, a related concern that combined both education and internal tribal impediments was that although the Native American Housing and Self Determination Act (NAHASDA) is more than 10 years old, tribes do not always recognize the full extent of their sovereignty with regard to housing and community development. Tribal leadership may not realize that, to promote the tribe’s own vision of sustainable construction and reflect cultural values, the tribe could enact building codes or conduct long-range planning beyond the requirements of the Indian Housing Plan (IHP).

Other impediments related to education include the perception of green housing as a want or luxury rather than a need; issues related to planning and budgeting where Federal agencies might be able to influence change, such as looking at life cycle costs as a way to balance higher upfront costs; weighing quantity vs. quality; standardization of rules and regulations, permitting, etc. across agencies; and need for green building codes or standards.

Another impediment to sustainable construction in Native communities is tribal capacity. Turnover among tribal leaders and tribal staff is often high; this can necessitate multiple efforts to educate leadership about the advantages of green building and decreased housing development as new leaders and staff may also need additional time to develop capacity. Other issues related to tribal capacity include:

- The large number and broad diversity of tribes decreases the ability of Federal agencies to provide adequate support to tribes.
- Remoteness, especially in Alaska, means that in some cases there is no or insufficient infrastructure for green building.
- More generally, remote housing locations increase the cost of transporting materials to construction sites, also increasing the cost of on-site technical education, and reducing the availability of knowledgeable contractors.

Given these impediments to developing sustainable construction projects, native communities need location specific assistance which is not being addressed.

The most important gaps include:

- Providing more information and support to tribes in planning for and funding green construction.
- Greater interagency collaboration and cooperation in educating tribes and providing technical assistance in all aspects of green construction.
- Generally more and better coordination of services to tribes.

Solutions that the team came up with where Federal expertise could be utilized include:

- Increasing formal and informal interagency cooperation to promote opportunities for tribes, incentivizing sustainability.
- In grant programs, increasing reciprocity across agency lines and regularizing requirements.
- Creating combined funding for grant programs.

Participants also suggested promoting the White House Executive Order which allows greater flexibility for tribes in terms of paperwork requirements. While that involves ensuring more documents are available on-line to facilitate affordability, the other side of the equation is bridging the digital divide to ensure that tribes have access to the Internet. The technology theme appears again when considering ways to provide training or capacity building that allow for cost-effective reach to remote communities, such as webinars. The tribal focus group later noted that, while webinars are available, some tribes may need to be walked through use of this unfamiliar technology.

One suggestion that also promotes economic development and self sufficiency included providing increased training in areas such as energy analysis and weatherization. This can assist tribes in 1) providing green collar jobs for residents and 2) conducting their own testing for energy efficiency. Labor force training is a critical component as many communities lack the expertise/skilled labor force to make sustainable construction practices a reality. Bringing in outside labor increases construction costs.

Nongovernmental (NGO) Focus Group

Nongovernmental focus group participants identified unmet community assistance needs. These needs fall into two basic areas: education and training, and funding. Tribes need support in development planning and green building, especially through technical assistance that is provided in-person and on-site. Training and TA providers cited the need for flexible, targeted, one-on-one TA from HUD and specific industry groups that can provide a type of capacity building that regional off-site training sessions cannot. Training and technical assistance should be targeted to specific projects, and ideally the consultants/TA providers will stay with the project until it is completed. The U.S. Army Corps of Engineers provides a similar service to tribes in Oklahoma that allows smaller tribes to take on projects they otherwise lack capacity to perform; see sidebar page 16. In addition, a tribal community often may send only one person to a training session. That person then has the responsibility for "translat[ing] it back" to the rest of the community. In contrast, with on-site training there is an opportunity for broader, immediate tribal buy-in. Participants emphasized the importance of repeated and on-site training again during the coordination meeting, where they noted that such training increased the likelihood of community acceptance of energy efficiency and other sustainable construction practices which are not always priority issues.

Participants said that, if HUD doesn't offer a specific kind of TA or training, tribes need to be allowed to pay other sources for the training and TA that they need.

Specific areas where communities need education include:

- Home maintenance
- On-site models that communities/builders can examine, information about how to build homes, and providing house plans
- Long-term planning/master planning
- More NAHASDA training

The other major gap in community assistance is in financing. Tribes need to be educated about the construction loans that are available, and given assistance in grant writing and throughout the application process. Tribes also need technical assistance in how to leverage funding sources.

Consistent with the above needs, NGO participants' suggestions about what Federal agencies can do to support them in helping tribes implement sustainable construction generally focused on funding. Participants want the Federal government to provide:

- More funding for all phases of green construction, including matching grants.
- Federal and private partnerships to develop creative funding.

- Money from veteran's agencies, labor departments, etc. for employing construction workers.
- Directing funding toward self-sufficiency (sweat equity, self-help training).
- Create pilot/demonstration projects with project evaluation/testing to provide technical data on payback, savings, etc.
- Setting aside money for tribes rather than making them get funding through their State or municipality.

In addition, participants reiterated the importance of helping tribes get funding and of building local capacity to fund projects. One way to do this is for Federal agencies provide a TA person like a Community Builder to assist tribes with developing local capacity to obtain program money.

Participants suggested that Federal agencies should provide Federal support for sustainable policies by requiring that projects reach a "standard" for sustainability or encouraging performance-based development, such as the Environmental Protection Agency's (EPA's) green labeling programs.

Further, some NGO focus group participants stated that Federal policymakers needed to revive previous interest in the institutional, physical, and structural infrastructure of rural America. The group noted that the training and education organizations once focused on rural community policy and development have been disbanded or defunded – while the need in Native communities remains.

The NGO focus group identified the following major impediments to working with tribes on sustainable construction:

- Cultural concerns – green building needs to reflect cultural values.
- Need to build community consensus around green building.
- Lack of master planning; communities need to develop comprehensive housing plans rather than plans that meet requirements for specific funding sources.
- Turnover of personnel at key tribal agencies and also in Federal agencies hampers having a consistent voice/direction.
- Land issues.
- "Low bid" requirements.
- Insufficient funding.

The areas where the NGOs felt they could provide increased education included a range of financial areas (housing loans and financing, leveraging Federal funds, using innovative funding tools, understanding how to deal with less common credit and income situations) and increasing access to self help housing (plans and financing). Several focus group participants, especially in the NGO focus group, cited the difficulty of getting tribes to attend trainings or getting the training to the specific people who need it.

Tribal Focus Group

Answers to the first question—what participants would change about their own or community housing to make it green—demonstrated an understanding on the part of participants of the range of topics encompassing sustainability. Comments ranged from building envelope fixes, to location and landscaping elements, to development issues and education to ensure durability. From the question regarding support and training, participants expressed the need for specialized education in how to become more fluent in the language of sustainable building, and how to adapt it to tribal cultures in order to pass an understanding of sustainability, its costs and its benefits, both up to tribal leadership and throughout the community to encourage community buy-in. The language of sustainability can be different, but so is the time frame. The community and leaders might be familiar with basing their approval on upfront or construction costs. They may not have had the experience of evaluating a unit's cost based on long-term life cycle costs, where the savings in utilities or in material durability leads to lowers higher initial upfront costs. These are areas where education can lead to a change in perspective.

Tribal focus group participants described the types of support and training they need to develop a sustainable construction project. One major theme was a comprehensive education program: educating everyone from tribal leadership to tribal members to maintenance workers to the regional housing association, etc., about the value of green construction. Participants also emphasized the need for training, especially hands-on, on-site training, in a number of areas including:

- Training residents about green practices, green building technologies, and the benefits of green building
- Training in community planning
- Workforce training

Specific training and technical assistance needs range from very basic training in planning and development to more project-specific support, for example:

- How to develop a master plan.
- How to define a project and write a request for proposal.
- Assistance in developing own building standards.
- Checklist for procuring green construction materials.
- Energy training.
- Local workforce training.

Additional suggestions for support needed include rebates and incentives as well as funding; having access to appropriate housing designs and to charettes to ensure community input in these designs; and flexibility in Federal regulations and policies.

Participants identified a number of impediments to developing sustainable construction projects. These include:

- Lack of homeowner, decision-maker, and general community education about the benefits of green building.

- The cost of green building.
- Not enough available land for building.
- Multiple environmental review requirements.
- Lack of availability of energy efficient products in rural areas.
- Funding.
- Manpower including maintenance and construction workers.

The participants also described cultural and political issues impediments to green building:

- Conflicts between using traditional methods versus incorporating modern technology.
- Perception that pushing back to traditional ways is a step back to poverty.
- Barriers to using new housing designs.
- There is not always a need for housing where tribal council members want it.
- Lack of cooperation with adjacent communities.

Participants in this group noted the complications that can arise from the short building season in Alaska and other northern climates. This reinforces the urge to replicate the "tried and true" models rather than launch a more innovative project. Local builders and planners are more confident they can fit the approval, planning, construction, etc, of the standard planned house into this building cycle. Another environmental complication discussed in this group as well as the governmental group is the difficulty of locating or transporting specialized sustainable materials to remote communities. In some cases, however, the sustainable materials could help solve a problem because they may be lighter and more easily transported than some standard building materials.

ANALYSIS OF FINDINGS

The group, which consisted primarily of governmental participants and several representatives from a regional Indian housing association, recognized that the results list was generated based on the questions asked during the focus groups and by the attendees of the focus groups. It therefore did not include the entire universe of possible responses. Operating from the available results, participants separately prioritized impediments that were general to the construction process within Indian Country and impediments that were specific to sustainable construction process.

The group identified the top five impediments to the general construction process in Indian Country as:

- Lack of money/flow of funds
- Tribal capacity – turnover, knowledge sharing and transfer. Change in leadership, short-staffed.
- Land issues
- Short-term versus long-term focus
- Fragmentation within the tribe

The major categories of impediments specifically related to the sustainable construction process are:

- Building codes
- Costs/funding
- Capacity building
- Planning
- Benefit analysis
- Infrastructure

RECOMMENDATIONS

This section discusses recommendations that could be encouraged or implemented, in particular, by governmental entities. Given time constraints and the focus on sustainability, the group primarily limited recommendations to the first four (the highest ranking) impediments related to the sustainable construction process.

Building codes

Green building codes or standards are a topic of interest for tribes in some parts of the country. A number of tribes are already impacted by green building standards in Minnesota when they incorporate certain types of State funding into affordable housing projects and the energy code in Washington State. These standards are another area where tribes have the freedom to develop their own standards that reflect their cultural priorities, and they have the option to be more stringent than State standards as well. At the same time, the process does require caution because too much strict regulation can inhibit construction. One possibility is to adapt the International Green Construction Code to each individual tribe's

Best Practices: Building Codes

The Tribal Green Building Codes workgroup, begun March 2010, includes more than 50 representatives from Federal and tribal agencies, and non-profit organizations engaged in exploring how tribes can adopt or adapt sustainable building codes or standards to support housing that meets "the environmental, social and cultural priorities of Tribal people" (National Tribal Green Building Codes Summit Statement). Building codes shape federally funded housing standards in Indian Country, but not all tribes have building codes or standards that express their priorities.

The workgroup held its first summit June 23-24, 2011, where it developed a set of priorities, which include:

- "It is important to maintain clarity about the need to have tribally-driven and culturally-based process."
- "Our emphasis needs to be on the development of a ***process*** rather than a product, from which tribally determined green building codes, and, or tribe-specific systems can develop."
- "Codes need to support each Native Nation's sovereignty, and be reflective of the community and culture."

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needs. Federal agencies can provide incentives to tribes to implement green practices/ meet green standards. Another part of the process includes consideration of ways to build tribal capacity to enforce building codes. The level of interest in green building standards at the tribal level is evident in the work of the interagency Tribal Green Building Codes Workgroup.

Costs/Funding

Cost and funding are constants, especially in an economic period focused on reduction rather than growth. The group suggested options for doing more with less which promote the use of sustainable construction practices from two directions:

- Education. This can show tribes how sustainable investments can save money and/or how they can get their money's worth
- Federal program use. A thorough understanding of Federal programs reveals built in supports to sustainable construction practices.

Best Practices: Federal Agency Funding Coordination

An exciting example of Federal agencies joining forces to standardize requirements, combine funding sources, and enhance collaboration is the groundbreaking cooperation between the HUD Office of Sustainable Housing and Communities, the Department of Transportation (DOT), and the Environmental Protection Agency (EPA) on the Interagency Partnership on Sustainable Communities. This partnership promotes better access to affordable housing, more transportation options, and lower transportation costs.

It has also led to coordination planning, policy, and investment such as in the Transportation Investment Generating Economic Recovery (TIGER) II grants. There, for the first time, DOT and HUD jointly awarded grants for local planning activities which will eventually lead to integrated transportation, housing, and development.

The U.S. Department of Agriculture (USDA) and the EPA also assisted with the grant program.

For more information, visit: http://www.sustainablecommunities.gov/

Education related recommendations included letting tribes know how the health benefits of sustainable housing can spill over into savings in other arenas. For example, health care costs can decrease when people live in healthier buildings; maintenance costs can decrease when materials are more durable. Other suggestions included creating tools to help tribes make smart energy improvement choices such as cost-benefit analysis tools or a matrix for tribal housing with information similar to a matrix for public housing agencies that shows the energy improvements with the greatest returns on investment: http://www.energystar.gov/index.cfm?c=affordable_housing.affordable_housing_phas. In addition, Federal agencies could develop a matrix that enumerates potential governmental funding sources for green improvements. In addition to the funding coordination listed in the box above, Federal agencies could incentivize sustainable building practices in their grant programs as they did American Recovery and Reinvestment Act grant programs.

Some education suggestions involved Federal agencies reaching out to other housing industry entities such as banks and lenders, insurance companies, and appraisers to educate them on the added value in energy efficient homes.

Federal programs have flexibility and credibility. HUD funds are still often seen simply as housing money, but they are also a tool that tribes can use to leverage other funds. This can be written into grants as a matching requirement, but HUD staff can also emphasize this in training, when reviewing IHPs and when working with tribes. Sustainable building components can be added into existing HUD training curricula. Federal agencies together can ensure that their training and TA efforts cross reference and consistently provide information on Federal efforts such as the EPA's green labeling programs, HUD's green construction programs, and DOE's weatherization and energy efficiency programs. In addition, while it might also be useful for total development costs to include life-cycle costs, right now tribes are eligible to apply for a variance to go above the total development cost (TDC) with Area Office approval based on the incorporation of sustainable building technologies (Notice PIH 2010-47).

Capacity Building

To expand the capacity of the tribes seeking to develop sustainable housing and communities, participants suggested expanding the services provided by NGOs and supporting the increased capacity and an increased number of community development corporations. Some suggested that the number of Native CDCs with a specific mission of serving Native communities might be increased. One under utilitized resource may be in tribal colleges. Tribal colleges are not only providing critically important training certificates and degrees in sustainable building vocations, but are, in many cases, leading the way in educating their communities and regions about sustainability from a long-term Native perspective. See below for a brief overview of sustainability efforts of one tribal college, the College of Menominee Sustainable

Best Practices: Capacity Building and Sustainability Education

The College of Menominee Sustainable Development Institute (SDI) College is one example of a college creating a rounded approach to sustainability by increasing campus efficiency, educating and inspiring students and regional communities in sustainability efforts, and also to provide training in green collar careers. SDI:

- Provides financial assistance to student interns researching sustainability issues, such as campus-wide baseline conditions including energy benchmarking and greenhouse gas emissions, vermiculture, and indoor air quality.
- Has increased the environmental education units in all areas of study and is engaging campus community on campus sustainable development through nine visioning sessions with more than 90 participants.
- Has engaged Great Lakes areas tribes in climate change education and outreach.
- Supports car pooling and other efforts among staff and on campus.
- Conducts applied, participatory action research as identified by tribes including the sustainability indicators research project.

For more information, contact Beau Mitchell, 715-799-5600, ext 3145

Development Institute.

During this meeting, a few participants reacted to the need for education due to frequent leadership and other turnover, and also to help leadership embrace quality since this will decrease the need to rebuild as frequently. These recommendations, similar to suggestions mentioned earlier, include providing incentives and rebates for sustainable construction, developing baselines and collecting comparison information on efficiencies and savings, adapting analyses on sustainability in other communities for tribal communities, and also getting the word about model tribal projects out to other tribes. One suggestion was for a tribal college version of the solar decathlon, where college teams compete to build innovative, affordable houses—often rooted in their regional culture or meeting a regional need—powered with solar energy. To be successful, educating prospective homeowners is as important as educating leadership, since they will live in and need to maintain the final product.

Best Practices: Capacity Building

Smaller tribes do not always have the capacity or staffing to manage construction projects. In Oklahoma, because of a memorandum of understanding (MOU) between HUD and the U.S. Army Corps of Engineers (COE), (allowed by 10 U.S.C. 3036d, the Chief's Economy Act) they can partner with COE to help with their grant applications and project management.

The COE will work with tribes to provide supporting documentation for their project applications that add credibility to the package. These can include floor and site plans, a letter of support, and cost estimates. If the project is awarded, the tribe enters into a contract with COE. COE is paid approximately 6 percent of a grant.

Typically, COE will provide the tribe with request for qualifications and interview support, documentation for the audit process, analysis of prospective subcontractor cost proposals, and design review. The COE has structural, mechanical, and architectural engineers on staff.

During the project, COE provides tribes with multiple quality assurance inspections. These have led to an increase in the quality of materials used in projects and an increase in the square footage of projects. They review the pay application to ensure that anticipated work is completed before payment is made, insure that the punch list is completed, and conduct a warranty inspection just before a year after completion.

For more information, contact Cynthia Kitchens, 918-669-7042, or Cynthia.Kitchens@usace.army.mil

Tribal capacity building also refers to the need for the development of specific technical skill sets that will allow tribal communities to control some costs of sustainable construction by doing the work in-house.

The partnership of COE and tribes in Oklahoma offers a different model. Here, smaller tribes who lack the capacity and staffing to carry out aspects of a construction project can collaborate with COE. COE takes on some of the technical aspects and wins quality and cost gains for the tribes.

Planning
Sustainable construction does not simply mean adding energy efficiency to individual housing units, but also planning for long-term community development. Participants suggested that the Federal government was well positioned to encourage and support long-term sustainable planning by informing tribes about available resources. These include Indian Community Development Block Grant (ICDBG) funds, Economic Development Administration (EDA) public works planning grants, and Administration for Native Americans grants that support long-range planning. In addition, Federal agencies can let tribes know about their own regional planning commissions that may have technical staff available to support communities with needs such as community comprehensive planning, grant preparation and assistance, mapping services, hazard mitigation planning, and environmental assessments. They can also alert tribes to planning assistance training opportunities available through organizations including the Native American Indian Housing Council (NAIHC) and the Native Learning Center.

The Mayor's Institute on City Design is a National Endowment for the Arts initiative that helps transform communities through design by preparing mayors to be the chief urban designers of their cities. Participants suggested that Federal agencies could team up to create a tribal version to bring sustainable development concepts to a greater number of tribal leaders.

Federal Coordination
Participants also offered some overarching recommendations to facilitate better information sharing and resource use among Federal agencies:

- Locate the right contact person in other agencies to provide TA or services. Federal agency staff do not always know their counterparts in other agencies or realize what who offers what services within a Federal agency. Regional contact lists could help.
- Coordinate/schedule trainings and meetings jointly rather than have multiple meetings with tribes.
- Similarly, coordinate among agencies to align agency visits to tribes.
- Support local regional training with multiple agency presence.
- Implement a joint project – agencies work together on, e.g., a master plan, a green building toolkit or a green building codes or standards toolkit.
- Develop a clearinghouse of meetings on topics relevant to tribes for sustainability.
- Conduct interagency meetings or establish an interagency workgroup.

SUMMARY

Increasing use of sustainable construction technologies in Indian Country, as in the rest of the country, carries an appeal for additional financial incentives to support the incorporation of these technologies. However, what may be even more critical to encouraging acceptance of and desire for sustainable construction technologies is a change in perspective. This new perspective includes the following insights:

- Sustainable housing does not have to be in conflict with issues of overcrowding or the replacement of substandard housing. As one meeting participant framed it, "Housing

development that is not sustainable perpetuates the current problem. It impoverishes families with high energy costs, high maintenance costs and health issues."

- Sustainable housing does not have to be more expensive over the lifetime of the housing unit. Inclusion of cost-effective sustainable technologies does require making informed choices based on availability of materials, suitability of materials to climate and housing unit, return on investment, as well as budget considerations.
- Sustainable housing offers health and financial benefits for residents. The savings from reduced energy costs or doctors' visits, in the case of decreased asthma attacks for example, can be redirected to other family needs.

The Sustainable Construction in Indian Country initiative is designed to provide types of assistance that can play a role in promoting understanding about the benefits of sustainable construction technologies:

- Providing supplemental technical assistance that can help tribes incorporate appropriate sustainable technologies into their residential construction projects.
- Educating demonstration projects about the range of sustainable construction technologies available.
- Promote use of available tools for helping tribes make informed decisions about which sustainable construction technologies to implement. Potential tools include free blower door testing through HUD ONAP, free modeling and benefit analysis software, and the Department of Energy's Tribal Energy Program TA.
- Highlight regional best practice case studies of successful tribal sustainable projects.
- Support tribes in collecting energy-related data for demonstrating energy and rehabilitation benchmarks and savings associated with sustainable technologies. This can show savings for TDHEs and residents.

Together with other Federal Agencies, and other committed partners, this initiative can implement strategies that will lead to a new perspective for some and a deeper understanding of green for others.

APPENDIX A: MEETING NOTES

All of the focus groups used U.S. Green Building Council's definition of "green building": Sustainable construction has as its goal residential housing that is healthier, more comfortable, more durable, more energy efficient, and with a much smaller environmental footprint than conventional homes."

The focus groups used a brainstorming process.

Focus groups had similar agendas:

- Introductions
- Focus Group Process
- Purpose
- Discussion/comments
- Next Steps

Cielo Gibson facilitated the meetings with assistance from Lynda Lantz, both of FirstPic, Inc.

GOVERNMENTAL FOCUS GROUP

9 am-10:30 am

Participants:

Randy Akers	HUD Northern Plains Office of Native American Programs (NPONAP)
Mike Blanford	HUD Policy Development and Research
Nova Blazej	Environmental Protection Agency (EPA)Region 9
Rodger Boyd	Deputy Assistant Secretary ONAP
Kate Brown	University of Illinois Urbana Champaign
Kevin Fitzgibbons	Eastern/Woodlands ONAP (EWONAP)
Brian Gillen	EWONAP, Region V Sustainability Officer
Rebecca Halloran	HUD ONAP Office of Loan Guarantee
Jed Harrison	EPA tribal advisor
Cynthia Kitchens	U.S. Army Corps of Engineers
Younes Masiky	U. S. Department of Energy (DOE) Tribal Energy Program
Carrie Nelson	Bonneville Power Administration DOE Energy Weatherization Program
Marty Nee	HUD Office of Healthy Homes and Lead Hazard Control (OHHLHC)
Lizana Pierce	DOE Tribal Energy Program
Michelle Tinnen	Southwest ONAP (SWONAP) sustainable and green development

Question 1: From your perspective as a Federal agency, what are the impediments to developing sustainable construction projects in native communities?

Participants noted the following impediments:

- Resident Investment-ownership. Someone else is paying for it so not as invested in making changes. There is a cost to investing in housing and energy. Homeowner buy-in is needed.
- Need
- Money
- Green Building is perceived as a luxury.
- Quality vs. quantity (is it better to do more or to do it better?)
- The initial cost vs. the life cycle cost. There is a big initial investment which will pay off in the long run.
- Educating the public about the short-term cost vs. the long-term savings benefit
- Getting information to the tribes about industry financing vs. government financing
- Media. The perception of green home being a want vs. a need
- Limited number of native architects/culturally relevant/sensitive green design
- Leadership priorities - regulation and banking not going well together
- Appraisal value - impeding costs of remoteness. For example, getting an appraiser out to a location can be costly.
- Permitting and recording
- Tribal transition - staff turnover
- Council turnover
- Fragmentation within the tribe (ownership/responsibility)
- Availability and development of green building codes - what are the benefits or deterrents. How do you sell it to the tribes?
- Standardization of rules and regulations and processes across agencies
- Tribal empowerment - lack knowledge of exercising their sovereignty; they don't always know they have the ability to legislate in that area. Tribes don't realize they have the authority and ability to do things, that they have more freedom of decisions.
- As agencies, we could incentivize green building. There is a lack of encouragement.
- Remoteness, especially in Alaska. Sometime the infrastructure does not exist.
- The number of tribes and the diversity of tribes
- The large number of tribes and the limited number of Federal staff
- Coordination with tribal groups/ NGOs is not as good as it could be
- Cost - such as the impact of Total Development Cost, Dealing with small tribes is not cost efficient. The program with the Corp of Engineers has been able to provide economy of scale. Smaller tribes need the benefit of collaboration
- Education - "Presolarizing" educating the tribes and the homeowners that there is much that can be done in small steps and at little cost. You can do the little things before you do the big things. For example, you can change the light bulbs or do blower testing in your home before you think about putting solar panels on. There are inexpensive options. Also there are inexpensive options that can be incorporated into new construction. Also at both the tribal and Federal level, there needs to be an understanding of what all the agencies can do.

- Codes and permitting - sometimes there are codes that are not mandated and getting people to do things that are not mandated is hard.
- Weighing benefits to dollars. Part of the education piece is to see that green homes mean healthy homes. In the long run, there are financial, social and health benefits. You can save money on health care costs if you have healthy homes free of mold, mildew, and other health hazards. Educating the public that green equals healthy.
- Quality Assurance - the U.S. Army Corps of Engineers (COE) program is a good example of how there can be guidance which provides quality assurance and expediting processes. SWONAP has a memorandum of understanding (MOU) with the COE. The COE assists tribes preparing their RFP/RFQ, engineer experience, etc. They help the tribes with complicated processes.
- Laws and regulations governing each agency differ. Managing each agency/program requirement on a big, complex project is difficult. It would be better if there were common interagency requirements. For example, it would be nice to have one definition of income limits. The programmatic structure and funding streams have to be streamlined and consistent. The differences in statutory requirements require a lot of coordination.
- Tribal capacity – turn-over, staff changes, tribal changes, knowledge sharing and knowledge transfer. They have change in leadership, short-staffed. They need to have people on the ground.
- Dissemination of information - Looking at what publications the other Federal agencies are printing and distributing. There are good documents that should be disseminated, but the government is no longer printing many documents. Can this be done electronically as a spreadsheet? Do tribes all have access? There needs to be education at both the tribal and Federal agency level.
- Physical inventory - Sometimes agencies cannot provide TA because there was no physical inventory. There is a lack of information about the actual housing stock and its conditions.
- Construction time and the availability of contractors.
- It is okay to go “deeper green” - the cutting edge of what is happening in green building construction

Question 2: What type of technical assistance (TA) and financial assistance does your agency currently provide or plan to provide in the future?

Participants identified the follow current and future resources:

CURRENT	**PLANNNING FOR**
NAHASDA (HUD) SECTION 184 (HUD) TITLE VI (HUD) ICDBG (HUD) Other HUD (Healthy Homes/RI/etc) Connecting communities for regional planning (Office of Sustainable Housing and Communities) Proforma creation Radon grants (EPA)	Healthy Homes Production (HUD OHHLHC) SHHIP Certification (Safe Healthy Homes Investment Partnership) gets additional points in NOFA (HUD OHHLHC) NAIHC - Green Building 2012 NAIHC - emergency response program NAIHC - discussing poor performance - TDHE - could expand into green construction, develop training on emergency response, 2012 green building.

GAP grants Smoke-free buildings Guidance on Smoke free buildings and ordinances (HUD) State resources for technical assistance Technical assistance through NAIHC to expand to green construction West - RHED Green Training - 6 sessions (USDA) Use of green materials: DOE, roof decking, light bulbs, solar water, green fair. IAQ - guidance training, scholarships, test shadowing, Web portal linking Networking among tribes share resources: Tribal Champions, Tribal Mentorships. Planning/Org for EE and renewable energy and capacity building, feasibility studies, retrofits, training. (DOE) Weatherization (3 tribal allocations); tribes must coordinate with States. (DOE) Weatherization training centers, i.e., Alaska. Also (ARRA) - 15 centers nationally, not specific to tribes (DOE) Retrofit training for auditors and inspectors and health/safety and weatherization (BPA) Funds equipment and weatherization materials; assist Washington tribes leverage funds with State grants (BPA) Supporting tribal green building codes working group (EPA) EPA standards and guidances are voluntary Utilities (e.g. PG&E in CA) provide weatherization training and do some outreach to tribes Meet in person with tribes as part of TA Collaboration with the natural resources dept	Green Homes Fair - existing and new homeowners New Construction standards or labeling of Indoor Air Plus Tax credits and utility incentives Workshops, FOA's, TA, information, education (DOE) Try to adjust regulations to allow tribal access directly (DOE) EPA/HUD/Other? outreach to ICDBG and IHBG recipients re: green building/healthy homes/weatherization options (EPA) Interagency collaboration on Web sites and through trips to tribes and conferences and training, such as USDA, HUD, EPA, BPA, DOE. Field level coordination (e.g. Denver office) Policy: Incentive based coordination Intertribal Environmental council has a tire clean up - are there other such resources that can be tapped into TA to provide a list of resources in the State Healthy Home Fair Need a convener to facilitate pulling people together - issue of sustainability is a shared responsibility across the entire tribe

Question 3: What kinds of assistance do communities need that are not being provided?

Federal agency participants identified the following needs:

- More education and information on sustained capacity building
- Information/technical assistance to tribes (limited because of travel to remote areas)
- Partnerships with TC&U, tribal colleges and universities

- Paper materials should be on-line (White House Administrative Executive Order flexibility for tribes) and tribes should know where these sources are.
- Limited infrastructure/Internet access
- More examples of best practices - tribal case studies and tribes learning from each other
- Assistance for leveraging colors of money.
- Multi Agency TA - TIGER TEAMS; strategic planning teams - work in advance on putting money together
- INTRA/INTER agency coordination vs. being siloed. Also coordinate with Indian Health Service (IHS) - healthy families=healthy homes
- Education and buy-in of agency staff and tribes on the importance of energy efficiency and green building
- Business code/legal infrastructure training
- Skilled workforce (green job skills) and job creation. More resources for workforce development, especially job skills
- Planning money
- Broader interagency collaboration - how to share information with tribes about technical assistance, conferences, via grass roots which can then inform higher level agency.
- Increased tribal capacity of how to conduct their own testing (weatherization, infrared, blower door, for example)
- Certified training of staff: purchasing equipment, utilizing equipment, (lead-based paint (LBP)/asbestos/radon, DOE, Native Workplace, etc)
- Curriculum development - weatherization plus health, indoor air quality, Healthy Homes, gas testing, backdrafting into house, moisture control
- Increased partnerships with Community Assistance Program (CAP) agencies
- Model codes
- Adjust regulation so that tribes can access directly
- More coordination with regional entities
- Partnership with tribal culture and agencies
- Assistance with developing infrastructure for Web development and access.
- Trainings provided through Webcast
- Leveraging – multi-agency strategic planning teams.
- Health and Human Services (HHS) coordination
- More education for our own agencies as to the importance and effects of green building. Overcome the “green is a fad” thinking.
- Development of building codes
- More resources for workforce development
- Centralized Web site that would include best practices, program resources, notices, publications (like an expand Codetalk)
- Coordinating the links so you can link back to the original resource site
- Expand the technical assistance that is currently being offered at SWONAP from the U.S. Army Corps of Engineers for other tribes, build capacity of grant applications and managing processes
- There needs to be a holistic approach to sustainable housing. That is, it needs to involve the entire tribal community and agencies in a collaborative effort
- Build the capacity of grant applications

- Relationship development (State, tribal, intertribal agencies) - how to develop a continuum to weather tribal changes. Continuum of programs and services.
- Green outreach - light bulb giveaway. It is easier to go where people are already gathered - e.g. pow wows
- Efforts needs to be comprehensive across agencies and tribal departments
- Certified training for tribal staff - e.g. radon mitigation
- Demographic and physical assessment tribe's housing inventory. E.g. BIA used to have a template, a checklist - spec sheet whereby you had a profile of the characteristics of a home.
- There are overlapping conferences that compete with each other - it is better for it to be a partnership and conducting trainings together. Exploring/Partnering with agencies on conferences and training- maybe expanding a day to prevent overlapping. For example, DOE energy conference last month and the HUD conference this month.
- Partnering with intermediaries (tribal colleges, CAP agencies, State initiatives, regional housing meeting)

Question 4: What groups do you serve? Tribes, non-profits, housing authorities?

- DOE and EPA said mostly to tribes.
- Whoever asks for the assistance.
- It varies among agencies.

NONGOVERNMENTAL AGENCIES FOCUS GROUP
10:45 am – noon

Participants:

Mike Blanford	HUD PD&R
Lacey Gaechter	Trees, Water and People
Judith Grunau	Cold Climate Housing Research Center (CCHRC)
Katie Hoyt	National Congress of American Indians (NCAI)
Russell Kaney	Enterprise Rural and Native Initiative
Jason La Fleur	AES
Beau Mitchell	College of Menominee Nation
Stewart Sarkozy-Banoczy	HUD Office for International and Philanthropic Innovation
Nick Tilsen	Thunder Valley CDC
Holly Youngbear Tibbets	College of Menominee Nation

Question 1: What types of technical assistance and financial assistance does your organization currently provide or plan to provide in the future? Who do you serve?

Nongovernmental organization participants identified the following services they offer currently or plan to offer in the future:

CURRENT	PLANNNING FOR
Renewable energy – straw bale construction – hands-on (Trees, Water and People) Constitution reform – in person, on-site, conference, webinars Tax – webinar - 40 people Annual/mid-year – variety of topics – target to resolution Planning – inclusion, survey, focus group Social media – only good at times – as many off reservation as on who follow it Community dialogue – they get input from community members to develop a plan. They work with the people, not with organizations. Reservation-wide opportunities for organizations to connect with each other Formal and community training/education in building trades – specializes in sustainable development (Menominee) Research on viable applications for the region (Menominee) Material construction and product testing, research, application in Circumpolar North (CCHRC) Community-based design of affordable, sustainable, culturally-appropriate housing (CCHRC) Instruction in building methods and building science – on-line, print and in-person (CCHRC) Partnership with tribes, housing authorities, village corporations and financial institutions (CCHRC) International education on sustainable forest management (SDI – part of Menominee) Financial assistance to student interns doing research for the college (SDI) Engage campus community on campus sustainable development (SDI) Engage Great Lakes tribes in climate change education, outreach (SDI) Applied, participator action research as identified by tribes (SDI) Training and competency development on design side Technical assistance on green building,	Energy efficiency Livelihood development with renewable energy focus/green jobs – business development, environmental stewardship Planning for housing—holistic support/training Housing for 300-500 people (on the Pine Ridge Reservation) Training for trades people, existing builders, middle-level professionals – insurance, appraisers, mortgage lenders, etc., tribes in Great Lakes (Menominee) Facility for sustainable northern community development – an interagency /interorganizational collaboration space and opportunity (CCHRC) Training and competency development on supply side but expand to construction trades Green Group trainings (Enterprise)

financial (Enterprise) Technical assistance registry on-line (architects, engineers, etc. vetted by Enterprise on "green credentials) (Enterprise) Grants for green charettes (Enterprise) Grants for organizational capacity building (Enterprise) Architectural "green" workshops (Enterprise)	

Who do you serve?

- Tribal leaders (elected) from member tribes – Federal/state
- Training center focused – from tribes – Great Plains
- Oglala Sioux tribe – people – Oyate
- Tribes in the Great Lakes region
- The Circumpolar North
- Tribal THDEs
- Tribal non-profits
- Tribal CDCs
- Tribal Human Services

Question 2: What types of assistance do communities need that isn't being provided?

Participants identified the following assistance:

- More education on available housing loans and how to apply for them – assistance through the application process
- More education on home maintenance
- Innovative financing mechanisms – revisit double declining depreciation declining depreciation schedules used previously
- Actual on-site models that communities/builders can examine
- More information to communities on how to build own home – construction loans and house plans available
- Institutional resources to enable preparation of skilled builders
- Multi-income families/households need help showing combined income of multi-generational household
- Grant writing assistance
- TA in how to leverage Federal/non-Federal funding sources – focus on helping NGOs learn this:
    - How HUD plans to leverage funds – share with NGOs
    - Need an assessment tool/framework to determine what NGOs can handle – some kind of tool to help NGOS build their internal capacity
- Utilization of networks – systematic way for HUD to connect with/use the networks that already exist on reservations

- Need in-person, on-site training. This is really important. If tribal members go elsewhere for training, then they need to "translate it back" to the others in their tribe. If they get on-site training, they get immediate tribal buy-in.
- More NAHASDA training
- More financial assistance—and learning to leverage what's there
- Flexible and targeted training and TA for projects/programs from HUD and also from specific "industry" groups. Bring housing authorities and NGOs together to work on specific projects. There is strong support for focusing training and TA on specific projects rather than general training.
- HUD's environmental assessment requirements are very specific, and HUD doesn't provide TA on how to get through their process. More generally, HUD needs to:
    - Provide more permanent TA for HUD grantees
    - If HUD doesn't offer a specific kind of TA or training, tribes need to be allowed to use their grant money to pay other sources for the training and TA that they need.
- Long-term planning – master planning or strategy on development
- Pre-development funding for market analysis, demographics, technical reports, etc.
- One-on-one on-site specific/community specific consultants/TA to stay with project
- Focus on culturally-specific aspects unique to community
- Comprehending impacts and opportunities associated with climate change
- Peer-to-peer training

Question 3: What can we (NGOs) do better?

- Engagement on appropriate nation-nation level to set agendas
- Needs assessments focused on community dialogue
- Relationship building
- Occupant education
- Green Home Fairs

Question 4: What can Federal agencies do to support you in helping tribes implement sustainable construction?

Some responses overlapped with responses to questions 2 and 3. The participants identified the following Federal support needed:

- Have Veteran's agencies, labor departments, etc., provide money to employ construction
- Provide business development assistance
- Provide TA person from HUD/DOE/etc. to help with getting specific program money to reservations and build local capacity to do so. Teach tribes best practices on how to access programs. Have "champion"/"community builder" – but don't just add this job to someone's existing workload because staff are spread too thin
- Set aside money for tribes rather than making tribes get funding through their State/municipality. Dedicate money to tribes so tribes don't have to compete with States

for money. Agencies need to better understand the sovereign status of tribes and how to interact with them.
- Share data/grant programs – application process
- HUD set "standard" for sustainability. Difficult with sovereignty status but could force tribes to do green building.
- Pay serious attention to the institutional, physical, and structural infrastructure of rural America, e.g., Rural Development Institute – no education/training component
- Provide matching grants – community raises amount of money and Federal agencies match it
- Federal and private partnerships for creative funding
- More funding toward training within community of sustainable building practices and techniques
- Provide intellectual capital and labor for on the ground tribal-driven planning and projects
- Don't take away funding, but direct it towards making people more self-sufficient (sweat equity self-help, training)
- Encourage, through resource allocation, performance-based development, which focuses on operations and maintenance
- Multiple funding opportunities throughout the year for planning, pre-development, visioning but allocated in climate areas across the county
- Federal support for fully qualified TA providers, materials, methods, i.e., standards and best practices
- Pilot/demonstration projects/homes, etc. with project evaluation/testing after to provide technical data on payback, savings, etc.
- Agencies listen, learn and apply traditional designs and values of tribal structures specific to "place."
- Ask the community how they think it would be best for the future of the community to use funding to develop sustainability

Question 5: What are the major impediments to working with tribes on sustainable construction?

Participants identified the following impediments:

- Lack of money and flow of funds
- Lack of connection between private sector innovation to Federal efforts
- Building codes – capacity building – regulation
- Do training, then no jobs for tribal members afterwards
- Getting the right person/people to attend trainings and meetings
- Cultural barriers – tribes have adapted to the "HUD house mentality."
- Existing units are unsustainable – need to commit to fixing old houses (disposition regulations).
- House design that is currently not focused geographically, culturally, climatically – commit to specific HUD support. Make a new, full commitment that replaces the 1960s, 1970s homes.

- Lack of local plan –difficult to do relocation for rehabilitating or redeveloping locations.
- Lack of master planning. Allocate more funding for tribes to do their Indian Housing Plans, so they can develop comprehensive housing plans rather than just meet requirements for using housing funds
- Transition from one "administration" to another – consistent voice; turnover of personnel at key tribal agencies/positions and Federal agencies
- Short-term versus long-term focus; need incentives to tribes to look long term at materials, etc; i.e., fewer restrictions on design, mandated materials, "low-bid" mentality undermines housing durability– want housing to have more durable life cycle
- Determining who owns land and what land is available for development and who has already done environmentals on the land. Also, often politics within communities among Village Corporations, tribes, and cities limit the land for sale, because they don't work together to get more housing, or no one wants to sell land
- Letting existing water/sewer/roads/electric limit sustainable development and creativity
- Need to meet with the community many times to get dialogue going and planning developed, and travel to remote communities is very expensive. Relationship building – who do you trust?
- Lack of funding to consolidate fractional heirship interested on allotted reservations
- Institutional resources for research and development
- Flexible funding – quantity of restrictions, e.g., multi-generational units, etc.
- Consensus building is much needed – dialogue, ask/listen to community
- Use appreciative inquiry for engagement

TRIBAL FOCUS GROUP

2:45 pm – 4 pm

There were about 16 participants (about 1/5 were Federal agency representatives like EPA and HUD). Tribes represented included the Pokagon Band of Potawatomi, Kalispell Band of Indians, Choctaw Housing Authority, Puyallup Tribe of Indians, as well as representatives of Alaska and southwest tribes.

Question 1: What would you change in your existing homes to make them green?

Participants identified the following items that were intended to get them thinking about sustainability and give a sense of what how much they already know about sustainability:

- Weatherization: roofs, windows, doors (2)
- Durability; make sure the homes last -- that they don't fall apart in a short time
- Solar power (2)
- Landscaping- more native plants (2)
- Location - it is not sustainable if homes are remote from access to transportation and services/town (e.g. stores, schools, etc.) (3)
- Building new homes next to existing homes

- Conservation should exist. The kilowatt measuring device "Kill-a-watt" calculates the cost of usage. People don't realize that having appliances plugged in (like a toaster), when not in use, still uses power.
- Educate homeowners about what they can do with what they already have
- Motion sensor lights
- Energy audits, especially for larger and community buildings
- Community outreach: tap into community, schools, etc. For example, there was a recycling project at the school. It educated kids about the importance of recycling. The kids went home and told their parents. It was an example of the younger generation making changes at the family and community level. It also lowered landfill costs.
- Getting recycling and waste company partnerships with the community
- Preventive maintenance
- HUD regulation - want more flexibility - what you can and cannot include. e.g. put in an additional fireplace
- TDC - more flexibility to increase TDC for green building
- Energy efficient light bulbs, e.g. when tenants move in and out
- Beneficial use of gray water
- Rainwater collection systems but some concern about mosquitoes – expensive underwater rain catchment
- Community garden
- Walking trails
- Encourage biking; carpool with neighbors
- Engage community members to educate residents on how to use systems.
- Upgrades to windows, doors, floors, appliances, low-flow toilets, water efficiency, HVAC, roofs (7)
- Lighting, bulbs, fixtures, use of natural lighting, etc. (2)
- Attic space
- Ventilation
- Site location
- Get contractors on contracted out rehabilitation work to use energy efficient products
- Educating tribal members how to maintain new products

Question 2: What support and training do you need to develop a sustainable construction project?

Participants identified the following types of needed support and training:

- How to define a project and write an RFP
- Top-down education. Getting political will and convincing the board
- Partner with tribal colleges, use of graduate students (engineers, architects), other local and community college partnerships and resources
- Educate maintenance and warehouse staff
- Have a green purchasing initiative
- Local workforce training - either on the job or at a training site

- Training residents on green practices, cost benefits, maintenance, etc.
- Pre-development and design funding – Big picture planning
- Engaging community partners. Need to work on the communication process and getting buy-in. Need to improve the mechanisms used for communication
- Need assistance how to have a community-building process
- There needs to be a link between language and culture on the issue of sustainability. Make sure we are all understanding the same concepts. Focus on "what is the message?"
- Staff training
- Technical support for code officials
- Assistance in developing own standards
- Charette with all stakeholders
- Money
- HUD: Develop a consortium of funding agencies that can partner with HUD dollars
- Training for NAHASDA on 1) green building technologies, 2) what LEED certification means and how that differs from other certification programs
- TA from HUD or HUD-approved agency on how to develop a master plan
- Webinar for TA is a potential BUT tribes may need assistance linking to a webinar
- Liaison at HUD that continues through a whole project - someone who can come out monthly
- On-line video training (YouTube) is a possibility, but there are concerns about tribal access
- Checklist for procuring green construction materials
- RFP template for contractors for green building; LEED provides a framework for ensuring all parties are committed to green building
- TDC is a limiting factor - need greater flexibility
- Energy training
- Decision makers need training
- Regional housing association training
- Force account training/certification
- Hands on training
- On-site training
- Train the trainers
- Financial support
- Community based education for our tribal members - for them to have buy-in
- Contact local housing associations to put out information to All tribal housing and building contractors
- HUD - allowing tribes to be empowered by allowing grant funds for develop and green builds (NOFA)
- More incentives for Green Builds/rebates

Question 3: What are your major impediments to developing sustainable construction projects?

Participants identified the following impediments to developing sustainable construction projects:

- Lack of homeowner education
- Perception of costs – green is too costly
- The conflicts that can be involved or perceived in using traditional methods vs. incorporating modern technology
- Perception that pushing back to traditional ways is a step back to poverty
- Board education and buy-in
- No more land – lack of space, needing to buy land
- Need for council buy-in and education
- Manpower – not enough maintenance workers; sometimes bring in workers from other areas, which increases cost
- Money/funding top to bottom – plan, build, maintain, and rehab
- Planning design is very important to avoid later problems
- Education of residents about benefits of energy efficient retrofits/behavior change
- Existing dispersed housing developments; developing consensus among community in developing Master Plan to reduce building footprint
- There is not always a need for housing where tribal council members want it; i.e., politics
- Lack of data on housing need; research
- Need to clearly demonstrate benefits of sustainable housing to decision-makers
- Multiple environmental review requirements
- Lack of cooperation with adjacent communities
- Land status; lack of documentation of real estate transfers
- Demolition of houses; regulations written for cities, not suitable for tribal communities
- Federal, State, local housing funding should have tribal set-aside based on formula
- Transportation
- Location
- Building cycle
- Political
- Funds/cost
- Education
- Myths
- The cost placed on the homeowner for replacement materials or products for energy efficient building
- Availability of energy efficient products in rural areas
- Cultural/traditional long-term cost
- Floor plans –barriers to using new designs – new generation homeowners not accepting anything less than grandpa's house
- Budget restraints
- TDC limitations

4. What can your tribe do to help your community understand the benefits of green construction?

Participants listed the following ways to bring communities on-board:

- Board and Councils should attend workshops and summits
- Promote projects you do get done
- Grant administrators leave to attend workshops
- Workshops should be free and include food and incentives
- Follow the money – explain the cost savings
- Educate community about green building:
    - About conservation methods, e.g., better to insulate home than burn free wood
    - Explain relationship between green homes and health
    - Increase awareness of the younger generation
    - Identify targeted groups –e.g., elders, youth – and target them in appropriate ways
    - Get buy-in from opinion leaders/"squeaky wheels"
    - Use social media to educate the community/twitter about your event, e.g., "free light bulbs"
    - Tribal newspapers, radio, television commercials
    - Media blitz everywhere – health clinics, schools, etc.
    - Community events, e.g., booth at sporting events
    - Hand out materials at general Council meetings, election day campaign/polling places (2)
    - Fact sheet for community members on green building benefits
    - Community dinner to discuss benefits of green building
    - Community meetings for all tribal members
    - Monthly newsletter and/or Web sites with information about green building
- Educate/orientation at move-in for new residents on green building features; have staff do hands-on tenant training
- Partner with other agencies so you are not duplicating the number of visits from departments (e.g., Health Department brought energy efficient light bulbs when making health visits.)
- Partner with casinos, lodges, hotels, restaurants, and tribal enterprises
- National Indian Housing Survey – see if they are getting information about green issues/practices
- Tie green building into cultural heritage
- The RFP for any housing element should include training for operations and maintenance staff and require training manual from installer
- Need tribal champion at decision-making level
- Tribal councils adopt a policy or include language in the mission statement that supports/encourages green building in **all** projects
- Have tribal council establish an environment committee that can educate the council as a whole on green building; educate employees and tribal leadership
- EPA should encourage cooperation by the tribal housing and tribal environment departments
- Share information between tribes on green housing successes
- Tribal lack of or minimal access/use of computers/electronic media is potential barrier
- One-on-one training
- Demonstration

- Utility data collection
- Testimonies
- Partnerships/NGO
- Sensitive to community concerns
- Urban areas in the tribal areas that may be using home loan funds to purchase homes need to be educated for pre-existing structures
- Provide giveaways with information on the products

COORDINATION MEETING

September 28, 2011
1:00 pm – 4:30 pm

Participants:

Payton Batliner	Department of the Interior, Office of Indian Energy and Economic Development
Mike Blanford	HUD PD&R
Dana Bres	HUD Policy Development and Research (PD&R)
Tedd Buelow	US Department of Agriculture, Rural Development
Melissa Fetters	Choctaw Housing Authority
Brian Gillen	HUD, Eastern Woodlands ONAP
Daniel Glenn	Glenn & Glenn Architects
Rebecca Halloran	HUD ONAP Office of Loan Guarantee
Jed Harrison	Environmental Protection Agency, Office of Radiation and Indoor Air
Lizana Pierce	Department of Energy, Tribal Energy Program
Sabrina Stephens	Southern Plains Indian Housing Association Board member and Choctaw Nation Housing Authority
Roger Taylor	National Renewable Energy Laboratory, Tribal Energy Program
Trina Thompson	Choctaw Housing Authority
Michelle Tinnin	HUD SPONAP
David Vought	HUD, Alaska ONAP

This meeting began with a summary of the barriers that were identified in the three focus groups from the prior day. Most participants in this meeting were present at one of the focus group, but not all.

Discussion during Barrier Summary

Participants expressed concern that a number of the barriers listed are not specific to green building. They think we need to focus on impediments to doing green building including the "low hanging fruit" such as weatherization, but omit those barriers that are endemic to doing any housing construction in Indian Country. Nonetheless, someone commented that some tribes are

less sophisticated that others and could benefit from training about the construction process. Tribes which are not familiar with the process may need this prior to any green training.

Another participant suggested that the questions asked in the focus group and the Green Building Council definition of sustainable development used in the focus groups favored certain responses and topics over others. He suggested both were designed to elicit strong discussion of environmental and energy factors, but not about the health side of sustainability or cultural issues. [Note that issues of the relationship of sustainability to culture and health were discussed as part of the focus groups. See pp 19, 21, 22, 23, 31, and 33.] The participant said that we need to broaden people's understanding of what "green" means to include these elements.

Participants were told that they could add barriers to the list. They added:

- Health factors
- Cultural relevance

Barrier: IHP and Comprehensive Planning

- Tribes submit the Indian Housing Plan (IHP) annually to HUD to describe their year's housing activities. HUD substantially updated the IHP this year. HUD reviews the IHP to ensure compliance and approves IHPs to release IHBG funding. Some tribes have fairly comprehensive IHPs and others give less detail. The level of detail is very tribe-specific. Some participants felt that tribes could use assistance to help them develop long-term/master plans.
- Some participants, however, felt that the planning issues faced by tribes were larger than the IHP. Tribes need to integrate their housing plan with the larger tribal planning process. Within their own governments, tribes need to plan roads, housing, etc. as a single entity. To have smart growth planning, need communication across different tribal entities. The goal is to integrate housing, roads, health services, zoning, etc. in one planning process. Housing should stem from the master plan.
- Several participants stressed that not all tribes are "reservation tribes," in particular tribes in Oklahoma and Alaska but also in other places. Thus, challenges may be different and familiarity with long-term planning may be different. Choctaw Nation, for example, has 5-, 10-, and 100-year plans so they can be sustainable in all areas for future generations. They also work with their counties, cities, and State to do comprehensive planning.
- Perhaps it would be productive to ask each region to identify barriers to tribes conducting comprehensive planning.

A participant said that some tribes keep doing the same things because that's what they are familiar with. It is easier to do what you've always done than to do something new. In contrast, another participant stated that there were tribes that were leading the way in commitment to sustainability: "The Pokagon Band of Potawatomi showed us what could be done to make a tribal community really green, from the planning of the site through the whole process. We have example after example in our communities of sustainable building. We just want to promote this and share this with other tribes."

After the barriers were summarized and discussed, participants were asked to use dot ballot voting to prioritize the barriers, which were also posted on the wall. They each were given 10 dots in each of two colors:

- Red dot: absolute priority even if not specific to green building
- Green dot: priorities among the barriers to green building

Most participants did not use all of their dots!

The combined impediment list for the coordination meeting was composed of the following:

- Lack of money and flow of funds
- Flexible funding – quantity of restrictions, e.g., multi-generational units, etc.
- Connect private sector innovation to Federal efforts
- Building codes – capacity building – regulation – permitting- recording
- Do training, then no jobs for tribal members afterwards
- Getting the right person/people to attend trainings and meetings
- Cultural barriers – tribes have adapted to the "HUD house mentality."
- Existing units are unsustainable – need to commit to fixing old houses (disposition regulations, written for cities not tribes).
- House design focused geographically, culturally, climatically – commit to specific HUD support. Make a new, full commitment that replaces the 1960s, 1970s homes.
- Lack of local plan –difficult to do relocation.
- Need master planning. Allocate more funding for tribes to do their IHPs, so they can develop comprehensive housing plans rather than just meet requirements for using housing funds
- Transition from one "administration" to another – consistent voice; turnover of personnel at key tribal agencies/positions and Federal agencies
- Short-term versus long-term focus; incentives to tribes to look long term at materials, etc; i.e., fewer restrictions on design, mandated materials, "low bid" mentality – want housing to have more durable life cycle, educating the public about the short term cost vs. the long term savings and health benefit
- Land issues: ownership and land is available for development (including environmental). Politics within communities among Village Corporations, tribes and cities limit the land for sale, because they don't work together to get more housing, no one wants to sell land. Funding to consolidate fractional heirship interested on allotted reservations. Also lack of space, needing to buy land
- Letting existing water/sewer/roads/electric limit sustainable development and creativity
- Need to meet with the community many times to get dialogue going and planning developed, and travel to remote communities is very expensive.
- Institutional resources for research and development, need for data
- Lack of consensus building
- Using traditional methods and incorporating modern technology or vice versa
- Perception that going back to traditional ways is a step back to poverty
- Council and Board education and buy-in

- Manpower – not enough maintenance workers; sometimes bring in workers from other areas, which increases cost
- Planning design is very important to avoid later problems
- Residents not knowing benefits of energy efficient retrofits/behavior change
- Existing dispersed housing developments
- There is not always a need for housing where Tribal Council members want it; i.e., politics
- Green building: need to clearly demonstrate benefits of sustainable housing to decision-makers
- Multiple environmental review requirements
- Lack of cooperation with adjacent communities
- Federal, state, local housing funding should have tribal set-aside based on formula
- Transportation
- Location
- Building cycle
- Myths
- The cost placed on the homeowner for replacement materials or products for energy efficient building
- Availability of energy efficient products in rural areas
- Cultural/traditional long-term cost
- Floor plans –barriers to using new designs – new generation homeowners not accepting anything less than grandpa's house
- Budget restraints
- Resident Investment-ownership: someone else is paying for it so not as invested in making changes. There is a cost to investing in housing and energy. Homeowner buy in is needed.
- Green Building is perceived as a luxury or a fad
- Quality vs. Quantity (better to do more or to do it better?)
- The initial cost vs. the Life Cycle cost. Big initial investments which will pay off in the long run.
- Getting information to the tribes about industry financing vs. government financing
- Limited number of native architects/culturally relevant/sensitive green design
- Leadership priorities - regulation and banking not going well together
- Appraisal Value - For example, getting an appraiser out to a location can be costly
- Fragmentation within the tribe (ownership/responsibility)
- Availability and development of green building codes
- Standardization of rules and regulations and processes across agencies
- Tribal empowerment - lack knowledge of exercising their sovereignty; they don't know they have the ability to legislate in that area.
- Agencies don't always incentivize green building.
- Remoteness, especially in Alaska. Sometime the infrastructure does not exist
- The number of tribes and the diversity of tribes
- The large number of tribes and the limited number of Federal staff
- Coordination with tribal groups/NGO's is not as good as it could be

- Cost - such as the impact of Total Development Cost, Dealing with small tribes is not cost efficient. COSTS AND FUNDING
- Quality Assurance
- Tribal capacity - turn over, knowledge sharing and transfer. Change in leadership, short staffed.
- Dissemination of information during digital age
- Lack of physical housing inventory
- Construction time and the availability of contractors.
- Okay to go "deeper green" - the cutting edge in green building construction

Results of Dot Ballot Voting

General construction issues (red dots)
The five impediments that received the most votes included:

- Lack of money/flow of funds (9 votes)
- Tribal capacity – turnover, knowledge sharing and transfer. Change in leadership, short-staffed. (7 votes)
- Land issues (9 votes)
- Short-term versus long-term focus (6 votes)
- Fragmentation within the tribe (ownership/responsibility)(5 votes)

Green issues (green dots)

The major categories that emerged from voting on specific barriers included:

- Building codes (21 votes)
- Costs/funding (16 votes)
- Capacity building (15 votes)
- Planning (15 votes)
- Benefit analysis (8 votes)
- Infrastructure (6 votes)

One participant noted that there are some issues the group can impact and others that are harder to impact, e.g., staff turnover. She suggested a focus on issues that the group can address.

Bridging the Gap (Solutions)

Capacity building

- Expand the services provided by NGOS that give interim support.
- Develop the capacity of CDCs because there are not enough groups that have this capacity.
- Develop the number of Native CDCs with capacity to serve Native communities.

Building codes

- Develop matrix of funding sources to tribes.
- Develop new green building standards. Participants think we should talk about standards rather than a code. Tribes can develop their own standards/policies that are more stringent than state codes.
- Have one, consistent income limit for all programs (several think this is true for all construction).
- Tribal policy.
- Adopt incentives that encourage tribes to implement green practices/ meet green standards.
- Adopt International Building Code (IBC) customized by individual tribes.
- Pick standards that you particularly want to emphasize, e.g., stand up to a particular wind speed. But need to be cautious because don't want to discourage building because of too stringent standards.

Planning

- Provide initial planning for tribes
- Education – identify funding for planning:
    - Let tribes know that they can use planning under ICDBG
    - Let tribes know that there are regional planning commissions that can help them do comprehensive planning
    - Can access EDA public works planning grants
    - Can get other grants to do planning, e.g., new Native American Business Development Initiative grant
    - ANA
    - Green PDR – can provide assistance to tribes to identify funding sources
    - NAIHC – training on development/financing
- Cross-agency training and training at the tribal level to educate groups about the types of assistance that are available
    - Native Learning Center
    - NAIHC provides classes and also provides direct TA to tribes
    - Mayor's Institute on Urban Design – do tribal version

Benefit Analysis – Resident and Community Education

- Because of turnover, need to do this "over and over and over again." Have to repeat education/training regularly because energy is not at the top of their radar screen. The training is more effective when you get a group of people in a given tribe together for a several day training because there is critical mass and the knowledge is sustainable. This is much more effective than having only one person from a tribe attend a regional training. You need a champion to lead the charge, and the champion can be a housing authority director.

Costs/Funding

- Focus on smaller items as a step toward going green.
- Education on the life-cycle costs; Daniel Glenn – HUD needs to reevaluate TDC to incorporate lifecycle costs; educate tribes on ability to get a waiver and go above TDC

- Education about the benefit to other programs – for example, healthier buildings will reduce health care costs
- Use creative financing – use other sources in addition to HUD funds – do better job of leveraging funding
- Cost-benefit analysis tools – see payoff of putting in different energy efficiency options – see return on investment (ROI) of different options
- Tax benefits, e.g., of solar
- Health benefits/impact on health
- Cultural relevance
- Insurance reduction -- Convince insurance companies that building green homes will save them a great amount of money. Fireman's Fund (offers discount for LEED home), Farmer's Insurance of Los Angeles and Fireman's Fund (provides eco-rebuild options)
- Train appraisers -- Get appraisers to recognize additional value to a home that has green features
- Educate local lenders about value of green building
- Cost-benefit analysis ("What if matrix")

Demonstrate benefits of sustainable housing to decision makers

- Assessment of existing stock that identifies shortcomings
- Comparison of green project to other homes – do as baseline (not ongoing)
- Look at best practices in tribal housing
- Lots of these analyses have been done for non-tribal developments – perhaps adapt these
- Have a tribal version of the DOE's Solar Decathlon featuring solar (or other renewable energy heated) homes built at tribal colleges.

Quality versus Quantity

- Perception change – show them tribes who have done it well/models
- Offer incentive/rebates

Paramount to this effort – need to change how homeowners perceive housing. How can housing providers change homeowners' attitudes and behaviors?

Coordination/Collaboration/Improvement: How do different agencies improve how they work together to accomplish goals?

- Find right person to provide TA
- Coordinate/schedule meetings better rather than have multiple meetings with tribes
- Coordinate among agencies about outreach schedules –align agency visits
- More local training – get more tribal areas together
- Do a joint project – agencies work together on, e.g., master plan
- Clearinghouse of meetings
- Interagency meetings

APPENDIX B: ORIGINAL INVITEES

Govern-mental Invitees	Name and title	Organization and address
1	Winter Jojola-Talburt, Electrical Engineer	DOI, Office of Indian Energy and Economic Development
2	Rebecca Halloran, Presidential Management Fellow	HUD, Office of Native American Programs
3	Lizana Pierce, Administrator	DOE Tribal Energy Program
4	Tedd Buelow, Native American Specialist	US Department of Agriculture
5	Brian Gillen, Region V Sustainability Officer	Eastern/Woodlands ONAP
6	Randy Akers, Administrator	Northern Plains ONAP
7	Lisa Stewart, Grants Management Specialist, or Tom Carney, GM Director	Northwest ONAP
8	Michelle Tinnin, Native American Program Specialist	Southern Plains ONAP
9	Carolyn J O'Neil, Administrator	Southwest ONAP
10	Jed Harrison, Tribal Program Advisor	EPA
11	Carrie Nelson, Low-Income Weatherization for Tribes	Bonneville Power Administration
12	Cynthia Kitchens, SWT	U.S. Army Corps of Engineers
13	Martin Nee, Division Director	HUD Healthy Homes
14	Dana Baer, Assistant Program Director, or Gordon Delchamps, General Engineer	Indian Health Service
15	Evangeline Campbell, Program Manager	Department of Labor Indian and Native American Program
16	David Vought, Native American Programs Specialist	HUD Alaska ONAP

NGO Invitees	Name and title	Organization and address
1	Stewart Sarkozy-Banoczy, Director	HUD PD&R IPI (formerly of Oweesta)
2	Russell D Kaney, Sr. Program Director	Enterprise Community Partners
3	Charles Anderson, Training & TA Specialist	National American Indian Housing Council
4	Katherine (Katie) Hoyt, Legislative Fellow	National Congress of American Indians
5	Judith Grunau, Architectural Designer/Program Manager	Cold Climate Housing Research Center
6	Tony Monroe, Board Member	Green Native Council
7	Jon Panamaroff, Executive Director	Oweesta
8	Dr. Holly YoungBear-Tibbetts, Dean, External Relations	College of Menominee Nation
9	Lacey Gaechter, Assistant National Director	trees, water & people
10	Holly Tiger Bowers, Executive Director	Native Learning Center
11	Colleen Steele, Executive Director	Mazaska Owecaso Otipi Financial Inc.
12	Zoe LeBeau, Sr. Program Manager	Corporation for Supportive Housing, American Indian Supportive Housing Initiative (AISHI)
13	Cindy Owings, Executive Director	Red Feather Development Group
14	Tanya Fiddler, Executive Director, also on Native CDFI board	Four Bands Community Fund

15	Greg Bland, Director	Travois Environmental Services
16	Hazel James, Executive Director (works with Navajo Nation)	Indigenous Communities Enterprises
17	Billie Spurlin, Executive Director	Salt River Financial Services Institution
18	Dorothy Stoneman, President, and Kim Phinney, Director Rural and Tribal Development	Youthbuild

Coordination Meeting	Name and title	Organization and address
1	Rick M. Garcia Regional Administrator	Denver Regional Office HUD
2	Rebecca Halloran, Presidential Management Fellow	HUD OLG, on rotation with the DOE's Tribal Energy Program
3	Lizana Pierce Director	Tribal Energy Program Department of Energy
4	Tedd Buelow Native American Specialist	US Department of Agriculture
5	Charles Anderson, Training & TA Specialist	National American Indian Housing Council
6	Phil Bush, Director	Nevada-California Indian Housing Association
7	Russell Kaney, Sr. Program Director	Enterprise Community Partners
8	Judy Romann, Construction Projects Coordinator, and/or Annette Bryan, Executive Director	Northwest Indian Housing Association (NWIHA)
9	Evangeline Campbell, Program Manager	Department of Labor Indian and Native American Program (INAP) TEAM
10	Jon Panamaroff, Executive Director	Oweesta
9	Sabrina Stephens and another SPIHA director	Southern Plains Indian Housing Association
10	Dan Duame, Board President	Association of Alaska Housing Authorities and Aleutian Housing Authority
11	Kitcki Carroll, Director	United South and Eastern Tribes
12	Jed Harrison, Tribal Program Advisor [or Alfreda Mitre, EPA Region 8, Tribal Assistance Programs]	Environmental Protection Agency (EPA)

13	Winter Jojola-Talburt, Engineer, or Payton Batliner, Program Specialist	DOI/BIA
14	Michael Chavez, President	Southwest Indian Housing Assn
15	Dana Baer, Assistant Program Director, or Gordon Delchamps, General Engineer	Indian Health Service
16	Steven Golubic, National Tribal Liaison	FEMA
17	Rodger Boyd, Deputy Assistant Secretary	HUD ONAP
18	Roger Taylor, Tribal Energy Program	DOE NREL
19	Martin Nee, Division Director	HUD Healthy Homes
20	David Vought, Native American Programs Specialist	Alaska ONAP
21	Brian Gillen Native Programs Specialist, Region V Sustainability Officer	Eastern/Woodlands ONAP
22	Randy Akers Administrator	Northern Plains ONAP
23	Lisa Stewart, Grants Management Specialist, or Tom Carney, GM Director	Northwest ONAP
24	Michelle Tinnin Native American Program Specialist	Southern Plains ONAP
25	Carolyn J O'Neil Administrator	Southwest ONAP

Appendix C-1:
Case Study

Sustainable Construction in Indian Country

Rehabilitating Housing to Incorporate Lower-Cost Sustainability Measures

Cocopah Indian Tribe

"Better housing is one of the most basic and important improvements we can make in peoples' lives, and the jobs this creates won't be the only benefit the community sees from this project."

- Arizona Congressman Raul M. Grijalva

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Increasing the number of tribal members living on the reservation by retrofitting and renovating existing housing to improve housing conditions and decrease energy costs.

Solution

Upgrading three existing apartment buildings with largely low-cost solutions so they become an affordable, energy-efficient model project in the community.

Community Snapshot

Location: Lying 13 miles south of Yuma, Arizona, the Cocopah Indian Tribe reservation takes in 6,500 acres, is divided into three noncontiguous areas, and borders Mexico along the Colorado River.

Location type: Rural/agricultural

Population: The Cocopah Indian Tribe has approximately 816 members.

Climate: Desert climate with extremely hot summers and warm winters. Extremely sunny, the area receives an average of 3 inches of rain annually. (Köppen classification: *BWh*)

Critical Sustainable Technologies and Strategies

- Compact fluorescent lamps (CFLs)
- Double-paned low-emissivity (low-e) windows
- Energy-efficient air conditioners
- Sustainable roofs
- Faucet aerators and low-flow showerheads
- Upgraded water heaters
- ENERGY STAR appliances

Table of Contents

Funding

Activity	Funding Source
Rehabilitation of three buildings with 24 units total	U.S. Department of Agriculture Housing Preservation Grant U.S. Department of Housing and Urban Development (HUD) Indian Community Development Block Grant HUD Native American Housing Assistance and Self Determination Act

Map

Summary

The Cocopah Indian Tribe seeks to encourage tribal members to stay on-reservation and to encourage members living off-reservation to return by providing affordable, safe, decent, and sanitary housing for all. To assist with this goal, Cocopah Indian Housing and Development (CIHAD) has been implementing affordable, energy-efficient changes to its older housing for the past 10 years. CIHAD Chief Executive Officer Michael Reed takes a commonsense approach to sustainability and cost savings: as old systems and appliances wear out, replace them with more sustainable products. Under the dry, hot desert conditions of the Cocopah reservation, they may wear out sooner than a system's normal anticipated life span.

CIHAD corporate office, Somerton, AZ

Currently, CIHAD is rehabilitating three two-story garden apartment buildings that have a total of 24 apartments. The apartment buildings, built in 2003, share a site with a community building and parking area.

Multifamily apartment rehabilitation project

CIHAD plans to upgrade these buildings as a sustainable, energy-efficient, affordable model project in the community. It is replacing lighting, water fixtures and fittings, appliances, air conditioning, and windows, and is making other changes. To carry out this work, CIHAD has added a new partner to the mix: its utility provider. The Tribe worked with Arizona Power Service (APS) to take advantage of an incentive program which provided free compact fluorescent lamps (CFLs), faucet aerators, and low-flow showerheads. In addition, it worked with building residents and APS to receive utility cost data from a 12-month period for one of the buildings. The data were analyzed to create a cost and usage baseline that will help guide future energy-efficiency strategy decisions. Reed said, "It is too soon now to see if we have cost savings and how much. We have a baseline and in a year we will see if electricity use has improved."

The following chart describes the technologies and their effect on sustainability.

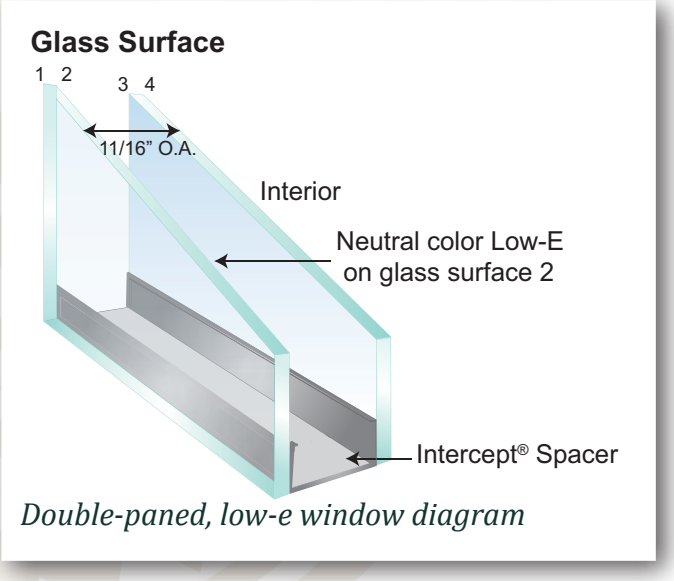
Sustainable Technologies	What Is It?	Effect
Compact fluorescent lamps (CFLs)	CFLs are made of glass tubes filled with gas and a small amount of mercury (100 times less than a thermometer). The mercury emits an invisible ultraviolet light that becomes visible when it hits the white coating inside the CFL.	Switching to energy-efficient lighting is one of the fastest ways to cut energy bills. CFLs last about 10 times longer and use about 75% less energy than traditional incandescent bulbs. A typical CFL can pay for itself in energy savings in less than 9 months and can continue to cut energy costs each month.
Low-e windows	Low-e, or low thermal emissivity, windows have a coating on the glazing or glass that absorbs, reflects, and emits low levels of radiant thermal (heat) energy depending on the weather.	Low-e windows typically cost about 10% to 15% more than regular windows according to the U.S. Department of Energy (DOE), but they may reduce energy loss by as much as 50%. The greatest savings tend to come from areas with hot summers, cold winters, or both.
Energy-efficient air conditioning (high Seasonal Energy Efficiency Ratio or SEER)	The efficiency of air conditioners is often rated by the SEER defined by the Air Conditioning, Heating and Refrigeration Institute. The higher the unit's SEER rating the more energy efficient it is.	High-efficiency air conditioners result in lower monthly energy bills and often include additional energy-saving features.
Sustainable roofs (30-year shingles)	Various factors such as the thickness of the shingle, the materials from which it is manufactured, and the amount of asphalt used determine the length of warranty on the shingle.	These shingle roofs are intended to last for a longer time than their 10-15 year predecessors. This is both financially and environmentally desirable.
Faucet aerators and low-flow showerheads	Aerators use specialized airflow regulators to mix water and air to reduce water flow while increasing pressure. Low-flow showerheads also significantly reduce water flow.	The aerators use 1.5 gallons per minute, or 31% less water than a standard faucet. The low-flow showerheads use 1.5 gallons per minute, 20% less water than standard showerheads, according to the Arizona Power Service (APS). By using a lower flow faucet, less energy is used for heating hot water for everyday use. APS estimates that $246 in utility bills and 8,212 gallons of water per year will be saved.
Energy Star appliances	Energy Star appliances are independently certified through a program of the U.S. Environmental Protection Agency (EPA) and the DOE.	The products save money and protect the environment. For example, replacing a 1980s model refrigerator with an Energy Star version could save $100 a year in total energy costs. Replacing a clothes washer could save as much as $110 a year.

Rehabilitation and Climate

In recent years, CIHAD has been renovating tribal homes with U.S. Department of Housing and Urban Development (HUD) and U.S. Department of Agriculture (USDA) grants. Fifty of the "oldest and most in need" homes on the reservation received major rehabilitation, including new roof shingles, heat/air conditioning systems, ductwork, floors, baseboards, exterior and interior doors, security screen doors, 200-amp electrical systems, dual-pane windows, and exterior and interior paint, according to an article in the *Yuma Sun*. Kitchen and bathroom upgrades involved installing new appliances, cabinets, countertops, vanities, showers, towel bars, medicine cabinets, exhaust fans, toilets, and plumbing.

Currently, CIHAD is undertaking rehabilitation on three garden-style apartment buildings that were built in 2003. Each all-electric building has eight units (four two-bedroom and four three-bedroom units), and split-system electric heat pumps (which include cooling systems). Each building is 8,523 square feet, with apartments ranging from 855 to 1,107 square feet. On the same lot are a community building with a common laundry area and parking.

Temperatures of up to 124 °F and the hot summer sun can shorten the lifespan of some materials and appliances. Some of the first upgrades the CIHAD maintenance team is making to the three buildings—Seasonal Energy Efficiency Ratio (SEER) 14 air conditioners and 30-year shingles on the roof (rather than the old 10-15 year shingles)—should help with cooling. The region also has hard water, which causes deterioration in the water heaters. As these water heaters give out, they are being upgraded to more energy-efficient models.



Double-paned, low-e window diagram

Windows were added into the mix when they began to experience problems. CIHAD will replace windows in all three buildings with double-paned, low-e models, which will come at a cost of $1,480 per apartment. The Tribe anticipates that replacing the lighting, windows, stoves, and refrigerator will take 18 months. An additional benefit of the project is that CIHAD's own staff, more than one-half of whom are tribal members, will conduct the work.

Community Involvement

CIHAD held two public meetings at the complex to inform tenants about the planned changes to the windows and lighting. CIHAD staff are also walking tenants through these changes as they install new windows, CFLs, and lighting fixtures, and make more renovations in the apartments.

Utility Company Opportunities

Utility companies are motivated to encourage smart energy use and energy efficiency to provide more consistent, efficient, and cost-effective power. Companies such as APS offer free or low-cost energy-efficiency services, incentive programs, and rebates to their customers. Tribes sometimes may be hesitant to reach out to utility company programs, but as paying customers of a utility, tribes, tribally designated housing entities (TDHEs), or tribal housing residents (depending on who pays the utility bills) may have access to a range of programs and incentives.

Assessments and Incentives

Many utilities offer energy-efficiency assessment services. APS offers a Multifamily Energy Efficiency Program that provides eligible building owners a free onsite energy assessment to identify quick areas of upgrade for energy savings, free energy cost reduction measures (ECRMs), and technical and field support to assist with installation. In May 2012, the Tribe requested an onsite energy assessment of one of its buildings. APS conducted an assessment of the eight apartments' lighting and water features. APS installed the following ECRMs at no cost:

Low-flow showerheads and faucet aerators

- 24 kitchen faucet aerators and 36 bathroom faucet aerators.
- 38 low-flow showerheads.
- 360 CFLs.

Other utility companies may partner with HVAC consultants to offer thorough energy assessments. The HVAC consultant observes the housing from top to bottom, noting features from insulation levels to water heater age and model. These assessments likely have an associated fee (although less than would be charged without the program) and come with recommendations that the utility may assist in funding.

Most commonly, utilities provide their customers with rebates. The occupant or TDHE purchases a qualified heating and cooling system or appliance. It then submits paperwork including a receipt to receive a cash rebate.

Benchmarking

Benchmarking is a method that facilitates energy accounting, comparing a facility's energy use with that of similar facilities to assess opportunities for improvement and quantify energy savings. Because CIHAD tenants pay their own APS electric bills with a utility allowance provided by the housing department, CIHAD initially did not have access to usage data for its buildings. Each tenant household provided APS with a signed release form, enabling APS to send CIHAD cost and kilowatt-usage data for the period of 1 year.

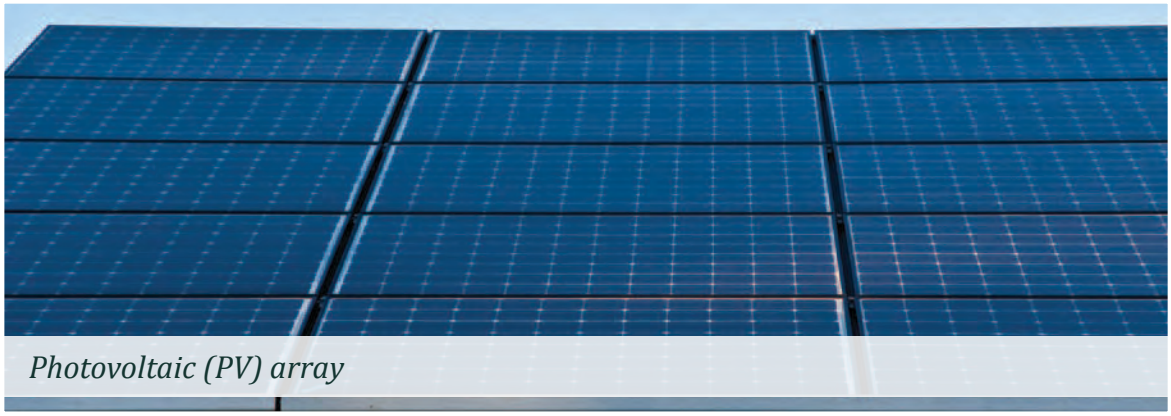
Apartment building electricity meters

A HUD Sustainable Construction in Indian Country (SCinIC) initiative team including the University of Illinois Urbana Champaign Building Research Council conducted a comprehensive energy analysis of the eight units of Building B, one of the three garden apartment buildings, for the 2011 calendar year. The SCinIC team plugged those figures into a modeling program to calculate a baseline usage for the building and to make recommendations for ECRMs. CIHAD can also use this initial baseline to measure its success in reducing energy usage and cost in future years.

Renewable Energy and Net Metering

Solar domestic hot water

APS also offers renewable energy incentive programs, including photovoltaic array and solar domestic hot water incentive programs; these are not available to the CIHAD, but to individual customers. Program members can also participate in APS' net metering program. In this program, if the renewable resource produces more power than is needed for the home, the electricity is fed back into the power grid and the participant's utility account is credited.



Photovoltaic (PV) array

Project Summary

PROJECT NAME: Multifamily Buildings
LOCATION: Somerton, Arizona
TIMELINE: 2011 though present
PROJECT TYPE: Multifamily apartment rehabilitation

Project Key Features

- Free incentives from the local utility company.
- Individual heat pumps.
- Associated community building.
- Common laundry area.

Key Sustainable Elements

- CFLs.
- Low-e windows.
- High-SEER air conditioning.
- Thirty-year shingles.
- Faucet aerators and low-flow showerheads.
- Upgraded water heaters.
- Energy Star appliances.
- Benchmarking.

Thirty-year shingles

Low-e windows

High SEER air conditioning

Best Practices

CIHAD has focused its initial energy-efficiency upgrades on the most affordable strategies—but these upgrades can have major consequences for a housing authority's or an occupant's bottom line.

The SCinIC energy assessment report compared cost and kilowatt usage for incandescent lighting and CFLs. It estimated that the building would save $282 annually through this simple upgrade. The cost of interior lighting with incandescents in one apartment building was estimated at about 21 percent of the building's total costs. The upgrade to CFLs, even when factoring in the cost of the CFLs, is estimated to pay for itself in less than 18 months and to save the building 2,171 kilowatts annually. (In this case, CIHAD did not have to purchase 360 CFLs because of its participation in the APS program.)

CFL Lighting upgrade				
Annual Savings per building				
Kilowatts	**Dollars**	**Percent of Energy**	**Cost of Installation**	**Simple Payback**
2,171	$282	3%	$395	1.4 years

CIHAD also had bathroom and kitchen aerators, and low-flow showerheads installed through the APS program. These items are not costly. Aerators cost between $5 and$10 each and less expensive low-flow showerheads between $15 and $50, but they can also bring in big savings. According to the U.S. Environmental Protection Agency's (EPA's) WaterSense program, the average household spends as much as $500 per year on water and sewer bills and can save about $170 per year by installing water-efficient fixtures and appliances.

CIHAD is replacing refrigerators, air conditioners, and water heaters as they wear out. Refrigerators consume the most energy of all household appliances because they operate 24 hours a day. The units' original refrigerators (1995 models) are estimated to cost $112 annually to run, compared with only $51 annually for an equivalent new Energy Star model. This upgrade could save each tenant $61 per year.

Refrigerator upgrade				
Annual Savings per building				
Kilowatts	**Dollars**	**Percent of Energy**	**Cost of Installation**	**Simple Payback**
3,754	$488	6%	$3200	6.56 years

Energy Star replacement

By starting with less expensive changes and replacing systems as they wear out, CIHAD and its residents can expect to see some quick return on their investment with cost and energy savings.

Next Steps

The Tribe has been renovating homes on the reservation for the past 10 years. The original focus of the current retrofitting project was three apartment buildings, but now the Tribe plans to make the same energy-efficient improvements to the remainder of its housing.

Many of the changes CIHAD is making to the three garden apartment buildings are the most affordable, quickest return options, but it is also considering more extensive sustainable upgrades for the future. According to Reed, although CIHAD is currently installing a 30-year upgraded shingle roof, it is looking at more expensive/durable roofs for the future, although "we're not there yet." CIHAD is also looking at solar panels for existing projects. Reed noted CIHAD is using the current projects as a pilot "to see if we break even."

The SCinIC report recommended adding window shading to the exterior of the building, protecting windows and apartments from the sun. Although this upgrade was estimated to cost about $2,000 per building, it had an anticipated payback time of slightly more than 8 years and an estimated annual utility cost savings of about $242.

CIHAD also is planning to include sustainable features in their new construction. It is submitting plans to Indian Community Development Block Grant to add infrastructure for two new homes on the North Reservation—and, in the long run, will seek funding for 14 homes on the lots. In the proposed rental housing units, Reed said, "We will do everything we can—lighting, higher R-factor walls, high SEER, nice 30-year roofs, stucco," depending on available funding. He also noted that CIHAD may choose totally different options in the future. For example, he said, "I like the idea of not having a hot water heater because water is so poor here, so we are open to other options." CIHAD will continue to apply for a variety of federal and state grants as they become available to continue financing its sustainable rehabilitation projects.

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How To Get Started

To learn more about utility program incentives and energy-efficient lighting, appliances, benchmarking, and the energy assessment report, check out these resources.

Database of State Incentives for Renewables & Efficiency on utility company and other incentives:
http://www.dsireusa.org/

EPA on energy efficient improvements, including low-e windows:
http://www.epa.gov/greenhomes/ReduceEnergy.htm

EPA on CFLs:
http://www2.epa.gov/cfl/

Energy Star on appliances:
http://www.energystar.gov/index.cfm?c=products.pr_find_es_products

Energy Efficiency Evaluation and Recommendations: 14380 S. Farm Road Multifamily Housing
http://www.huduser.org/portal/SCinIC/EnergyAssessment_Cocopah11_28.pdf

APS:
http://www.aps.com/

DOE and EPA Energy Star on benchmarking for multifamily housing programs:
http://www.energystar.gov/index.cfm?c=multifam_housing.bus_multifam_housing

CIHAD:
http://www.ontherez.org/

This best practice case study is one in a series that examines how Native American and Alaska Native communities have incorporated sustainable technologies and strategies into their housing development.

The Sustainable Construction in Indian Country initiative was created to support and increase sustainable construction practices in Native American communities. It is administered through the U.S. Department of Housing and Urban Development's Office of Policy Development and Research in partnership with the Office of Native American Programs.

Some photos, tables, and renderings courtesy of CIHAD and the University of Illinois Urbana Champaign Building Research Council.

Produced May 2013

Appendix C-2:
Case Study

Sustainable Construction in Indian Country

Moving Toward Sustainable Design and Homeownership Despite Emergency Circumstances

Native Village of Kwinhagak

"We are among the most poverty stricken communities in rural Alaska. It is imperative to me that we find energy efficient, more durable, and affordable housing that will last. I am hopeful and excited to see how these new energy efficient designs will hold up over time."

- John O. Mark, Native Village of Kwinhagak Tribal President

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Providing new, sustainable opportunities for homeownership and replacing 55 units of housing that has emergency-level structural damage, overcrowding, and extremely high utility costs.

Solution

The Kwinhagak Work Group, established at the request of U.S. Senator Mark Begich, is pursuing a pilot self-help model homeownership program with sustainably designed housing.

Community Snapshot

Location: Less than 1 mile from the Bering Sea, 70 miles south of Bethel, Alaska
Location type: Remote, rural
Population: 800
Household size: 4.05 (compared with the Alaska average of 2.65 and the Bethel average of 3.09)
Climate: Wet, with 11,700 heating degree days in Alaska for 2011; cool summers (41 ˚F to 57 ˚F) and cold winters (6 ˚F to 24 ˚F) (Köppen classification *Dfc*).

Critical Sustainable Technologies and Strategies

- Quinhagak wall
- Vented airspaces
- Mold-resistant materials
- Heat Recovery Ventilator
- Floating-raft foundation
- Spray-foam envelope insulation
- Energy-efficient electrical appliances and lighting
- Octagonal design that addresses cultural and climate requirements
- Integrated "whole-house" truss

Table of Contents

Funding

Activities	Funding Sources
Demolition and disposal of materials	U.S. Department of Housing and Urban Development (HUD) Indian Community Development Block Grant (ICDBG) Imminent Threat Grant
Purchase of deteriorated houses from homeowners	ICDBG 2011
Construction	Title VI loan, donations, Indian Housing Block Grant
Mortgage products	U.S. Department of Agriculture Section 502 Loan Guarantee Program and HUD Section 184 Loan Guarantee program

Map

Summary

In 2009, the Native Village of Kwinhagak (NVK), 70 miles south of Bethel, Alaska, and less than 1 mile from the Bering Sea, was in a difficult situation. Not only were many of its young families unable to find homes, but also 55 out of NVK's 160 houses were severely deteriorated because of frequent battering by harsh wind, rain, and storms. NVK declared a housing emergency.

Native Village of Kwinhagak

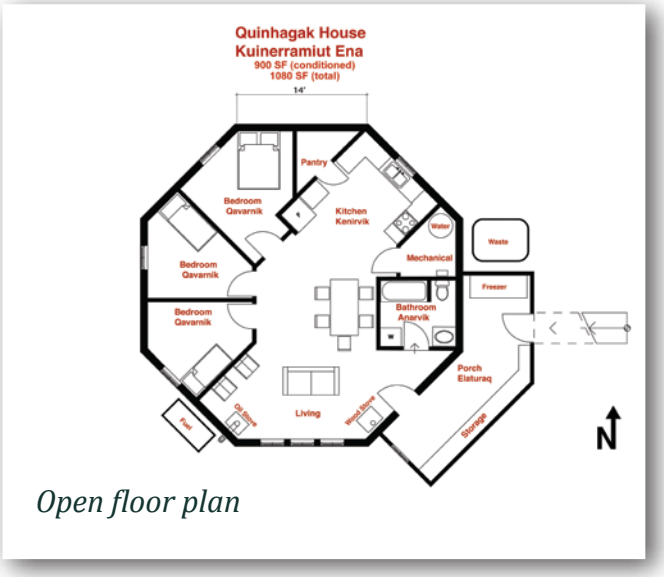
First priorities involved securing funds for demolition, cleanup, site control, and new construction. The community determined it needed homes that were more durable and energy efficient than the conventional housing style it had been using. NVK invited representatives from the Cold Climate Housing Research Center (CCHRC) to conduct charrettes and develop a culturally appropriate prototype. This house, known as the Quinhagak prototype, was completed in 2010.

Quinhagak prototype

In the 2012 building season, community leaders decided on an ambitious plan: NVK would continue to build the multisided Quinhagak house, with its proven energy efficiency, but also add a more conventional-looking, but still energy-efficient, rectangular house. Both designs incorporate critical sustainable technologies and strategies. These technologies include a monolithic thermal envelope, vented airspaces, mold-resistant and lightweight materials, Heat Recovery Ventilators (HRVs), and energy-efficient electric appliances and lighting.

The designs meet the community's and designers' goals of lowering annual fuel usage, addressing moisture and mold conditions, decreasing shipping expenses, and facilitating construction assembly without heavy equipment. The Quinhagak design also addresses a cultural preference for an open floor plan and includes an arctic entrance large enough to process wild foods.

To finance the large-scale replacement, NVK leveraged existing housing funds with other resources. It is in the process of implementing a mortgage program that will allow for a self-help program, whereby families will contribute labor.



Open floor plan

The following chart describes the technologies and their effect on sustainability.

Sustainable Technologies	What Is It?	Effect
Quinhagak wall	A continuous monolithic thermal envelope that includes 3-inch thermal breaks in walls and 4-inch thermal breaks in the foundation. The walls and exterior siding are constructed of lightweight materials. The exterior wall is covered with foam insulation to create an envelope with no gaps.	Water- and wind-resistant, spray-foam thermal envelope eliminates thermal conduction; use of lightweight plastic and metal aids in shipping and construction. The Insulation rating is R-40.
Vented airspaces	Ventilation is created in spaces between trusses and roof sheathing. The roof is insulated to a rating of about R-50.	This system creates a necessary drainage plane and drying path.
Antimold materials	These materials include AC plywood and metal studs and joists. No gypsum wall board is used in the assembly.	In this a very damp location, these materials avoid mold growth, which can cause deterioration and unhealthy living conditions.
Heat Recovery Ventilator (HRV)	This mechanical ventilation system uses blowers to pull cold outside air into the house, warm it with existing heated inside air through an air-to-air heat exchanger, and distribute fresh air throughout the house.	HRV provides fresh air, which is critical in very tightly sealed housing.
Adjustable raised foam-filled mat foundation	Rigid frame foundations with spray foam-embedded metal joists are placed on an overbuilt gravel pad with adjustable post bases.	Spray foam provides water resistance, a thermal barrier, and greater rigidity for the frame. Adjustable post bases allow for changes in leveling.
Spray foam insulation	Spray foam insulation is used in walls, ceilings, crawlspaces, and other parts of buildings. It seals heat inside during cold weather and does not allow water to penetrate inside. Also reduces shipping cost, as it is transported in liquid form.	Spray foam insulation stops air and moisture infiltration, making homes more comfortable, energy efficient, and stable. This is a non-toxic foam.
Octagonal design	This design lessens surface area-to-volume ratio. An arctic entry was also included.	The lowered ratio means less surface area exposed to the cold and wind compared with a rectangular model of the same size. The special entry improves heating efficiency and protects the home from wet winds.
Whole-house or integrated truss	A prefabricated structure wherein the walls, floor, and roof are designed as a single component.	This design can be raised in a day without a crane, decreases raw material use, and increases recycling.

Planning

U.S. Senator Mark Begich inspects NVK homes

NVK is near the coast of the Bering Sea and is frequently battered by wind, rain, and heavy storms. Reports found that 55 units—approximately one-third of the community's housing stock—suffered from extensive mold and moisture deterioration. To address its short-term needs, NVK applied for and received an Imminent Threat Indian Community Development Block Grant to perform emergency health repair and enable residents to continue to live in their homes.

The community also faces high energy costs. NVK sought to develop a new housing model that was both more durable and more energy efficient. "The old buildings are so bad, it is hard to keep them warm," said John Mark, NVK Tribal President. NVK approached CCHRC 4 years ago. "In year one, the goal was to build a single house—to come up with a model that would be energy efficient, stand up well against the elements, and fit into the culture," said Jack Hebert, CCHRC President.

Charrette with NVK tribal members

CCHRC conducted charrettes to determine what issues were most important, including cultural elements, and to ensure complete understanding of energy efficiency. Of about 800 tribal members, 60 to 100 attended.

Bill Marks, former U.S. Department of Housing and Urban Development staff member and consultant with NVK, recalled that CCHRC separated men and women to capture different housing wishes. The women more often requested a nice kitchen and study areas for the kids, whereas the men wanted space to fix the snow machines. John Mark said, "We got great input from those in attendance. People were put into small groups to tackle part of the bigger puzzle. Their task was to say what they thought and to answer questions about how best to resolve a problem."

"The charrettes were helpful in getting everyone on board," Bill Marks added. "Council members participated in the charrettes. When talk started about what kind of housing, people reminisced about the kinds of homes we used to have—circular in nature for keeping the home pleasantly heated. It was not hard to convince anyone because people understood the concept already. It was not a hard sell."

Although the community was involved in the development process, reaction to the new design was mixed. Bill Marks said that some found "the idea was something of 'Back to the Future' …an octagonal house with a hole in the center of the roof for ventilation." Regardless, the housing committee was on board and simply said, "Now we have a design; let's build a house!" The prototype was completed in 2010 and monitored during 2011 for energy usage.

For the 2012 season, the community discussed whether the prototype would be replicated. After a discussion of need, local climate, and energy costs with members of the younger and older generations, members of the NVK council (tribe), city of Quinhagak council (municipality), and Qanirtuuq, Inc. board (local corporation) decided to move forward with a plan for four octagonal and one rectangular houses.

Construction Challenges

Procurement and transportation can raise significant challenges in remote communities, where logistics may amount to as much as 30 to 40 percent of the building budget. NVK is not accessible by road. It may be reached by airplane year round and by two to three barges in the summer. Hébert said, “If you forget to order a hammer and it doesn’t come on the barge, then you have to pay to fly it in, and that is much more costly.

Building materials arrive at Quinhagak Airport

When possible, the materials selected for these energy-efficient houses are lightweight or may be placed without need for a crane. Because procurement also takes time, planning 5 to 6 months in advance also helps keep costs down. “If you have to order something that has to be made or fabricated, you have to give enough lead time for these things to be built and then delivered to the barge. You have to be cognizant of the barge schedule. You can’t just call up a week before and order kitchen cabinets to come up on the June barge,” Hébert said.

In fact, in the 2012 building season, the NVK work crew framed and enclosed only three of the five houses it had hoped to construct, in part because of significant barge transportation issues. Because the materials for the additional houses are already onsite, the work crew will be able to start its 2013 building season early.

The building season also coincides with the traditional lifestyle calendar. For example, the first barge arrives in June, just as the salmon do. Construction in 2012 started at the beginning of moose and caribou hunting.

According to Hébert, “Knowing that the seasons (berry picking, salmon fishing, game hunting, etc.) are very important is essential when working with the villages. For us, it might seem very different culturally. We want to just push, push, and push all the time. We don’t understand why they are taking longer to complete something that in the lower 48 would be done much quicker. We have to look at things differently and respect that this is their cultural life and their livelihood."

He added, "This is true all over Indian Country. We have to understand that we cannot use our own filters to value one thing over another. For the village, subsistence and traditional life needs to take precedence over homebuilding.”

Design Adaptations

To withstand the wet, stormy, and cold climate, CCHRC developed several technologies. These were experiments and the interaction of a prototype house with both the climate and with occupants can lead to additional adaptations.

Foundation

The first winter after construction in 2011, monitors evaluated the octagonal prototype to show which elements worked and which needed improvement. The only architectural change made to the 2012 octagonal houses was to the foundation. The prototype was built on an insulated raft foundation sitting directly on the gravel pad.

2012 Octagon house (left) & prototype

The unstable soil thawed and heaved more than originally anticipated, causing drainage issues. The design was later modified to have the foundation float just above the ground. This updated foundation uses off-the-shelf components to create a foundation assembly that can be adjusted and releveled, should doing so become necessary because of shifting of the pad.

Whole House Truss

Integrated truss construction

The rectangular house design is also adapted from a prototype home that CCHRC designed in Crooked Creek, Alaska. The design shares many energy-efficient features with the octagonal house, including spray-foam envelope; metal roofing; and triple-glazed, low-e windows. A unique design feature is the "whole-house," or integrated truss construction; the structure of the walls, floor, and roof are designed as a single component. The truss was constructed offsite (in Alaska) and can be assembled onsite in a day without heavy machinery. Use of a prefabricated truss decreases the amount of wood used and allows for increased recycling; this approach also decreases construction time and generally lowers costs. This house is easier to construct than the octagonal design, but it lacks the cultural tie-in to the community.

Monolithic thermal envelope

Both house designs are extremely energy efficient because of a thermal envelope. In the Quinhagak house, the walls are constructed of 4-inch metal studs, a 3.5-inchplastic spacer in the middle, and a light-gauge angle iron that holds the siding 7.5 inches out from the inside of the stud. The rectangular house walls are wood. In both, a non-toxic soy-based spray foam is applied continuously inside the exterior wall to create a wind- and water-resistant envelope that is not drafty and requires little energy to heat.

Thermal envelope construction

Spray Foam

Spray foam application

Because NVK will need to build many additional houses, it decided to invest in the specialized equipment and training to enable the work crew to spray foam its own units in the future. This investment will add to in-house capacity, cost savings, and control over the building schedule. Initially, however, it was difficult to maintain the storage temperature needed keep the spray foam usable and the equipment required more careful cleaning than anticipated leading to some equipment malfunctions.

Project Summary

PROJECT NAME: Octagon houses
LOCATION: Quinhagak, Alaska
DESIGN/PLAN TEAM: Cold Climate Housing Research Center
TIMELINE: August 2012 through spring 2013
PROJECT TYPE: Single-family house

Project Key Features

- Gravel pad site- built-up gravel pad.
- Toyotomi OM-22 Oil Miser Direct Vent Oil Heating System.
- Backup wood stove.
- Half-roof trusses with metal hub connection.

Key Sustainable Elements

- Octagonal aerodynamic design.
- Venmar EKO HRV.
- Cultural open space and arctic opening design.
- Quinhagak wall.
- Floating-raft foundation.
- Triple-glazed low-e windows.
- LED (light-emitting diode) and CFL. (compact fluorescent lamp) lighting.
- Energy-efficient appliances.
- Vented air spaces.

Completed octagon house

2009

Multiple reports find 55 units "severely compromised."

NVK asks CCHRC to partner to develop prototype.

2010

Quinhagak (octagon) prototype completed.

2011

Data collected on octagon prototype energy usage.

Project Summary

PROJECT NAME: Rectangular house
LOCATION: Quinhagak, Alaska
DESIGN/PLAN TEAM: Cold Climate Housing Research Center
TIMELINE: August 2012 through spring 2013
PROJECT TYPE: Single-family house

Project Key Features

- Gravel-pad site and elevated wood piling foundation.
- Toyotomi OM-22 Oil Miser Direct Vent Oil Heating System.
- Backup wood stove.

Key Sustainable Elements

- Whole-house truss.
- Venmar EKO HRV.
- Triple-glazed low-e windows.
- LED and CFL lighting.
- Energy-efficient appliances.

Rectangular house construction

2012

- **CCHRC developed its Crooked Creek (Rectangle) prototype.**
- **NVK decides to build more octagon and whole house truss houses.**
- **NVK demolishes one unit and secures the site.**
- **NVK carries out health and safety repairs on 54 units.**
- **CCHRC visits to assist NVK.**
- **NVK completes enclosure of 2 octagon and 1 rectangle house.**
- **Interior work on houses continues over the winter.**

Best Practices

Monitoring of the Quinhagak protype has shown it to be 80 percent more efficient than previous housing, creating a significant savings when fuel oil costs $7 to $8 a gallon. Hébert said, "This is not so much a reflection of how intelligent we are but how bad the current housing truly is."

Spray foam insulation

These houses have the potential to give NVK much greater control over its budgets, utility costs, and even construction schedules. Because the cutting-edge thermal spray-foam envelope used in both housing designs is so energy efficient, the community can budget better for its heating fuel usage. In 2012, severe weather caused additional usage in the community that led to emergency shipments of fuel at even higher prices. The spray-foam envelope also lowers costs for residents, who can put the extra savings into a mortgage.

The use of a spray-foam envelope and other mold-resistant materials should increase the durability of the housing, enabling it to withstand the weather in NVK. Prospective homeowners are more likely to accept mortgage payments when they can count on their homes outlasting the mortgages.

The lightweight construction means that NVK does not need to bring in cranes and, with careful planning, that some transportation costs can be lowered. As NVK develops its internal capacity in skilled areas such as spray foaming, it will not need to adjust its construction schedule to accommodate specialists and can save costs. These considerations are important, considering the number of units that are needed in the community.

To build capacity of its work crew, NVK sent three crew members to specialized technology training. For the five houses NVK is currently building, it has needed to bring in only three outside workers: an electrician, a plumber, and a contractor for the foam insulation. NVK saves the cost of additional specialists, transportation, housing, and per diem. This capacity building at the village level is an important benefit to the community and financial stimulus for the local economy.

Next Steps

In the coming years, NVK needs to move from prototypes to 100 new homes to meet its housing need, addressing not only substandard units but overcrowding and the growing population of young families needing homes. With the successful sale of all the units already constructed by NVK, the community has seen firsthand that purchasing homes outright is possible. Thus, the number of families hoping to take advantage of new construction and the self-help concept has increased.

The self-help program will involve residents assisting with construction under the supervision of the skilled workers. To date, this component has not been implemented because many of the construction crews have been learning the basics.

The self-help program also involves the introduction of mortgages. Villagers are not accustomed to paying more than $150 a month for their homes; thus, challenges will likely be associated with this process. The Tribe applied for a rural development grant with a 1.0- to 1.5-percent interest rate, requiring families to make $500 to $800 monthly mortgage payments. Education and discussions will be required to teach tribal members how they might save through energy-efficient homes, freeing up money for these payments.

NVK is exploring the feasibility of constructing its own trusses in a former fish-processing plant or other protected location. Work crews could build trusses during the slower winter months, increasing winter employment opportunities, decreasing shipping costs (and eliminating damage caused by shipping), and ultimately enabling NVK to get a jump on its next building season.

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How To Get Started

To learn more about the prototype designs, HRVs, Toyotomi systems, and energy-efficient lighting and appliances, check out these resources.

CCHRC, prototype octagonal Quinhagak house:
http://www.cchrc.org/quinhagak-prototype-home.

CCHRC, Crooked Creek prototype house:
http://cchrc.org/crooked-creek-prototype-home.

The National Association of Home Builders' toolbase.org onHRVs:
http://www.toolbase.org/Technology-Inventory/HVAC/energy-recovery-ventilators.

Toyotomi OM-22:
http://www.toyotomiusa.com/products/laserventedheaters/OM-22.php.

U.S. Department of Energy, Energy Star on energy-efficient lighting and appliances:
http://www.energystar.gov/index.cfm?c=next_generation.ng_ee_light_app.

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Some photos courtesy of the Cold Climate Housing Research Center (CCHRC).

Produced May 2013

Appendix C-3:
Case Study

Sustainable Construction in Indian Country

Addressing Housing and Financial Need Through Sustainable Housing Improvements

Mississippi Band of Choctaw Indians

"The goal is to help every family achieve the American dream of owning their own home and driving their own destiny."

-Eric Willis, Executive Director, Choctaw Housing Authority

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

A substantial waiting list of tribal members reporting housing issues, including prohibitively high utility costs, which directly affect their ability to make housing payments and meet other expenses.

Solution

Creating new, energy-efficient homes featuring structural insulated panels (SIPs) and other sustainable components proven to reduce utility costs.

Community Snapshot

Location: Throughout east-central Mississippi, 8 communities in 10 counties
Location type: Rural
Population: Approximately 10,000 tribal members
Climate: Warm-to-hot summers (average 91 °F) with high humidity and mild winters (average 41 °F). High tornado activity (Köppen classification: *Cfb*)

Critical Sustainable Technologies and Strategies

- SIPs for walls and roof.
- Low-emissivity (low-e) windows and glass in doors.
- Compact fluorescent lamps (CFLs).
- Energy Star qualified/EnergyRight Platinum certified.
- High-efficiency heating, ventilation, and air-conditioning (HVAC)
- Energy Star appliances.

Table of Contents

Funding

Number of Homes	Funding Sources (2009-2012)
11 single family houses (SFHs)	U.S. Department of Housing and Urban Development (HUD) Native American Housing Assistance and Self Determination Act (NAHASDA)
32 SFHs	HUD NAHASDA
8 SFHs	HUD American Recovery and Reinvestment Act (ARRA)
1 SFH	HUD NAHASDA
10 SFHs	HUD NAHASDA
12 SFHs	HUD NAHASDA
8 duplex units	HUD ARRA

Map

Summary

The Choctaw Housing Authority (CHA) seeks to provide affordable, accessible, and sustainable housing for all of its tribal members. Unfortunately, many Mississippi Band of Choctaw Indian (MBCI) families live in overcrowded, drafty, uncomfortable, and sometimes unhealthy houses. The CHA waiting list currently has 500 Choctaw families waiting for new homes. The families' current homes often also have inefficient energy systems or aging windows and doors, resulting in high utility costs that some families struggle to pay.

Road construction for new subdivision

Some communities place the pressing need for more housing in opposition to the need for better quality and durable housing. MBCI was not willing to make this tradeoff; they are working to meet both goals. The CHA built 82 new, energy-efficient homes throughout its eight communities during the course of 3 years. At the same time, to encourage support for the new housing and its sustainable materials, the CHA implemented educational events—first, to let community members know about the benefits of energy-efficient housing and, second, to educate residents in the appropriate operation and maintenance of their new homes.

The CHA recently completed its fourth subdivision of new housing featuring structural insulated panel (SIP) walls and roofs. Although most of the houses are single family, these recent new homes include eight duplexes, which are designed to meet the needs of tribal members who are elderly, disabled, or veterans. All the homes are also equipped with low-emissivity (low-e) windows and doors; compact fluorescent lamp (CFL) lighting; high-efficiency heating, ventilation, and air-conditioning (HVAC); and Energy Star appliances. Tribal members report reducing their monthly heating costs from approximately $350 or $400 to $120.

The following chart describes the technologies and their effect on sustainability.

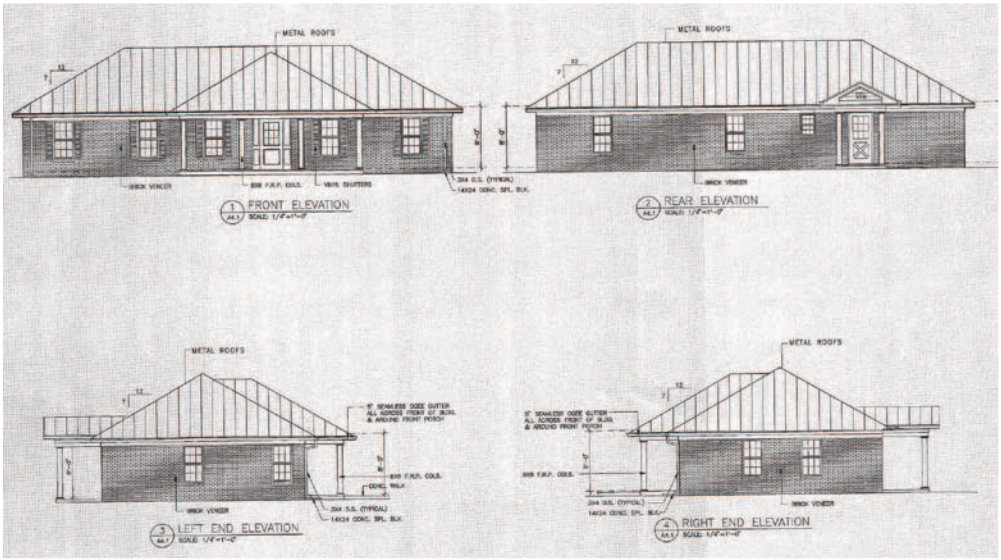
Energy Efficient Solutions	What Is It?	Effect
Structural insulated panels (SIPs)	SIPs are a building system for residential and light commercial construction. The panels are constructed like a sandwich. The filling is an insulating core and the bread is two structural facings, or *skins*. Manufactured in a factory, SIPs can be produced to fit nearly any building design.	A SIP building envelope provides high R-value in insulation and is extremely airtight. Department of Energy (DOE) studies are finding that SIPs can cut the amount of energy used to heat and cool a home by 40% to 50% when used in conjunction with other energy efficiency strategies.
Low-emissivity (low-e) windows and doors	Low-e, or low thermal emissivity, windows and low-e glass in doors have a coating on the glazing or glass that absorbs, reflects, and emits low levels of radiant thermal (heat) energy, depending on the weather.	Low-e windows typically cost about 10% to 15% more than regular windows, according to DOE, but they may reduce energy loss by as much as 50%. The greatest savings tend to come from the areas with hot summers, cold winters, or both.
Energy-efficient lights	CFL (compact fluorescent lamp) bulbs are made of glass tubes filled with gas and a small amount of mercury (100 times less than a glass thermometer). The mercury emits an invisible ultraviolet light that becomes visible when it hits the white coating inside the CFL bulb.	Energy Star-qualified fluorescent lighting uses 75% less energy and lasts up to 10 times longer than normal incandescent lights.
EnergyRight Platinum certified/Energy Star qualified	EnergyRight Platinum-certified new homes are Energy Star qualified. They are designed and built to standards above most other homes on the market today. Certification requires a process of third-party inspections to meet requirements.	Like Energy Star-certified new homes, EnergyRight Platinum-certified homes are certified as 15% more energy efficient than a minimum standard. Certified homes receive financial incentives in addition to utility cost savings and increased comfort.

Planning Process

Breaking ground on a new subdivision

Each year, the CHA holds a public hearing for tribal members to voice their opinions about MBCI housing needs and related issues. Each of MBCI's eight communities has a Development Club, which functions similarly to a homeowners' association, participating in local events and advocating for community residents. When CHA was preparing to begin development of these new SIP-built houses, it began an education campaign to help residents understand what this new construction material looked like and what it could offer. CHA provided the clubs with boxes of materials to use as visual aids to educate members about SIPs and other improvements. Although SIPs can cost more upfront, they can lead to significant cost savings over time. (The SIP construction costs were under CHA's HUD-allowed total development cost (TDC) requirements.) According to CHA Executive Director Eric Willis, "There was a learning curve regarding conservation and sustainable living. They chose SIPs because they thought they were a flexible option that would increase the integrity of construction and save money in the long run."

The CHA's Board of Commissioners also includes representatives from each community. The board provides direct input regarding the design and construction of homes. At the end stage of the planning process, CHA develops a proposal that requires board approval for the design of each home. After that, the procurement and development processes can begin.



4 bedroom home design

Goals

CHA is seeking to balance the higher upfront costs of sustainability with the extreme need on the reservation. This balance has required careful planning and use of cost-effective sustainable materials. Some residents have reported utility costs dropping more than 50 percent.

Housing Design and Location

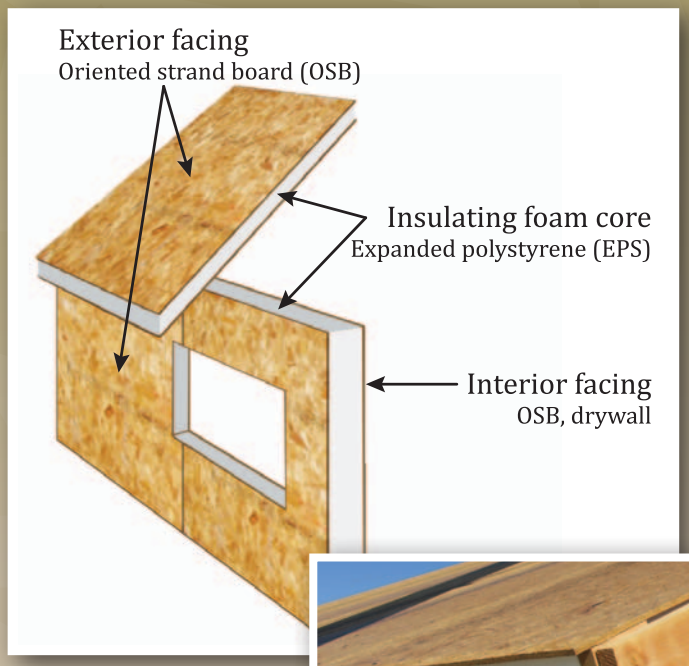
As executive director, Eric Willis needs to ensure that the most tribal members possible can be served with the limited budget available under the Indian Housing Block Grant. The community-designated lot size, in general, is 1 acre, so raising density is not an option. Willis has, at times, reduced extra amenities; the houses do not feature carports or garages, allowing for more living space. The four-bedroom houses, for example, are approximately 1,400 to 1,500 square feet. Residents can select from four designs to allow for individual taste.

To maximize CHA's budget and resources, the first houses are constructed along the outer edge of a subdivision to use the existing infrastructure. From year to year, new construction rotates among the eight communities. It may, therefore, take a little longer to complete an individual subdivision, but the new housing is spread among the communities.

Structural Insulated Panels (SIPs)

SIPs can be used for outside walls, floors, roofs, and foundations. The CHA had its houses designed to use SIPs for the exterior walls and roofs. (The houses are built on a slab foundation.)

SIPs are made of two facings, or surfaces, usually created from oriented strand board, on either side of an insulating foam core. Different facings include metal, fiber cement, plywood, gypsum board, and fiber-reinforced concrete. The most common types of foam core include expandable polystyrene, polyurethane, or polyisocyanurate. SIPs are also very strong, which is a plus during severe weather, including hurricanes, and has assisted CHA in decreasing rodent infestation problems.



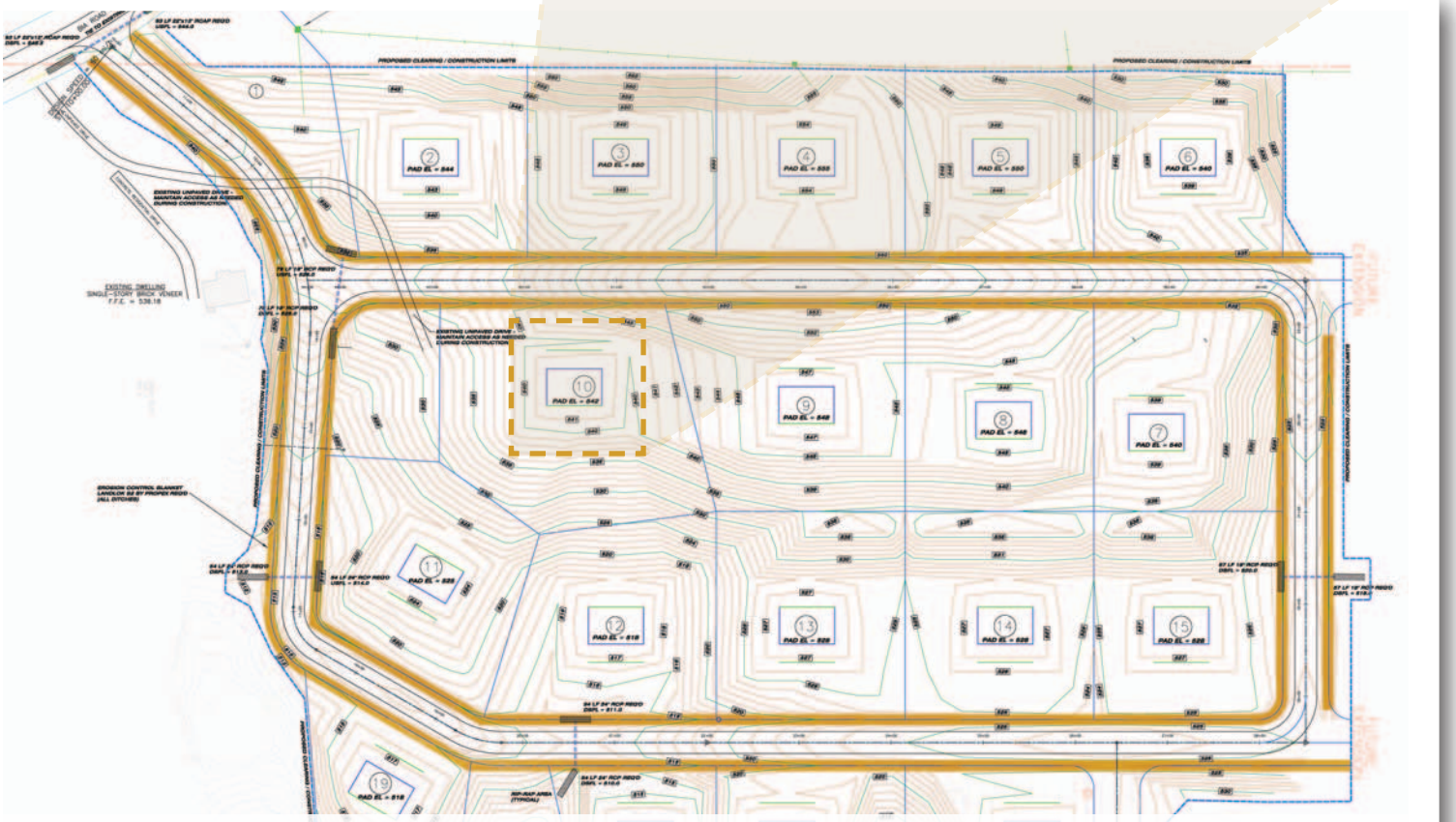
SIPs are assembled in a factory to the specifications of the developer. Because they are constructed offsite rather than in the field, like a stick-built house, they benefit from economies of scale, greater consistency of fit and performance, and better use of resources. Because they are prefabricated, houses can be assembled more quickly, and potentially with a smaller crew, than a stick-built house after the construction team is experienced. They can cost more upfront, especially when a crane must be used to install large panels.

Certification

The new energy-efficient homes have achieved Energy Star certification each year since 2010. They qualify under a New Homes Program operated by the Tennessee Valley Authority (TVA). The TVA, a corporation and utility company owned by the U.S. government, provides electricity for 9 million people in parts of seven southeastern States. The TVA New Homes certification has two program levels; platinum is the higher level.

The CHA new homes met a variety of efficiency standards, which made them eligible for TVA financial incentives, such as rebates. They were independently verified as 15 percent more efficient than required by the 2009 International Energy Conservation Code. This standard rated them as EnergyRight Platinum certified, which is also Energy Star qualified.

Energy Star/EnergyRight Platimun certified home



MBCI subdivision plan

Project Summary

PROJECT NAME: MCBI SIPs housing
LOCATION: Developments are in each of MBCI's eight communities
DESIGN/PLAN TEAM: Has differed on each subdivision Contractors have included Hal Brumfield (architect), Pritchard Engineering, and Engineering Service
TIMELINE: First subdivision homes came online in 2010 and continue coming online through the present
PROJECT TYPE: Seventy-four single-family houses and eight duplex units

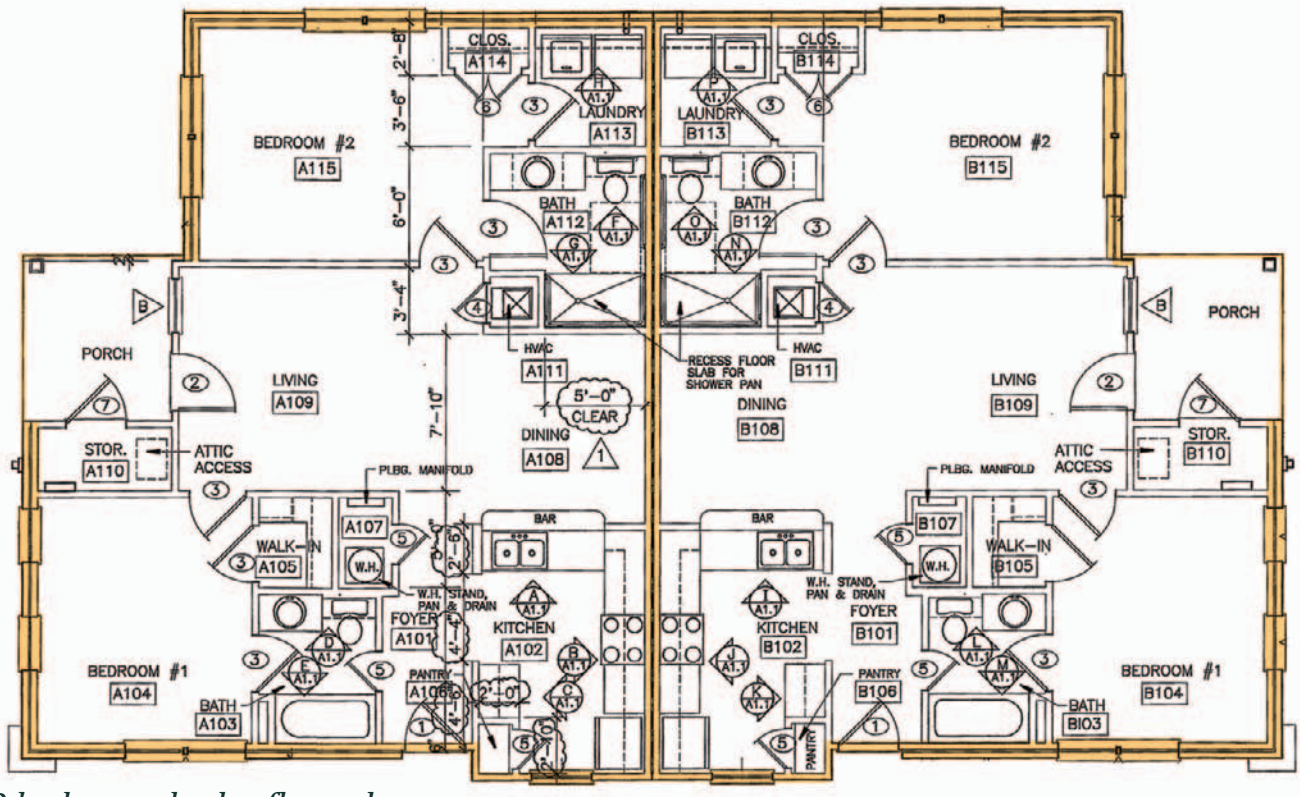
Project Key Features

- Built incrementally as budgeting permitted.
- Slab-on-grade foundations.
- Decreased operation and maintenance costs.
- Four design styles.
- No garages or carports to maximize living space.
- All electric.

Slab-on-grade foundation

Key Sustainable Elements

- SIP walls and roofs.
- Energy Star certified/EnergyRight Platinum certified
- Low-e windows and doors.
- High-efficiency HVAC.
- Energy Star appliances.
- CFL lighting.



2 bedroom duplex floor plan

Climate Adaptations

Because SIPs create a tight air seal, they require mechanical ventilation to ensure that indoor air quality remains good. High humidity in the local climate posed a significant challenge: The dampers for air return must be adjusted specifically to bring in adequate amounts of fresh air while consistently keeping moisture out of the home. CHA had special timers installed to monitor humidity levels.

Mechanical ventilation damper

Resident Education

Energy-efficient technologies can need specialized care and operation to perform up to their efficiency potential. To ensure tenants could enjoy the full benefits of their new homes, CHA mandated classes in properly using the new technologies and equipment to help residents save money and increase comfort and quality of living.

Energy efficient CFL bulbs

Specifically, CHA taught tribal members how to conduct preventative maintenance, including cleaning filters in their air conditioners and heaters. It also included making seasonal preparations, such as identifying, wrapping, and covering exposed pipes to increase efficiency. Residents learned to check that downspouts were not loose, blocked, or allowing water to pool around the house. The classes also included budgeting components so residents could most efficiently use the money saved.

Energy saving pipe insulation

The mix of a tight house, humid climate, and many occupants in a house can lead to specific education needs. Over time, CHA has added education to help tenants understand the necessity of keeping all doors and windows closed while the air conditioner or heater is running, to maximize efficiency. In homes with many occupants, it can be difficult to find a temperature that is comfortable for everyone. Willis said that some residents would retreat into other rooms and open windows, resulting in both energy loss and system overcompensation. The SIP system creates energy efficiency with a tight air seal; an open window can undo the energy savings.

Best Practices

Despite the difficulty of planning for and addressing the diversity of challenges that can arise in building new homes, CHA's sustainable housing construction has come in within budget and on time every year. According to Willis, converting to SIPs and adding other energy-efficient components was easier than he had imagined, thanks to the assistance of skilled outside contractors. He hopes eventually to be able to hire contractors and laborers who are tribal members as necessary skill sets develop.

Lessons learned on one site were brought to the next, and all the panels were built at one source, General Panels by Perma "R" Products, in Grenada, Mississippi, less than 100 miles away. The ability to use local materials from a single source has allowed for increased consistency, more cost savings, and a smaller carbon footprint. Perma also helped train the contractors who were installing the panels, thereby reducing their learning curve.

SIPs being transported.

The SIPs, in conjunction with energy-efficient lighting, windows, doors, HVAC, and appliances, offer the potential for cost savings for CHA housing residents. The educational component that CHA implemented can help make those cost savings a reality. Some residents have already reported that their utility bills dropped from about $350 or $400 monthly to $120 monthly.

Accomplishments/Awards

The TVA awarded the CHA with the All Electric Home Award in 2012 and 2013. CHA was recognized for its efforts in providing EnergyRight Platinum certified (under TVA's New Homes Program) and Energy Star-qualified housing on the reservation. "Providing energy efficient housing allows our Choctaw families to lessen their financial burden and use those resources to elevate their standard of living," said Tribal Chief Phyliss J. Anderson in an MBCI press release.

Next Steps

The CHA has developed energy-efficient housing with the potential to house residents cost effectively and healthily for many years, but many families are still waiting. The CHA's next steps are to continue to increase its housing stock to meet this need while continuing to qualify for Energy Star certification, which is on its third revision; that is, CHA must consistently educate itself on the new standards and find ways to apply them.

Willis also is continuing to research the most cost-effective, energy-efficient solutions appropriate to the regional climate. For example, he is now exploring the long-term durability and cost of metal roofing as compared with shingles in a humid, damp climate. The CHA is also investigating the cost efficiency of spray-foam insulation and tankless water heaters. Tankless water heaters provide hot water only as needed, thus using less energy than traditional storage water heaters, but they do have a higher upfront cost and require specialized maintenance.

Improved site planning is another area of interest. If a site can be cleared and landscaped to retain trees, protect waterways, and minimize habitat disturbance, residents enjoy increased privacy, water resources are conserved, and erosion is decreased.

Willis noted that the existing construction will be used to inform future endeavors. Each time his team members build a home, "They learn more and more, thereby streamlining ongoing construction and building better and better homes."

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How To Get Started

To learn more about SIPs, and energy-efficient windows and lighting, check out these resources.

U.S. Department of Energy (DOE) on insulation, including SIPs:
http://energy.gov/energysaver/articles/types-insulation.

DOE on SIPs:
http://energy.gov/energysaver/articles/solar-decathlon-technology-spotlight-structural-insulated-panels.

DOE, Oak Ridge National Laboratory research data on SIPs with other energy-efficient technologies:
http://info.ornl.gov/sites/publications/Files/Pub10081.pdf and http://www.sips.org/wp-content/uploads/2011/01/ORNL-2600.pdf.

DOE on energy efficiency in windows:
http://energy.gov/energysaver/articles/window-types.

DOE on efficient lighting choices:
http://energy.gov/energysaver/articles/tips-lighting.

This best practice case study is one in a series that examines how Native American and Alaska Native communities have incorporated sustainable technologies and strategies into their housing development.

The Sustainable Construction in Indian Country initiative was created to support and increase sustainable construction practices in Native American communities. It is administered through the U.S. Department of Housing and Urban Development's Office of Policy Development and Research in partnership with the Office of Native American Programs.

Produced May 2013

Appendix C-4:
Case Study

Sustainable Construction in Indian Country

Expanding Sustainable Construction with In-House SIPS Manufacturing

Muscogee (Creek) Nation

"The Tribe is at a turning point where we will really start to see energy savings. The new administration is ready to jump on board with next steps. Then we can put the money we've saved into other programs to serve our Tribe and keep improving housing."

- James Williams, Senior Environmental Specialist, Muscogee (Creek) Nation

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Improve quality of life for residents and save energy by testing cost effectiveness and difficulty of implementing green technologies.

Solution

The success of a 2008 demonstration project has led to wider incorporation of sustainable construction practices and enhanced in-house economic development capacity.

Community Snapshot

Location: Approximately 40 miles south of Tulsa, in Okmulgee, Oklahoma; tribal members live throughout 11 counties.
Location type: Rural
Population: More than 70,000 enrolled members
Climate: Okmulgee County temperatures range from an average daytime high of 93°F in July and August to an average low of 25°F in January (Köppen classification: *Cfb*).

Critical Sustainable Technologies and Strategies

- Structural insulated panels (SIPs)
- Geothermal systems
- Energy-efficient triple-paned windows
- High-efficiency water heaters
- Light-emitting diode (LED) lighting
- Energy Star appliances

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Funding

Projects	Funding Sources
15 duplex units	U.S. Department of Energy (DOE) and U.S. Department of Housing and Urban Development (HUD) American Recovery ad Reinvestment Act (ARRA)
Purchase of geothermal rig	DOE ARRA

Map

Summary

In 2007, the Muscogee (Creek) Nation (MCN) began planning its entry into the world of sustainable construction. The Housing Division developed a pilot program home in 2008, with "the goal of incorporating as many green technologies as possible," as MCN Senior Environmental Specialist James Williams stated. The single-family house was built with technologies including a geothermal heat pump and cooling system, a heat recovery ventilator (HRV) to supply fresh air, cellulose insulation, a radiant heat block, high-efficiency water heater, and compact fluorescent lamps (CFLs). The Tribe compared the energy costs of the pilot program house to those of conventionally built houses. Utility costs on the pilot program house were under half of the utility costs of the conventionally built houses: $1,403 compared to $2,875 per year. Green homes do cost more to build, Williams said, "The extra expenses have been recuperated in 3-4 years." The homeowner, he added, was very happy with his lower utility bills.

With the positive pilot program experience under its belt, MCN added additional sustainable technologies to its tool kit. The Tribe completed Phase II of an existing elderly housing development in 2012. The new construction added 15 green duplex units to the 24 originally built. The technologies used included structural insulated panels (SIPs), geothermal heating and cooling systems, high-efficiency water heaters, triple-pane custom windows, Energy Star appliances, and light-emitting diode (LED) lighting. The technologies have worked well. Brent Coleman, assistant construction manager, said, "We think the houses are even tighter than we expected."

Phase II construction of SIPs roof

The tribe has also been building alternative replacement housing with SIPs because it is affordable and quick to construct.

The installation of SIPs and of geothermal systems are not simply newly acquired construction skills sets for MCN work crews. The techologies are also potential economic opportunities because all SIPs used on the elderly housing development and the replacement housing were manufactured in a SIP plant operated by MCN – a unique situation that offered significant cost savings. MCN has also purchased a geothermal rig of its own and is digging geothermal wells.

The following chart describes the technologies and their effect on sustainability.

Sustainable Technologies	What Is It?	Effect
Structural insulated panels (SIPs)	SIPs are a high-performance building system for residential and light commercial construction. The panels consist of an insulating foam core sandwiched between two structural facings, such as oriented strand board (OSB). SIPs are manufactured under factory-controlled conditions and can be fabricated to fit nearly any building design.	A SIP building envelope provides high levels of insulation and is extremely airtight, so that the amount of energy used to heat and cool a home can be cut by one-half.
High-efficiency water heaters	High-efficiency water heater technology includes tank water heaters, tankless water heaters, and heat pump water heaters, and solar water heaters. The water heaters used here are run off the geothermal system.	Energy Star notes that heating water accounts for approximately 15% of a home's energy use. High efficiency water heaters use 10% to 50% less energy than standard models.
Geothermal systems	A geothermal or ground source heat pump system transfers heat stored in the earth and pumps it into the indoor air delivery system in the winter. In the summer, the ground acts as a heat sink, and the heat is transferred from the interior through the heat exchanger back to the ground. The system relies on the ground beneath the surface being warmer than the air above it in the winter and cooler in the summer.	The energy produced by geothermal systems is naturally concentrated, existing heat that is clean and sustainable. Although costly to install, geothermal systems have low operating and maintenance costs. According to the U.S. Department of Energy (DOE), system life is estimated at 25 years for the inside components and 50+ years for the ground loop.
High-efficiency windows	Windows can be a weak spots in a home's thermal envelope. Energy efficiency in windows depends on types of glass or glazing, such as low-thermal emissivity (low-e) or gas fill; frame material, and, once installed, weatherstripping and caulking.	According to the DOE, leaky windows can account for 10% to25% of a home heating bill. Installing high-performance windows will improve a home's energy performance—but may take a number of years to pay off in energy savings.
Energy Star appliances	Energy Star appliances are independently certified through a program of the U.S. Environmental Protection Agency and the DOE.	Energy Star products save money and protect the environment. For example, replacing a 1980s model refrigerator with an Energy Star version could save $100 a year in total energy costs. Replacing a clothes washer could save as much as $110 a year.

The Pilot Program


Workers installing SIP walls

The pilot program, Take Control & Save, was inspired by the Housing Director and council members passing green building codes to reduce consumption and energy costs. MCN partnered with the East Central Electric Cooperative on the program.

MCN constructed a 1,900-square foot single-family house for a family of five. It was wood-framed, but included a construction method known as California Corners. This advanced framing technique allows for additional insulation through caulking and placement of the drywall backer stud. The house also used TechShield© roof decking, a radiant barrier that keeps the attic cool. The Tribe also added in wet- and loose-blown cellulose insulation, a Marathon water heater, CFLs, a Bosch ground source heat pump and cooling system and a HRV to maintain indoor air quality within the tightly built unit. The foundation was an insulated concrete slab.

Comparison of 12-months of utility data between the all-electric (except for a propane-fueled stove) pilot house and a conventionally built unit of the same size (with propane heat, water heat, and stove, but only two occupants) showed average monthly savings of $123 a month. Annually savings were $1,472. After the pilot program success, Williams said that the Tribe realized, "We can do this!"

Housing for Elderly Residents

U.S. Department of Energy (DOE) and U.S. Department of Housing and Urban Development (HUD) American Recovery ad Reinvestment Act (ARRA) funds provided MCN with an opportunity to expand their energy-efficiency activities significantly. An award of $5 million from HUD funded infrastructure, roads, and construction of the Phase 2 Elderly Housing project, while part of $2 million from DOE paid for geothermal drilling equipment and training. (The DOE funds also funded a geothermal conversion for the College of the Muscogee Nation, a recycling center, and tribal building energy audits.)

SIPs construction required training for the contractors and subcontractors, although Coleman said, "The learning curve wasn't steep. They were already familiar with construction using wood." The speed of the new construction process inspired the construction teams. At approximately 2,800 square feet, the duplex buildings have SIP walls and roofs and geothermal heating and cooling systems with two wells per duplex. The high-efficiency water heaters operate off the geothermal system. The triple-pane windows were specially designed by a factory. The units also feature Energy Star appliances, LED lighting, a pond and walking trails.

The all-electric units have monthly utility bills of approximately $45-55, Williams said, compared with $120 in the older units. According to Coleman, "I understood it was going to be energy efficient, I just didn't realize how much. The feedback has been better than expected."

SIPs are also a key component in the no-frills alternative single-family houses that the Housing Division is providing elderly residents whose houses are deemed substandard. The new homes, about 1,000 square feet, are positioned next to the old home and the old home is demolished. Williams said, "We put sod out front and it looks really nice."

Economic Development Opportunities

It is too soon to know if the MCN's investments in the green collar industry will provide economic development opportunities that will spread beyond the tribe's own projects. In the meantime, providing jobs for some tribal members in emerging construction and energy industries is an accomplishment worth celebrating.

In-House SIPs Plant

The idea for the SIPs manufacturing plant grew out of the Tribe's effort to build affordable homes that are easy and economical to heat and cool. The elderly housing addition was the first project for the plant. The 13,000-square-foot plant provided all 1,700 wall, roof, and ceiling panels for the 15 duplexes during 2011. To test the accuracy of their early work, pieces of the duplex were cut out, then fit together to make sure measurements and cuts were correct. "It was like fitting together a puzzle," Williams remembered.

SIPs manufacturing plant worker finishing panels

The plant included a demonstration house built with SIP walls, floor, ceiling, and roof for visitors to walk through and see the inner workings of a SIP-constructed house. The demo house is being brought online for a family. It has been moved to a building site and currently under construction.

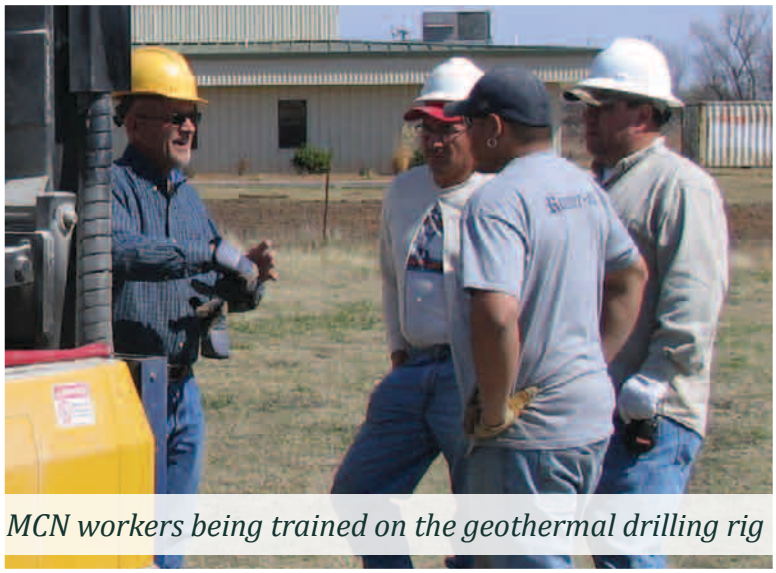
With six employees, the plant has current capability to provide panels for a house a day. The plant made panels for the duplex project in approximately a month. Williams said, however, that the demand was not yet there. A more realistic number at this time might be 12-15 houses. "It's a learning process," he added.

Completed SIPs ready to ship on-site

Current plans are to focus on providing panels for MCN Housing Division new construction and rehabilitation, and to develop marketing materials to expand into other communities. The plant has been supplying the panels for the alternative houses. Located in Wetumka, the southern region of the MCN, the plant also owns trucks for panel delivery.

Geothermal Drilling Equipment

The geothermal drilling rig equipment was purchased in late 2010. The construction team received training in 2011, but gaining experience with the rig has been challenging. Well-drilling on the elderly housing development was slowed by the team's lack of experience. The construction team was forced to contract out some of the work. Ultimately everyone worked well together. According to Williams, "We have a great team at MCN." He added, "The drillers are getting used to the rig now. We are building tribal capacity as the guys are getting the hang of it."



MCN workers being trained on the geothermal drilling rig

Workers using geothermal drilling rig

Close-up of drill in progress

Project Summary

PROJECT NAME: Elderly Housing Addition
LOCATION: Okmulgee, Oklahoma
TIMELINE: 2011 through summer 2012
PROJECT TYPE: 15 duplex units

Project Key Features

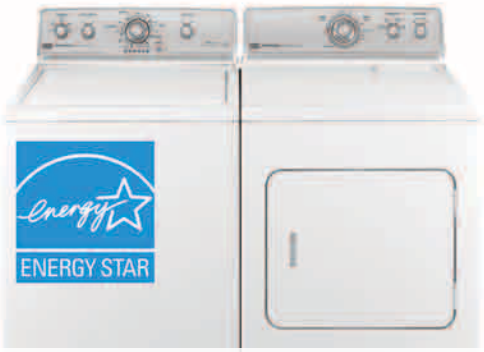
- Affordability.
- ADA-compliant (one-half of units).
- Brick veneer.
- Tornado safe rooms.
- In-unit laundry.

Key Sustainable Elements

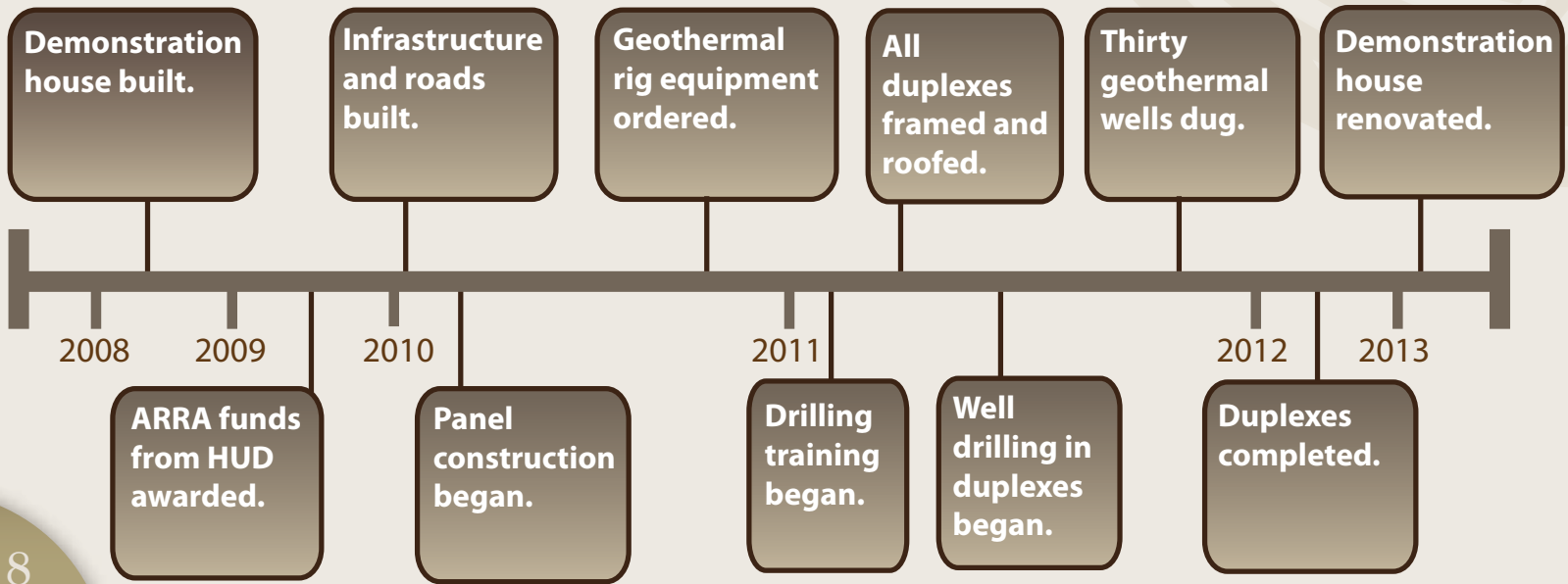
- SIPs.
- Geothermal heating and cooling system.
- Triple-paned windows.
- Energy-efficient water heater run off geothermal.
- LED lighting.
- Energy-efficient appliances.
- Pond and walking trails.

Completed duplex unit

Geothermal system installation



Energy-efficient washing machine



Accomplishments/Awards

The MCN Housing Division recently received a rebate check for $40,000 from the East Central Electric Cooperative high-efficiency rebate program for the Tribe's use of high-efficiency energy technology at the newly constructed elderly housing addition.

MCN Chief Tiger accepts rebate check

The project was also nominated for a Henry Bellmon sustainability award (**www.bellmonawards.com**).

Best Practices

MCN has developed a housing model that is employing tribal members at the same time it keeps residents comfortable and saves on costs. Summer in Oklahoma is hot. Williams noted, "Last summer, I was visiting with a lady and a gentleman in one of the SIP homes. They were surprised how hot it was outside because they had not needed to turn their air conditioner on yet. The homes naturally keep cool in the summer and warm in winter. We have gotten good feedback on the elderly homes."

A crane is used to assist workers install SIPs

Caulk is used to improve the homes air tightness

Next Steps

Coleman says, "Tribal administration has great leadership who has been very positive and forward-thinking." The Tribe hopes to use the money saved from its new sustainable units for future projects. It is also exploring marketing SIPs panels to other tribes. Because the Tribe already owns trucks and trailers, it is additionally equipped for delivering the materials it manufactures.

A team from the Sustainable Construction in Indian Country (SCinIC) initiative visited MCN in April 2013 to conduct blower door testing on five stick-built and SIP-built houses to test air tightness. One of the SIP houses tested was under construction; however, the two completed SIPs houses were 36 to 49 percent tighter than the stick-built houses.

The report also noted that additional opportunities for air sealing were still available, which would require minor additional effort. Unsealed wall penetrations and receptacles that were not caulked left open holes in the SIPs where energy was escaping. For example, dryer vent and electrical service penetrations through the SIPs are not being sealed before the brick veneer is installed. The report also estimated that additional construction cost savings improvement and utility savings would be possible if the thermal boundary between the attic or roof and SIPs were clearly defined. When that boundary is not well defined, the SIPs used in the roof or attic area are not effective at reducing energy consumption.

The report recognized MCN's willingness to "try new construction techniques and install high-end geothermal heating and cooling systems" and praised it for a "a very motivated staff with a keen desire to provide tribal residents with energy-efficient and well ventilated homes."

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How To Get Started

To learn more about the energy-efficiency strategies highlighted above, check out these resources:

EPA Energy Star Program:
http://www.energystar.gov/

DOE on selecting windows for energy efficiency:
http://windows.lbl.gov/pub/selectingwindows/window.pdf

DOE on SIPs:
http://energy.gov/energysaver/articles/solar-decathlon-technology-spotlight-structural-insulated-panels

DOE on geothermal systems:
http://www1.eere.energy.gov/geothermal/heatpumps.html

Energy Star on high-efficiency water heaters:
http://www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf

Muscogee (Creek) Nation Housing Division Web site:
http://creeknationhousing.org/

SCinIC technical assistance report on Muscogee (Creek) Nation:
http://www.huduser.org/portal/scinic/home.html

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Produced June 2013

Appendix C-5:
Case Study

Sustainable Construction in Indian Country

Providing Affordable, Accessible, and Sustainable Housing

Nez Perce Tribe

"The Housing Authority is going very green, beyond LEED in a lot of ways. The Nez Perce are pursuing a green expansion of a community, not a green subdivision, but a sustainable and culturally appropriate village expansion."

- Nathaniel Corum, architect and straw-bale construction specialist

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Providing affordable, accessible, and healthy housing for low-income families.

Solution

Constructing low-income duplexes with lower maintenance and utility costs; and making units accessible so residents can remain in their units as they age.

Community Snapshot

Location: Tribal lands in parts of four northern Idaho counties (part of the Lewiston, ID-WA Metropolitan Statistical Area), which includes the largest community—the city of Orofino, near the northeast corner of the reservation.

Location type: rural/agricultural

Population: 17,959 reservation residents, as of the 2000 Census.

Climate: Orofino's low elevation and northwestern location give it one of warmest climates in Idaho in the summer (average high of 86 ºF) and one of the mildest in winters (average high of 43 ºF) (Köppen classification *Cfb*).

Critical Sustainable Technologies and Strategies

- Straw-bale construction.
- Structural insulated panels (SIPs).
- Low-impact site management and landscaping.
- Double-pane low-emissivity (low-e) windows.
- Ductless heat pumps.
- Heat-pump water heaters.
- Compact fluorescent lamps (CFLs).
- Energy Star appliances.
- Use of nontoxic materials.
- Shed-style roof maximizes potential for solar panels.

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Funding

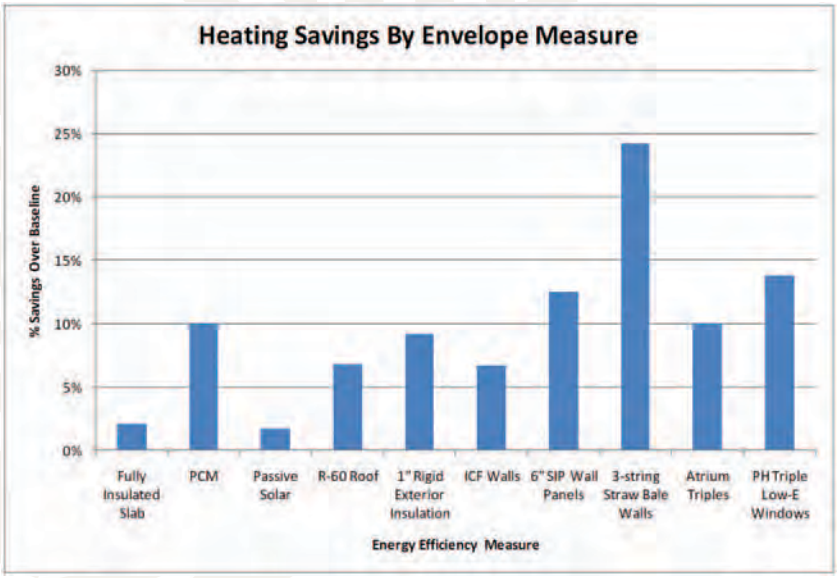
Activity	Funding Sources
Infrastructure	Nez Perce Tribe
Duplex construction	U.S. Department of Housing and Urban Development Native American Housing and Self Determination Act, Low-Income Housing Tax Credits, and volunteer labor

Map

Summary

The Nez Perce Tribe is developing healthy, sustainable housing. Its current project, nine duplexes with 17 two-bedroom units and 1 three-bedroom unit, is designed for low-income families. This project, however, is also bringing the Nez Perce Tribal Housing Authority (NPTHA) new experiences in terms of sustainability, construction materials and techniques, incorporation of cultural features, and funding sources.

The primary sustainable technology is a nonload-bearing straw-bale construction in conjunction with structural insulated panels (SIPs). Each unit will also include a ductless heat pump system and heat pump water heaters. Laurie Ann Cloud, Executive Director of the NPTHA, said the design would "most definitely" reduce utility costs. "It is a high priority to reduce the operating cost of units. The heat pump is designed to do this. It sounds almost too good to be true." Units will have Energy Star appliances, energy-efficient lighting, and low-flow plumbing fixtures.



Although the duplexes are family units, they will be handicapped accessible. This will allow for more options for families with a disabled family member or make it so that residents will not have to move out of their housing because their physical abilities change over time.

Cultural design features that are interwoven into the design include housing clusters, a common area, and an eastern entry orientation consistent with Nez Perce culture. The housing is modern, but the carport roof and shed-style roofs are designed to call to mind the Nez Perce traditional teepees' extended shade structure. The carport has multiple purposes: it serves as an outside room and a protective parking space.

The shed-style roofs, with south-facing orientation, are designed to be solar ready, allowing for the houses at some point to become even more energy efficient.

The site includes a planned community garden, playground, and a walking path leading along the creek to the sweat lodge. The site is designed to allow the community to grow and meet housing needs while also preserving the agricultural and rural setting. NPTHA has worked with the adjacent farmers to ensure that their alfalfa crop and subsequent grazing and the housing can co-exist.

The following chart describes the technologies and their effect on sustainability.

Sustainable Technologies	What Is It?	Effect
Straw-bale construction	A building method that uses bales of straw as structural elements, building insulation, or both. This method is commonly used in natural building or "brown" construction projects.	Advantages of straw-bale construction over conventional building systems include renewability, cost, availability, natural fire-retardant qualities, and high insulation value.
Structured insulated panels (SIPs)	SIPs are a building system for residential and light commercial construction. The panels are constructed like a sandwich. The filling is an insulating core and the bread is two structural facings, or skins. Manufactured in a factory, SIPs can be produced to fit nearly any building design.	A SIPs building envelope provides high R-value in insulation and an extremely airtight space. U.S. Department of Energy (DOE) studies are finding that SIPs can cut the amount of energy used to heat and cool a home by 40% to 50% when used in conjunction with other energy-efficiency strategies.
Double pane low-e windows	Low-e, or low thermal emissivity, windows and low-e glass in doors have a coating on the glazing or glass that absorbs, reflects, and emits low levels of radiant thermal (heat) energy, depending on the weather.	Low-e windows typically cost about 10% to 15% more than regular windows, according to DOE, but they may reduce energy loss by as much as 50%. The greatest savings tend to come from areas with hot summers, cold winters, or both.
Ductless heat pump system	Ductless heat pumps are also called "mini-split" heat pumps. They operate on the same principle as traditional heat pumps, using electricity to move heat between outdoor and indoor air by compressing and expanding a refrigerant, although without a duct system.	Because they deliver heated or cooled air directly to the room, ductless heat pumps avoid efficiency loss associated with ductwork. According to the DOE, duct loss can account for more than 30% of energy consumption for space conditioning.
Energy-efficient lighting	CFL (compact fluorescent lamp) bulbs are made of glass tubes filled with gas and a small amount of mercury (100 times less than a glass thermometer). The mercury emits an invisible ultraviolet light that becomes visible when it hits the white coating inside the CFL bulb.	Energy Star-qualified fluorescent lighting uses 75% less energy and lasts up to 10 times longer than normal incandescent lights.
Energy Star appliances	Energy Star appliances are independently certified through a program of the U.S. Environmental Protection Agency and the DOE. It identifies high quality energy efficient products.	The products save money and protect the environment. For example, replacing a 1980s model refrigerator with an Energy Star version could save $100 a year in total energy costs. Replacing a clothes washer could save as much as $110 a year.

Design Process

Coeur d'Alene straw-bale project

Although NPTHA had previously built with SIPs, the Housing Authority was interested in exploring other green technologies and materials. At the same time, it was apprehensive about the cost of adding more sustainable technologies. When several NPTHA Board members visited the Coeur d'Alene Housing Authority's new multifamily straw-bale project, they became excited to explore this technology for their own tribe. Would it be too difficult to build without previous experience? How much energy might it save? A Sustainable Construction in Indian Country (SCinIC) team developed an energy modeling report, which compared different technologies for construction and heating/cooling, including straw bale. "Having access to modeling data and being able to compare options for cost-effectiveness and utility savings played a big role in the decision to go with straw bale," SCinIC team member architect Daniel Glenn said.

NPTHA had already engaged a local architect, Jerry Brotnov, for a stick-frame, SIPs design, but then NPTHA decided to move ahead on a duplex housing straw-bale project. The SCinIC initiative was able to provide the local architect with technical assistance support from Nathaniel Corum, an architect with straw-bale and sustainable design and construction experience in collaboration with Native American communities. The new technology, however, also interested Brotnov, who pursued further education in straw-bale construction.

NPTHA originally planned on building on uninsulated crawl spaces, but these were not very compatible with straw-bale construction and the SCinIC energy modeling study indicated that the homes would lose significant energy through the floor. Plans now include an insulated slab on grade, which is easier to build and less expensive than crawl spaces in straw-bale construction. To address elders' concerns about walking on concrete, the insulated slab will include subflooring to provide "give" so the floor is softer.

To lower water consumption and increase drought resistance, the project will include a drip system, with drip irrigation for the rain gardens. NPTHA has brought on-board a landscape architect to realize a number of plans for additional low-impact site management and sustainability.

Community Involvement

Getting input from community members is a common challenge for housing authorities. Executive Director Cloud capitalized on planned events. She said, "What was nice is that we got some elders to come in… this year the Tribe and the city of Lapwai had a community review. I participated in it and it opened my ears to community observations and I brought that into my own planning process."

Cloud further said that the project "meets the needs of the community. Most tribal members will agree." One important issue was that the units fit with other housing in the community: "It is a set-alone project but it still will be comparable to local styles so it won't stand out in a bad way," she said. It is "right size" housing, Cloud added, in which the size and number of bedrooms meet local need. The units are affordable, and in a good location.

Corum noted that NPTHA has a waiting list and two- and three-bedroom units for low-income families are a great need. The new project "will take a huge chunk out of their waiting list."

Goals

NPTHA incorporated technologies and materials that will allow them to achieve tribal community goals: create affordable, accessible, sustainable, and culturally relevant housing.

Straw bale

Corum said, "Straw can be harvested several times a year. Local straw wheat bales are a non-toxic renewable resource that provides amazing insulation value. If built well, straw-bale construction is superior to wood construction in several ways." NPTHA is procuring straw from local farmers, increasing project affordability.

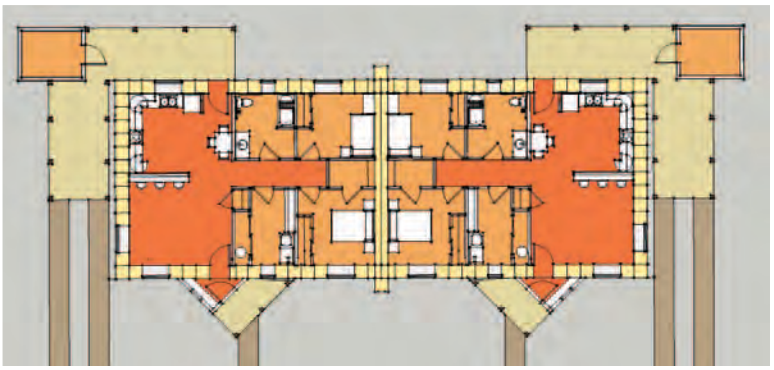
Straw-bale construction in this project is nonload bearing. The load bearing structure is timber framed, with SIPs above 8 feet. The straw bales, which function as insulation, fit into the supporting structure. The 24-inch-wide walls are estimated to have a high (thermal resistance) R-value of 40.

Example of straw-bale construction (not at Nez Perce Tribe).

In addition to their insulating value, straw-bale buildings are fire and mold resistant after they are coated with plaster. Mice are not likely to nest in straw bale houses, and the houses are not prone to insect infestation.

Accessibility

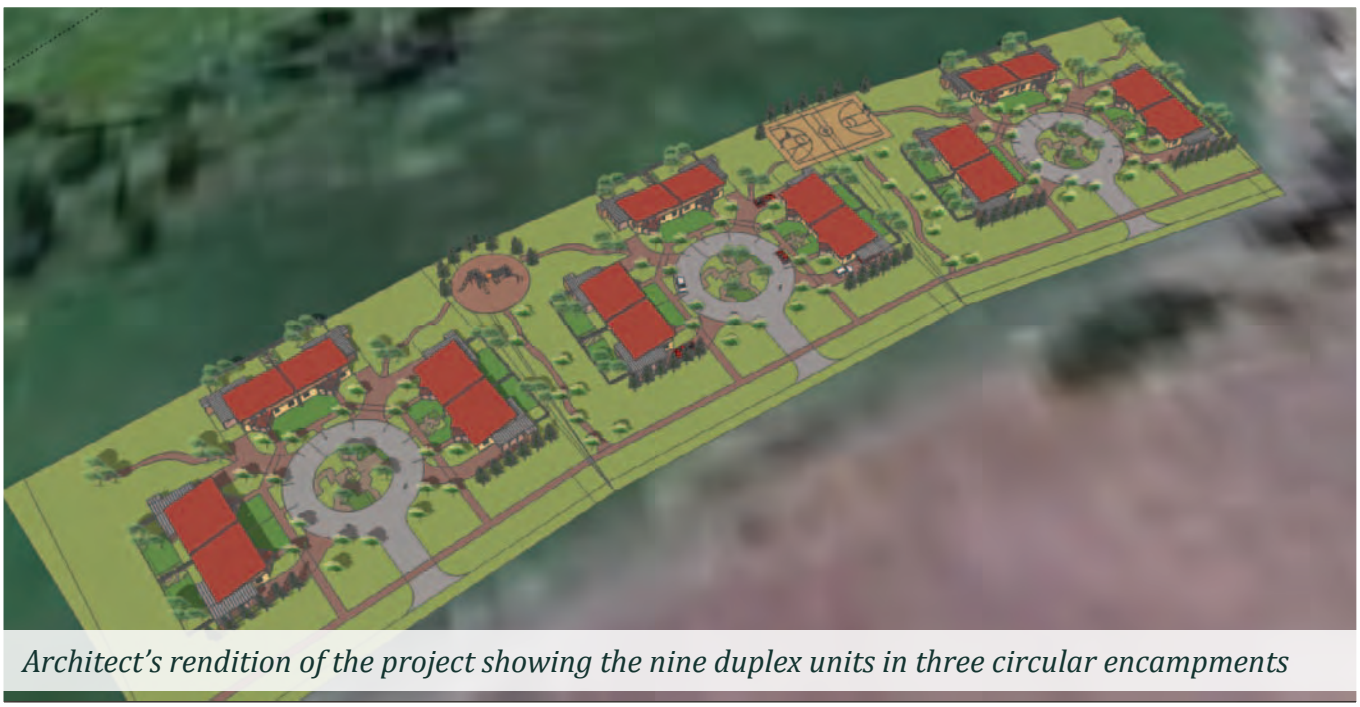
The units are single-level and compliant with Americans with Disabilities Act requirements so residents can remain in their units as they age. Cloud described the units as having "visitability" with their wider doorways and halls, as well as graduating sidewalks that allow for wheelchair entry. One unit may be fully handicapped accessible with lowered countertops and higher toilets.



Single-level ADA compliant floor plan.

Cultural elements

The design plan consists of nine buildings in three circular encampments. The units are laid out in cul-de-sacs that emulate villages with a center common area. The doorways are oriented to face east, which is an important expression of Nez Perce culture. Secondary vestibules on the houses allow all doorways to appear to face east in this circular design. They serve a sustainable function as well, keeping wind and other elements out of the house. The duplexes have a cathedral ceiling and slanted roof shed, as does the carport, a design that echoes a teepee's shade structure. Some say the straw-bale could even be said to recall tule mats used to construct another of the Nez Perce tribe's traditional houses, and basket patterns are being cut into a panel above the straw-bale wall.



Architect's rendition of the project showing the nine duplex units in three circular encampments

(Pre)Construction Challenges

Pre-construction image of the development site

Although construction has not yet begun on the project, construction challenges begin in the planning stages. From the beginning, NPTHA has been concerned about who would construct the development because NPTHA does not have that skill set readily available. But inspired by experiences of other tribes, including the Puyallup Nation Housing Authority, at building tribal capacity in new technologies, NPTHA is planning to use force account labor. This means a construction manager, either in-house or with straw-bale experience, will hire and manage a construction team composed of tribal members with support of experts in straw-bale construction.

Several challenges have delayed construction. Initial discussions of the project site did not indicate that the site had cultural significance, but the environmental review revealed cultural concerns. NPTHA tabled infrastructure and water construction plans, and bid solicitations while the Tribe considered conducting a full archeological survey. Testing cleared the immediate housing site, but culturally sensitive areas along the perimeter will cause some changes to infrastructure placement and may require additional testing.

Glenn said, "Funding was certainly a challenge." The construction method, design elements, and other sustainable additions added to the budget that NPTHA had set aside. Obtaining additional funds was more difficult and time intensive than anticipated, which delayed construction. NPTHA worked with a consultant to apply for low-income housing tax credits, which were awarded in December 2012. Ironing out the budget is a struggle since NPTHA and their team are estimating costs for a construction process with which they are not familiar. Cloud, however, pointed out an upside to the delay: "The good thing is it bought us time to investigate the green and sustainable activities that we are going to use."

Certification

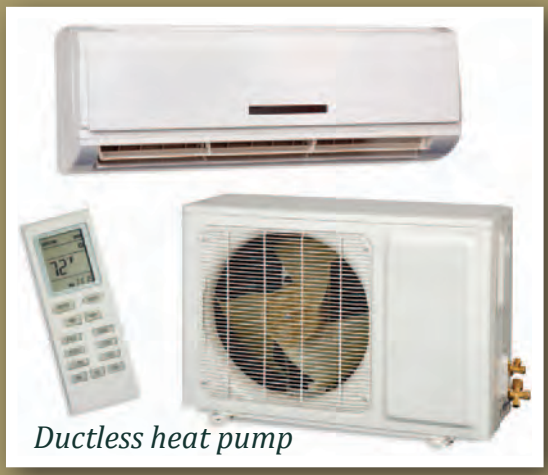
NPTHA plans to follow Enterprise Green Communities certification, which has base standards and opportunities for additional points for exceeding those standards. The Nez Perce project needs at least 35 points to become certified as a Green Community. NPTHA added certification into its plans to gain additional points on its LIHTC application. It selected Enterprise Green Communities standards because these were more affordable than some other certification processes. As one part of meeting Enterprise Green Communities standards, NPTHA plans to develop a green maintenance/operations manual that includes a training component.

Project Summary

PROJECT: Straw-bale Duplexes
LOCATION: Lapwai, Idaho
DESIGN/PLAN TEAM: Jerry Brotnov (architect of record), Daniel Glenn (consulting design architect/green building consultant), Nathaniel Corum (consulting design and straw-bale architect), Ecotope (consulting design engineer) Brian McCormack (landscape architect), and Ken McCown (consulting landscape architect)
TIMELINE: 2011 through fall 2014
PROJECT TYPE: Nine duplex units

Project Key Features

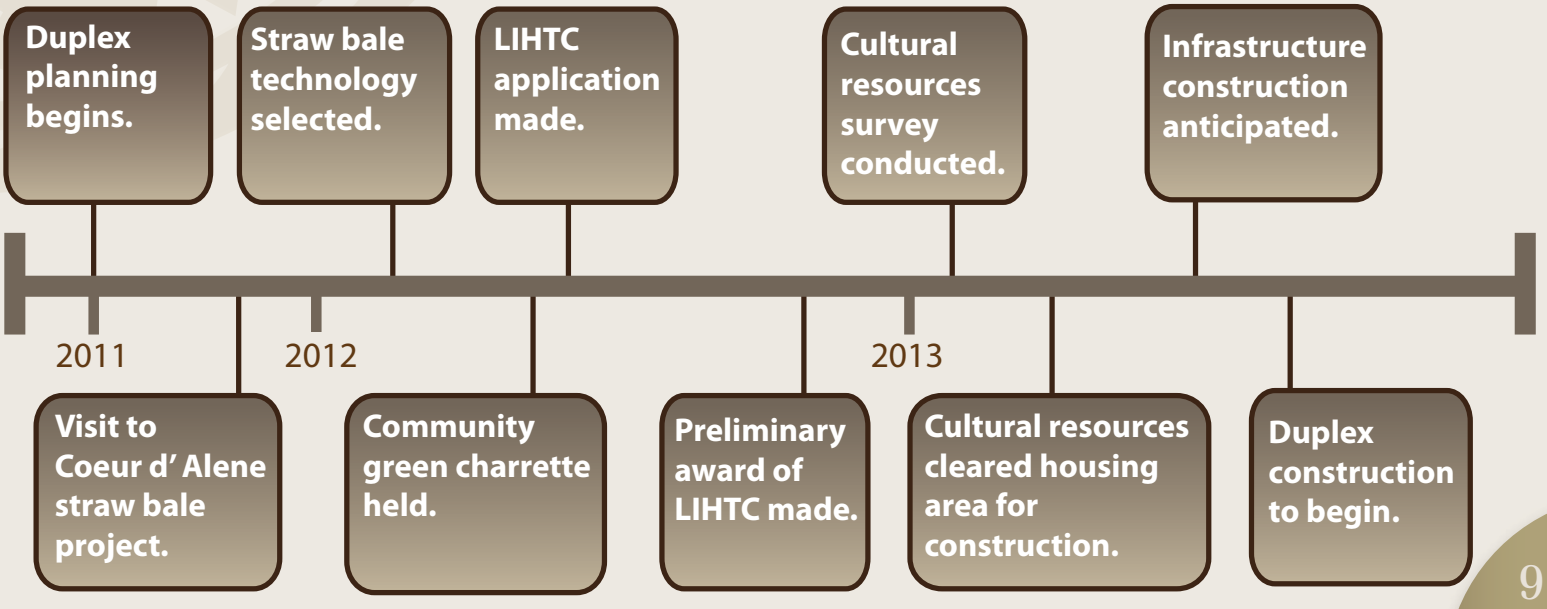
- Affordability.
- Accessibility.
- Healthy, non-toxic home.
- Orientation and design incorporates cultural traditions.
- Cathedral ceiling maximizes light.
- Insulated slab on grade foundations.



Ductless heat pump

Key Sustainable Elements

- Straw-bale construction.
- Super-insulated envelope with local materials and SIPs.
- Double-glazed low-e windows.
- Ductless heat pumps.
- Heat-pump water heaters.
- CFL lighting.
- Energy-efficient appliances.
- Low-flow water fixtures.
- Walking trail and community garden.
- Low-impact site management.
- Conservation subdivision.



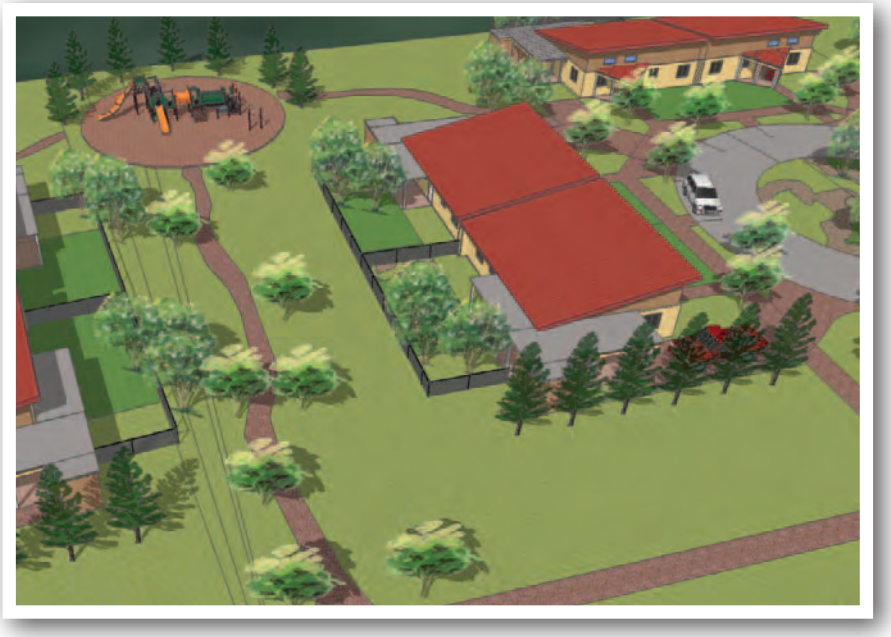
Best Practices

The NPTHA duplex project combines best practices in land management; sustainable and appropriate technologies and materials, and culturally relevant features. Super-insulated duplexes built with straw-bales and SIPs are both energy efficient and durable. These construction techniques will save on utility and operational costs.

A crane lowers the SIPs roof into place (not at Nez Perce Tribe).

NPTHA is using local materials including straw and building healthy, toxin-free homes to last for future generations. Corum said using natural, nontoxic materials "is the modern version of the Tribe's responsibility to their future generations. It fits the Tribe's definition of sustainability. It also meets community imperatives: residents can walk to facilities, and it is respectful of a nearby spring and adjacent ceremonial area."

The Tribe seeks to integrate the site with nature and agriculture. This conservation subdivision will retain existing landscape and respect adjacent wetlands while the neighboring farm will continue operation. The project includes native plants, a trail leading down to the stream near the site and to the community sweat lodge, a playground, and a community garden. Culturally relevant design features emphasize the continuity of the Nez Perce people on this land.



NPTHA is refining its sustainable choices based on experience and empirical modeling data to be more resilient and efficient relative to the local climate. A comparison of double-pane and triple-pane low-e windows showed that, for the Nez Perce, the triple-pane windows would be more expensive without offering a sufficient payoff in heat savings. Although, in the past the Tribe has used heat pumps with ducts, the ducts can contribute to energy loss. Since the planned units are small enough to go ductless, each unit will have one ductless heat pump, with baseboard heat in the bedrooms as backup.

Next Steps

NPTHA is fully involved in the process of getting this project off the ground. Glenn sees this project as an inspiring beginning: "The Nez Perce Tribal Housing Authority has demonstrated a keen interest in bringing sustainability and cultural responsiveness to its new housing developments and an openness to exploring new approaches and ideas to achieve the goal of creating excellent affordable housing for tribal members."

Solar is another technology that the Housing Authority want to try, but the current budget does not allow at this time. The Ecotope engineers explored passive solar heating, but determined it was not a viable option because there are too few solar heating days in winter. They also modeled solar water heaters for NPTHA. The energy modeling report showed that heat pump water heaters were less expensive and almost as efficient as solar water heaters in this region.

To accommodate budget limits, the duplexes are solar-ready. Roofs are sloped and oriented to maximize the potential area for solar panels. The electrical system and layout of the building can accommodate either photovoltaic or solar hot water panels at a later date.

For more information:

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NPTHA project team members (left to right): Matthew Horwitz, Paul Nye, Laurie Ann Cloud, Daniel Glenn, Jerry Brotnov and Nathaniel Corum

How To Get Started

To learn more about Energy Star, energy-efficient windows, SIPs, CFLs, straw-bale construction, and ductless heat pumps, check out these resources:

U.S. Environmental Protection Agency (EPA) Energy Star program:
http://www.energystar.gov/

EPA on energy efficient improvements, including low-e windows:
http://www.epa.gov/greenhomes/ReduceEnergy.htm

U.S. Department of Energy on SIPs:
http://energy.gov/energysaver/articles/solar-decathlon-technology-spotlight-structural-insulated-panels

EPA on CFLs:
http://www2.epa.gov/cfl/

National Association of Home Builders (NAHB) Toolbase on straw-bale construction:
http://www.toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=971&BucketID=6&CategoryID=13

NAHB Toolbase on ductless heat pumps:
http://www.toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=4016&BucketID=2&CategoryID=42

NPTHA:
http://www.nezperce.org/official/tribalhousingauthority.htm

This best practice case study is one in a series that examines how Native American and Alaska Native communities have incorporated sustainable technologies and strategies into their housing development.

The Sustainable Construction in Indian Country initiative was created to support and increase sustainable construction practices in Native American communities. It is administered through the U.S. Department of Housing and Urban Development's Office of Policy Development and Research in partnership with the Office of Native American Programs.

Some drawings, photos, and floor plans courtesy of Daniel Glenn, Jerry Brotnov, Nathaniel Corum, and Skip Baumhower Photography. Graph courtesy of Ecotope.

Produced June 2013

Appendix C-6:
Case Study

Sustainable Construction in Indian Country

Incorporating Sustainable Land and Water Strategies Into a Master Plan

Pokagon Band of Potawatomi Indians

The mission of the Pokagon Band of Potawatomi Indians is "to respectfully promote and protect the culture, dignity, education, health, welfare and self-sufficiency of our elders, our youth, our families, and our future generations while preserving Mother Earth."

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Developing a long-term plan that includes water management and conservation as an integral part of the overall land use and community planning strategy.

Solution

The Pokégnek Bodéwadmik Master Plan has guided the development of sustainable water management and conservation, housing, and a LEED (Leadership in Energy and Environmental Design) Gold certified community center.

Community Snapshot

Location: Communities in Dowagiac and Hartford, Michigan, and South Bend, Indiana
Location type: Rural
Climate: hot summer/cold winters with heavy snow (Köppen classification *Dfa*)
Population: 4,325 enrolled tribal members
Median age: 22

Critical Sustainable Technologies and Strategies

- Community master plan based on tribal mission statement
- Watershed protection including
  - Bioswales
  - Cluster housing design
  - Permeable pavement
  - Replacement of invasive plant species with prairie grasses and indigenous vegetation

Table of Contents

Funding

Projects	Funding Sources
Master Plan	U.S. Department of Housing & Urban Development (HUD) Native American Housing Assistance and Self Determination Act funds
Édawat Phase I	HUD Indian Housing Block Grant (IHBG), Bureau of Indian Affairs (BIA) Indian Reservation Roads (IRR)
Édawat Phase II	HUD IHBG, BIA IRR
Édawat Phase III (community center)	HUD American Recovery and Reinvestment Act, BIA IRR, HUD Indian Community Development Block Grant

Map

Summary

The largest community of the Pokagon Band of Potawatomi Indians is in Dowagiac, Michigan. The name "Dowagiac" comes from the Potawatomi description for a "place to hunt, fish, and forage." Care and restoration of earth and water are at the center of the Band's master plan.

Dowagiac, Michigan

The Pokégnek Bodéwadmik Master Plan blends deeply rooted cultural beliefs with state-of-the-art best management practices (BMPs) to achieve high-performance infrastructure. (The term "BMP" refers to environmental management strategies that prevent or reduce stormwater pollution.) The infrastructure includes stormwater management and water conservation, roadway and walking-path surfaces, and landscaping. Part of the water management includes planning the location of the housing units on the site.

Here are some of the BMPs and their effect on sustainability.

Best Management Practices	What Is It?	Effect
Bioswale	An alternative to storm sewers that uses natural landscaping and native plants to drain and move stormwater	Effective stormwater management, reduced landscaping maintenance, improved water quality, elimination of chemical and fertilizer use
Permeable roadway and walking path	Smooth surface for transportation that allows water to reach soil, not become run-off	Effective stormwater management, improved water quality, reduced pavement maintenance
Planting and restoration of native trees, wildflowers, and grasses	Use of plants that are native to a particular ecosystem to improve the environment	Effective stormwater management, reduced landscaping maintenance, increased plant survival, improved water quality, elimination of chemicals and fertilizer
Clustered housing plan	Building houses in a clustered pattern to follow the topographical contours of a building site	Minimized excavation and maximized open space

The Band is moving toward greater integration of sustainable technologies and renewable energy in future housing developments and the community as a whole.

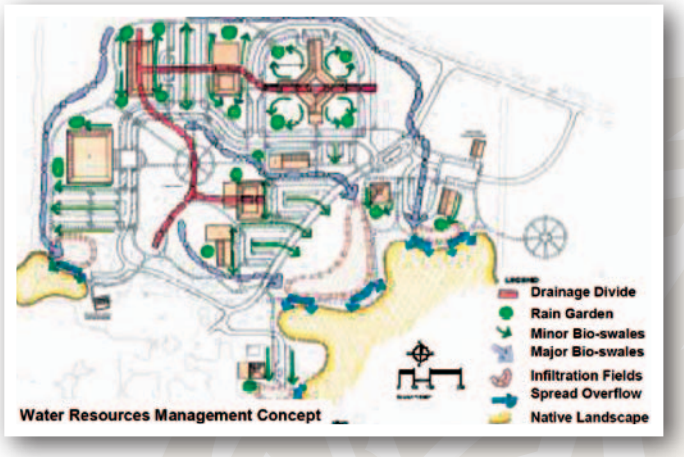
Visioning

In 2002 the Pokagon Band began to develop its master plan. A question guided the visioning process: What would a plan look like if it embodied the Pokagon mission statement:

To respectfully promote and protect the culture, dignity, education, health, welfare and self-sufficiency of our elders, our youth, our families, and our future generations while preserving Mother Earth. We will strive to give our people a better quality of life. The Band will also strive to be economically independent from federal and local government allowing the Band to fully exercise its sovereignty.

To make sure that the plan created sustainable development, the Band allowed time to gather input and comments from community leaders and residents, conduct assessments and reviews, and make careful decisions about the selection of the development firm and contractors. Objectives in the master plan and the Band's development strategy are:

- Protection and restoration of Mother Earth.
- Housing development as an investment.
- Quality, long-lasting housing and infrastructure.
- Deep green standards for future housing investments.
- Deference to and respect for tribal elders.
- Healthy lifestyles and outdoor recreation.



Water Resources Management Concept

As a result, the master plan balances strong development principles with environmental sustainability. This can be seen most clearly from the plan's water conservation and management strategies. "Édawat has been held as a national example of good resource planning. This resource planning started with a master plan that evolved from discussion of traditional tribal villages," David Yocca, landscape architect for Conservation Design Forum, said.

Build support for sustainable development through:

- Ongoing education of Tribal Council members.
- Meetings and dialogue among tribal departments.
- Design charrettes to educate and hear from residents.
- Workshops and event invitations to engage Tribal Council.
- "Planning to Plan"–Former Housing Director Troy Clay.
- Keeping contractors informed.
- Training for maintenance staff on environmental systems.
- Opportunity for residents to experience first-hand how homes and community buildings save energy and use resources wisely.

Master Plan Resources

Every master plan will be different based on the community that creates it and will change over time. One important emphasis in this plan is the protection of water quality. Mark Parrish, Pokagon Band Director of Natural Resources, stated, "Land use has the greatest influence on water quality. There are certain ways to build while protecting our natural resources…and expanding our envelope to become more sustainable." Planning documents used to help develop the Pokégnek Bodéwadmik Master Plan include:

- Dowagiac River Watershed Management Plan.
- Southwest Michigan Planning Commission's Green. Infrastructure Project.
- St. Joseph River Watershed Management Plan.
- Lake Michigan Lakewide Management Plan.
- Great Lakes Water Quality Agreement.

Design Charrette

The Band engaged in various design charrettes during the design and development phases. A design charrette is a design and planning workshop (or series of workshops) where project stakeholders come together to learn, brainstorm, discuss, and develop recommendations that will lead to a feasible plan. "It is a very exciting time to be a tribal planner," said Jason Auvil, Pokagon Band Tribal Planner. "The data gathered during the charrettes as well as from the tribal census, staff will analyze the data and take it to tribal council… By no means is this the end of this process…staff will try to get the best information that we can to make these developments reflect what tribal citizens want."

Watershed Goals

The Pokagon Band master plan includes goals for protecting its watershed. These goals were met by using low impact development (LID) BMPs in their infrastructure design. According the the Environmental Protection Agency, "LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible." LID BMPs include cluster development, minimization of total disturbed area, protection of natural flow pathways and of sensitive areas, and reduction of impervious surfaces.

Goal 1: Protect watershed hydrology and water quality

Protecting the watershed begins with protecting the landscape's existing natural features. The housing development is clustered within the existing geography. This planning strategy preserved glacial depressions that formed natural drainage patterns as well as sensitive areas. Bioswales are a natural alternative to storm sewers; they also infiltrate and filter water. Infiltration means that the water seeps into the ground.

Bioswale

Rain garden

Restored vegetation

Clustered housing design also reduces costs because roadways are shorter and utility infrastructure is less. In addition, fewer trees need to be removed and less land excavated. The area kept more rural, open space. Constructing homes on smaller lots, with smaller footprints, also keeps more of the land's natural features. Smaller lots reduce the distance to the roadway and the amount of lawn maintenance.

Goal 2: Reduce sediment, chemicals, and thermal inputs to surface water

Streets narrowed to 18 feet wide

Interlocking permeable pavers

To protect the quality of the surface water, the Pokagon Band used infiltration techniques to ensure that this new development would not increase the amount of run-off. One technique is to limit impervious surfaces. Concrete driveways, walkways, and roads, and most asphalt cannot absorb water. Rainwater entering the soil directly is less likely to gather with it harmful chemicals, extra nutrients, or heat that may change the quality of surface water.

Streets were designed slightly narrower using interlocking permeable pavers. David Yocca said, "Permeable pavers are not only a great way to provide roadway and parking, but to allow rainwater infiltration." In addition to their environmental benefits, the street width and layout were designed to naturally slow traffic, which is important in a residential community. "The permeable pavers were more expensive up front… but require no maintenance and, therefore, save on long-term costs,"said Troy Clay. Many of the walking paths in the community are also permeable, using aggregate and mulch.

Goal 3: Protect the public water supplies by reducing nutrients and chemicals

Public water quality is directly linked to ground water quality. Restoring the vegetation native to the area is one way to protect the water supply. The Pokagon Band restored portions of their wooded areas by removing invasive species and opening up the tree canopy. They enhanced the bioswales with prairie grasses and native plants. Wildflower and rain gardens limit the amount of turf. The native vegetation develops deep root structures and generates soil's organic carbon. The ground can better filter the water, which protects water quality. These plants do not require irrigation systems, fertilizers, or lawn chemicals—making them less expensive to maintain and better for the environment.

Native plants

Prairie grasses

Phases of Development

Energy efficiency, sustainable water use, landscape-sensitive planning, and the selection of appropriate material and methods of construction are current practices of the Pokagon Band of the Potawatomi Indians. The addition of new key and sustainable features in the projects demonstrates the Band's growing vision of sustainable development.

Phase 1: Project Summary

LOCATION: Pokagonek Édawat Housing Development (Dowagiac, Michigan)
DESIGN/PLAN TEAM: Conservation Design Forum (Master Plan/ neighborhood design), Wightman & Associates, Inc. (home design)
TIMELINE: Visioning began in 2004. Units were occupied in late 2005.
PROJECT TYPE: High performance infrastructure with 20 single-family elder units

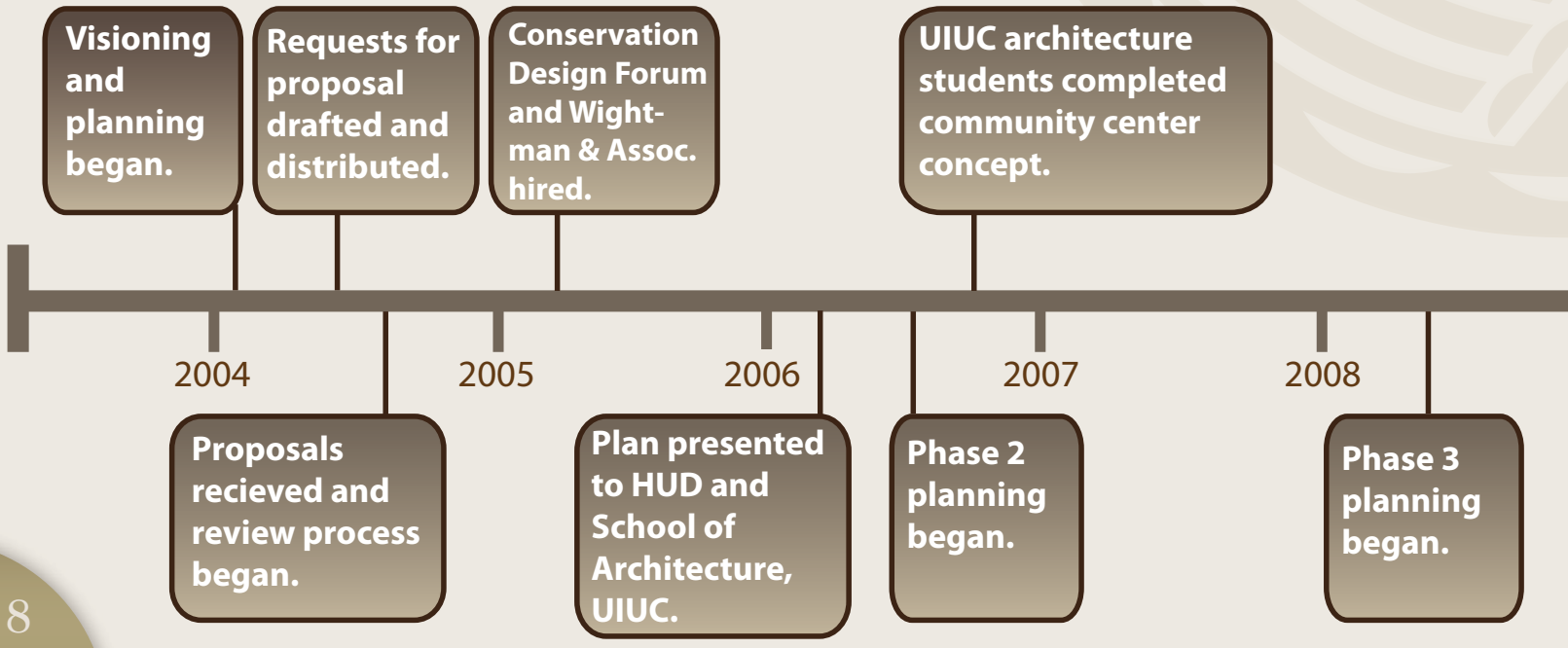
PHASE 1

Project Key Features

- Culture-based development.
- Integrated design--streets, sidewalks, stormwater management and landscaping.
- Financial benefits.
  - Decreased operation and maintenance costs.
  - Decreased energy costs.
  - Increased real estate values.

Key Sustainable Elements

- Dense deep-rooted vegetation—aids in pollutant removal and infiltration.
- Permeable pavement.
- Clustering and placement of houses in development preserves topography and existing vegetation.
- Rain gardens and bioswales.
- Energy Star appliances.



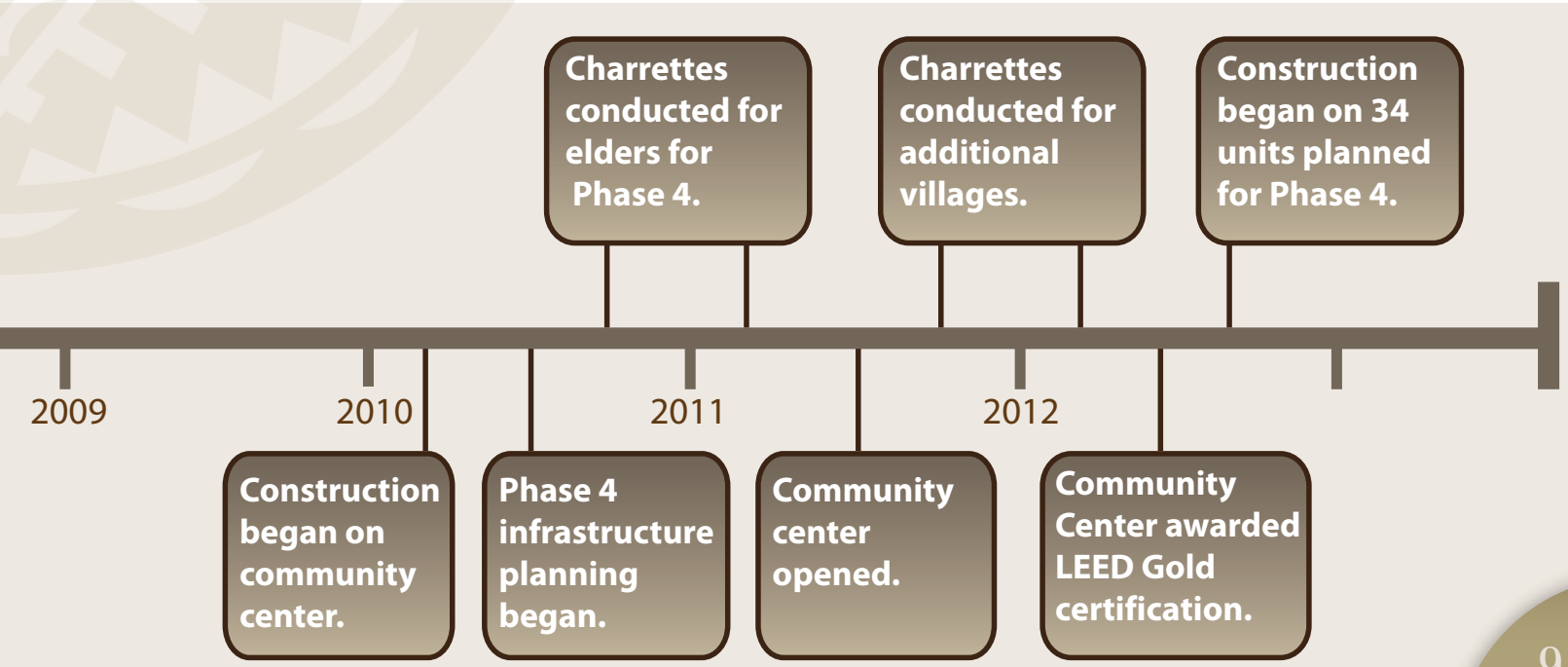
Phase 2: Project Summary

LOCATION: Pokagonek Édawat Housing Development (Dowagiac, Michigan)
DESIGN/PLAN TEAM: Wightman & Associates, Inc.
TIMELINE: Visioning began in January 2006. Units were occupied in 2006.
PROJECT TYPE: Fourteen single-family units. (High-performance infrastructure was already in place.)

PHASE 2

Additional Key Sustainable Elements

- Energy-Star Certified houses



Phase 3: Project Summary

LOCATION: Pokagonek Édawat Housing Development (Dowagiac, Michigan)

DESIGN/PLAN TEAM: University of Illinois at Urbana Champaign School of Architecture, Wightman & Associates, Inc.

TIMELINE: Visioning began in 2006. Construction began in 2010. Building opened in 2011.

PROJECT TYPE: Community Center

PHASE 3

Additional Project Key Features

- Built to LEED Gold standards.
- Decreased dependence on fossil fuels.

Additional Key Sustainable Elements

- Dedicated open space, native vegetation and landscaping, preserved tree line.
- Vegetated roof and LED site lighting.
- Photovoltaic system and geothermal heat.
- Bike rack and minimized parking.
- Earth berm.
- Local, natural, and durable building materials.
- Passive solar heat sink with roof overhang and tinted insulated glazing.

Best Practices

The Band is planning a phase IV in its housing development. This will include 20 additional housing units at the Édawat development (half elder and half single-family units) and also housing with high performance infrastructure in its Hartford, Michigan, and South Bend, Indiana, locations. Planning for these new houses begins with best practices taken from the earlier phases of development. Troy Clay, who took part in the planning process from the start, says, "The community is just now realizing the community center as a resource and wanting more amenities." The best practices include:

- Culture of the Pokagon people embedded in each housing development.
- Sensitivity to the landscape in the development of the built environment.
- Successful performance of the high-performance infrastructure.
- Community center's sustainable features, such as passive solar heat sink, insulated glazing, vegetated roof, minimized parking, and earth berm.
- Walkability features within the Édawat Development.
- Good stormwater management and water quality through infiltration and filtration strategies.
- Limited housing footprint and lot size to maximize existing rural landscape.

Accomplishments/Awards

- American Institute of Architects (AIA) Michigan Chapter Design Merit Award

- LEED Gold certification for community center

- Best Practices and Innovation Award, 2005 HUD National Indian Housing Summit
- 2011 HUD Greener Homes National Summit awardee
- Featured on Southwest Michigan Planning Commission Web site: **http://www.swmpc.org/pokagon_band.asp**
- Featured on Southeast Michigan Council on Governments, Low Impact Development Case Studies: **http://www.semcog.org/Data/lid.report.cfm?lid=132**

Next Steps

With the eventual goal of becoming a net-zero energy community which produces as much energy as it uses, the Band sees opportunities for continued improvement. Development of the first three projects has begun to expand the Band's idea of what sustainable housing can be. In addition to housing with a small footprint and Energy Star certification, for example, the Pokagon Band wants to explore renewable energy, alternative sustainable building materials, and multifamily housing. Although already adapted to its topography, future housing can accomplish greater energy savings if it also can be oriented to benefit from passive solar heating and ventilation practices based on prevailing wind patterns.

The original master plan called for on-site residential wastewater treatment. In the long term, this option may be possible if the Band takes the properties into trust. The shorter term plan, which supports Pokagon's cultural emphasis on reducing and reusing, is to explore additional water reclamation and treatment opportunities.

Increased community building is another area of interest. Clustering housing is one strategy. The Band also plans to develop additional housing types to build a supportive community in which tribal members can live, work, and play without traveling long distances.

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How To Get Started

To learn more about creating a master plan, implementing a water management and conservation strategy, or conducting a charrette, check out these resources.

Search for local State, county, or city at the Council of Governments Web site on planning organizations:
http://narc.org/regional-councils-mpos/listing-of-cogs-and-mpos-2.html

Intergovernmental Partnership for Sustainable Communities Web site for community planning. (Also, see sections on Energy Efficiency and Rural Communities):
http://www.sustainablecommunities.gov/toolsKeyResources.html

U.S. Environmental Protection Agency for LID:
http://water.epa.gov/polwaste/green/index.cfm

Toolbase.org low impact development BMPs:
http://www.toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=909&BucketID=6&CategoryID=11

Landscaping with native plants:
http://www.epa.gov/greenacres/

U.S. Department of Agriculture, Natural Resources Conservation Service fact sheets:
http://www.ia.nrcs.usda.gov/news/brochures/urbanfactsheets.html

Handbook from the National Renewable Energy Laboratory on planning and charrettes:
http://www.nrel.gov/applying_technologies/pdfs/charrettes_handbook.pdf

National Charrette Institute:
http://www.charretteinstitute.org/

This best practice case study is one in a series that examines how Native American and Alaska Native communities have incorporated sustainable technologies and strategies into their housing development.

The Sustainable Construction in Indian Country initiative was created to support and increase sustainable construction practices in Native American communities. It is administered through the U.S. Department of Housing and Urban Development's Office of Policy Development and Research in partnership with the Office of Native American Programs.

Produced October 2012

Appendix C-7:
Case Study

Sustainable Construction in Indian Country

Incorporating Sustainability and Renewable Energy Into Housing for Elders

St. Regis Mohawk Tribe

"The community is very impressed with this project. It is located in a relatively isolated area, so community members didn't know this was going on and had never realized it was here. Then they went to the grand opening and were blown away by the neighborhood we created."

-Retha Herne, Executive Director of the Akwesasne Housing Authority

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Problem

Adding sustainability features and renewable energy into design plans for an affordable housing project for elderly tribal members when those designs are already partly developed.

Solution

Adopting a flexible approach to design and development, with attention to selecting the most reasonable and relevant sustainability elements.

Community Snapshot

Location: In northern New York State, the territory of Akwesasne is divided internationally between Canada and the United States (U.S.). The U.S. (southern portion) of the reservation includes the village of Hogansburg and the Canadian (northern portion) is further divided by the provinces of Ontario and Quebec along the St. Lawrence River.
Location type: Rural
Population: 3,288 in the 2010 census
Climate: Cold winters (14–31 ºF) and moderate summers (60–82 ºF) (Köppen classification *Dfb*).

Critical Sustainable Technologies and Strategies

- Geothermal system for heating (and cooling in the training center), with in-floor radiant heat
- Solar domestic hot water
- Active solar photovoltaic power generation
- Active daylighting via skylight tubes
- Insulating concrete form (ICF) construction
- Recyclable metal roofing
- Stormwater management/pollution control
- Energy Star appliances
- Light-emitting diode (LED) and compact fluorescent lamp (CFL) lighting
- Dual flush toilets and water saving plumbing fixtures
- Sustainable community

Table of Contents

Funding

Costs for the Sunrise Acres Phase 2 project including a community building, parking lot, rental office building, and 20 units of residential housing, came in at about $5.6 million. Renewable energy systems and energy-efficient upgrades cost an additional $1.4 million.

Source	Amount
U.S. Department of Housing and Urban Development (HUD) American Recovery and Reinvestment Act (ARRA)	$4 million
HUD Native American Housing Assistance and Self Determination Act (NAHASDA)	$3 million

Map

Summary

When the Akwesasne Housing Authority (AHA) began Phase 2 of its Sunrise Acres expansion project, an additional 20 units of housing southwest of an existing 20-unit complex, it was interested in sustainability and renewable energy sources, but did not initially have funding to incorporate such features. After AHA was fully immersed in the design phase, new funding allowed for the additional components but presented a new challenge: modifying existing plans to integrate sustainability.

Sunrise Acres

Phase 2 was completed in the summer of 2011. It provides safe, affordable units for elderly tribal members with much lower utility costs than the Phase 1 housing. Phase 2 includes five quadplexes, a community and training center, a parking area, and a public pavilion on 28 acres of tribal land. Each one-story, multifamily building has its own mechanical room and is divided into four apartments. Each buildings is approximately 4,050 square feet.

Utility cost data for a period of 12 months showed dramatic utility savings: approximate 50% annual cost savings between the Phase 1 buildings and the Phase 2 buildings—more than $4,000 per building a year. This is in large part due to the change from kerosene to geothermal heat.

A geothermal system provides the primary heating source (and cooling in the training center only), with in-floor radiant heat connected to the system by heat exchangers. The major benefit of this system is that it allows the AHA to move away from costly kerosene that was the primary heating fuel. The geothermal system uses no fuel other than electricity to run the pumps that circulate the water. The project also incorporates six solar photovoltaic arrays of 24 panels each, which partially supplement electricity use. Solar domestic hot water (DHW) systems are installed on the roofs of each quad building.

The walls include a 6-inch insulating concrete form (ICF) wall system. Although the walls have standard insulation (an R20 value for heat transfer), the thermal mass of the concrete combined with in-floor heat maintains very stable and even heating levels. With well-sealed windows, this type of construction produces an extremely tight building without air infiltration. In addition to saving energy, ICF systems keep units more comfortably cool in the summer and warm in the winter.

The project not only provides safe, affordable, and attractive housing for the elderly, but it also is helping the Tribe move away from fossil-fuel dependence. This move is critical because green measures that reduce the carbon footprint—including renewable energy systems—are consistent with cultural values.

Here are some of the technologies and their effect on sustainability.

Sustainable Technologies	What Is It?	Effect
Geothermal energy system	A geothermal or ground-source heat pump system transfers heat stored in the earth and pumps it into the indoor air-delivery system in the winter. In the summer, the ground acts as a heat sink, and the heat is transferred from the interior through the heat exchanger back to the ground. The system relies on the ground beneath the surface being warmer in the winter and cooler in the summer than the air above it.	The energy produced by geothermal systems is naturally concentrated, existing heat that is clean and sustainable. Although costly to install, geothermal systems have low operating and maintenance costs. According to the U.S. Department of Energy (DOE), system life is estimated at 25 years for the inside components and 50+ years for the ground loop.
Photovoltaic (PV) array	A PV array generates power when exposed to the sun. It is composed of PV panels and modules. Energy is converted to watts and stored, used, or, if tied to the grid, sent back to the utility grid.	The Florida Solar Energy Center (University of Central Florida) estimates PV modules can last 20-30 years.
Solar domestic hot water (DHW)	In a passive system, the sun heats water in a solar tube system. Solar-heated water flows into a tank in the mechanical room. An electric tank also provides backup.	Passive DHW systems require little maintenance and can reduce energy costs.
Insulating concrete form (ICF)	ICF is a system of formwork for concrete that stays in place as permanent building insulation for energy-efficient, reinforced concrete walls, floors, and roofs. The forms lock together similar to LEGO bricks and serve to create a form for the structural walls or floors of a building.	ICFs provide superior insulation, high thermal mass, and low infiltration. They may raise construction costs approximately 2 to 5 percent (according to the National Association of Home Builders' Toolbase) but can significantly lower utility costs compared with wood or steel construction.
Sustainable community	The definition varies by community. A sustainable community is one that is economically, environmentally, and socially healthy and resilient, according to the Institute for Sustainable Communities.	This community is more walkable, has easily accessible diabetes services, and provides more opportunities for social interaction.

Design Process

The AHA designed the project in collaboration with architect Barry Halperin of Beardsley Design Associates. From the beginning, the AHA was interested in incorporating green concepts and sustainability as guiding principles, although it did not have funding to include these elements. AHA's later successful American Recovery and Reinvestment Act (ARRA) application received points for sustainable technologies, allowing for changes to the design plan. Specifically, the AHA was interested in high-efficiency mechanical systems. The architect suggested a geothermal system. The challenge of using a geothermal system is that it costs considerably more money up front than a traditional mechanical system. However, the Tribe was willing to invest in this sustainable feature because of its commitment to green building, lower utility costs, and decreased environmental impact.

The Tribe's commitment to sustainable construction is also evident in its decision to use solar photovoltaic arrays and a solar DHW system to provide supplemental energy sources.

The design phase included a great deal of discussion about incorporating culturally relevant features. Some, such as adding artwork that would highlight the welcoming prayer on the outside of each building, were not implemented. The design, however, does address the cultural significance of kitchens in the St. Regis Mohawk Tribe. Typically, kitchens in senior housing are small because seniors tend not to cook extensively. In Sunrise Acres, the kitchens were more generously designed to allow tribal members to continue to use them as family gathering places.

Retha Herne, Executive Director of the AHA, described the housing authority's approach to incorporating culturally relevant features in the design: "It can be hard to do culturally relevant features in design because they are expensive. Green products are another kind of cultural relevancy because we want to lessen our footprint on the environment."

Community Involvement

Before Phase 2 of Sunrise Acres could be constructed, the AHA needed to identify the properties it would purchase for this project. As part of that process, AHA presented an elderly housing plan to the community and invited comments.

Herne noted: "Typically we don't get comments. But we knew there was a need for elderly housing because of the wait list and trends we had been seeing in the elderly selling larger homes and downsizing."

She also noted the Tribe has received the completed project very positively: "The community is very impressed with this project. It is located in a relatively isolated area, so community members didn't know this was going on and had never realized it was here. Then they went to the grand opening and were blown away by the neighborhood we created."

AHA intentionally created a neighborhood that values quiet and independence, while also encouraging healthy living and intergenerational activities. The "healthy" distance between quads enables residents to be close to their neighbors while maintaining some privacy, and the ICF construction reduces noise so that units are quiet. In support of the Diabetes Center for Excellence Program, housed in the training center, exterior LED lighting and extensive landscaping, including plants adjacent to the patios, encourage seniors to walk around. The project also provides space for the residents to put in a vegetable garden. As further incentive, Phase 2 includes a small, covered pavilion and picnic tables on the south side of the project where seniors can meet with their extended families. The Tribe is also planning to develop a wetlands wild bird sanctuary sighting area on the remaining property.

Certification

Although the AHA consulted the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system checklist and used some of these concepts to guide construction, AHA decided ultimately not to seek LEED certification. This decision was made, in part, because of the potential added costs, time, and the knowledge that it would have taken to coordinate all of the necessary pieces to bring LEED certification into the picture.

Herne further noted that the benefits of the ARRA funding and its tight deadlines played a significant role. They "didn't go the LEED route because when the funding became available, we were starting to work on the Sunrise expansion. We had planned to build a few units at a time, but this funding gave us the ability to construct the whole project at once."

Construction Challenges

For more than 10 years, AHA has built its own dwellings utilizing a force account construction crew. This gives AHA greater control over quality assurance than contracting out to other sources. The size of the new Sunrise Acres project, however, was larger than what AHA would normally undertake in a year. That, combined with ARRA's rigorous grant timelines, reporting, and rules, made contracting out a "grim reality," according to Herne. AHA bid the job out and, with a limited number of the Native contractors, the AHA had to increase due diligence in responsibly carrying out its procurement policy.

Tracking the progress of the general contractor and the subcontractors was also a challenge. Some design features and specifications were missed and/or had to be put in place later "because we weren't on top of it," said Herne. Based on these issues, the AHA learned to pay better attention. In the future, said Herne, "We would have more inspectors out there on our end to ensure that all specifications are met."

Some tasks were difficult to coordinate on this large project. For example, one firm installed the fiber optics for the mechanical system, which uses a central computer to control and monitor the system across all the buildings, but another firm was asked to prepare the building for fiber optic Internet service.

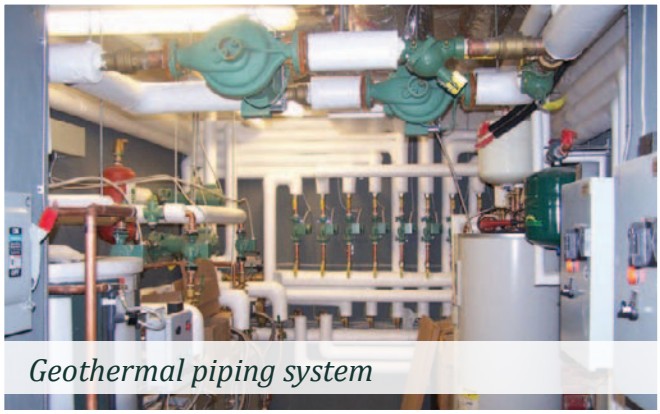
Overall construction was a positive experience. The general contractor did an "excellent job" and the project benefited from "a brainiac" inspector on staff who was also an electrician by trade, said Herne. "He knows the systems, knows how to troubleshoot," she added. Given contracting challenges, design challenges, and the fact that the project schedule was stressed by 75 to 80 days lost to rain, it is noteworthy that AHA needed to extend the project by only 1 month.

Renewable Energy Systems

The AHA hopes that installing renewable energy systems will mark a major step toward energy independence. According to the Environmental Protection Agency (EPA), renewable energy includes "resources that rely on fuel sources that restore themselves over short periods of time and do not diminish." The AHA uses sun and the earth's heat, but other renewable fuel sources include the wind, moving water, and organic plant and waste material (for biomass). Because renewable energy systems are expensive, it is important to include them early in the long-term budgeting and planning process. The AHA is monitoring costs and savings to determine the cost-effectiveness of their renewable fuel sources, while also incorporating inexpensive energy efficiency measures.

Geothermal System

Phase 2 of the Sunrise Acres development has a closed-loop geothermal system with seven wells per building and nine wells for the training center. The cost for the wells and piping was approximately $320,000. The cost for the control system and the radiant floor heating system was about $820,000. Each building has a mechanical room that houses a mechanical system. The training center has a central office for system operation, monitoring, maintenance, and temperature control. These controls are also connected to the main administration building, thanks to the fiber optic network.

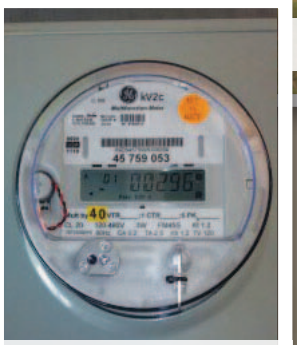


Geothermal piping system

Solar PV Array

The solar PV array is intended as a supplemental energy source to further reduce the amount of electricity that must be purchased from National Grid, the electric utility company. The project has a six-panel solar array—one to provide supplemental energy for each building—that can generate 5.04 kilowatts each. According to PV Watts Calculator, a 5.0 watt array local to the St. Regis Mohawk reservation (Massena, NY) is estimated to produce 5,814 kilowatt/hour annually, which could save the AHA an estimated $813.96 per year per building on utility bills. Over the course of the project's first 14 months, the PV array produced approximately 20 percent of the energy that a new Sunrise Acres building consumes.

PV array



National Grid meter

Solar Domestic Hot Water

DHW is provided through a solar tube system. Each building's mechanical room contains two tanks with a holding capacity of 80 gallons: one tank contains water heated by the solar system and one tank is a conventional electric hot water tank. Water from the solar holding tank flows into the electric tank as needed. This type of system can require significant space with multiple tanks, including possibly a storage tank for the hot water loop. Together the panels and DHW systems cost approximately $260,000.

Solar DHW on roof

Solar and electric water tanks

Insulating Concrete Forms

The walls of the new Sunrise Acres quadplexes are built with ICFs. Instead of being poured into wood or metal forms, concrete for the walls is poured into interlocking modular foam forms. The forms are stacked without mortar and filled with concrete. The foam is not removed, providing a layer of thermal insulation that raises R-value and also decreases air infiltration. ICFs do require some specialized knowledge to install, but the National Association of Home Builders (NAHB) indicates that the learning curve is slight. The ICFs cost about $240,000. These upfront costs are also slightly higher than with wood-framed walls, but increased energy efficiency decreases the cost differential.

ICFs with reinforcing steel

Project Summary

LOCATION: Hogansburg, NY
DESIGN/PLAN TEAM: Beardsley Design Associates
TIMELINE: Design began in 2009. Residents occupied units in 2011.
PROJECT TYPE: Five single-story quadplex buildings (20 apartments) for seniors, one training center, and a rental office building.

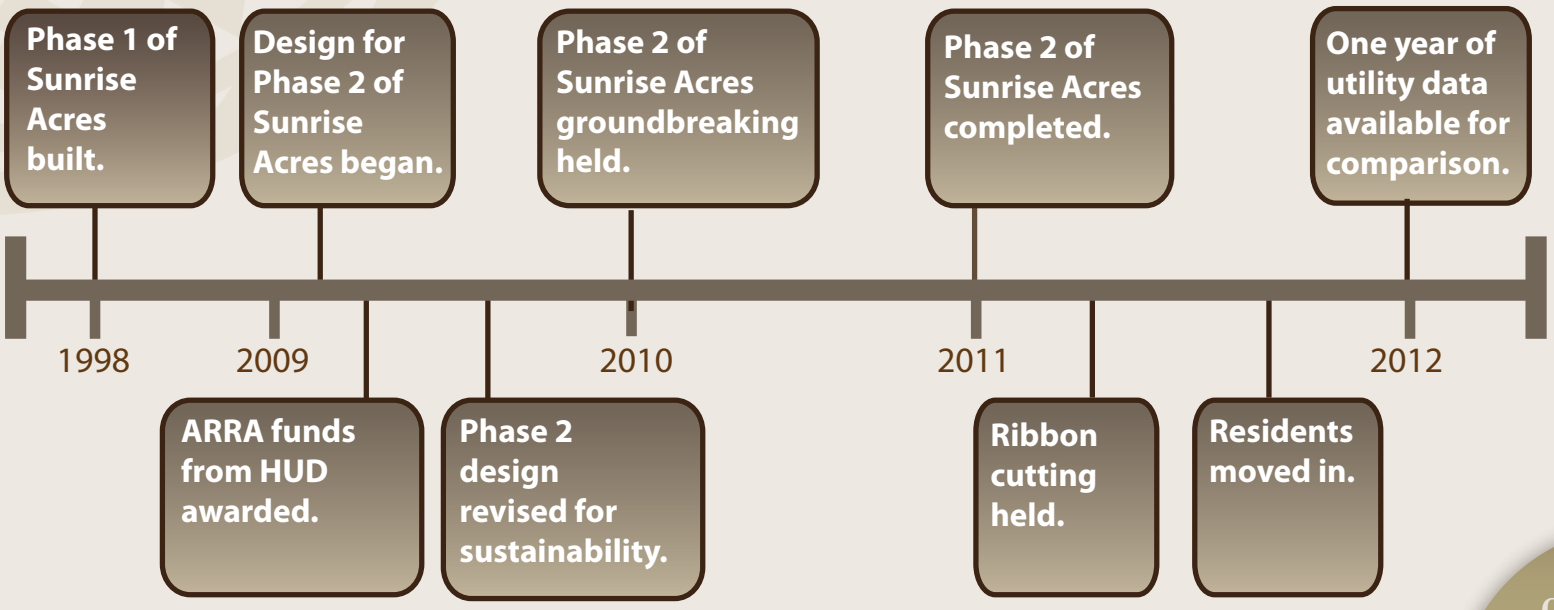
Training center

Project Key Features

- Mechanical room in each building.
- Slab-on-grade foundations.
- Heat recovery ventilators.
- Increased kitchen size.
- Decreased operational costs.
- Elimination of kerosene fuel use.
- Landscaping emphasis to encourage walking.

Key Sustainable Elements

- Geothermal heating and cooling system.
- Solar panels.
- Solar DHW.
- ICFs.
- Community development to encourage healthy habits.
- Metal roof system.
- Energy-efficient windows.
- Solar daylighting tubes.
- Energy Star appliances.
- Energy-efficient lighting.
- Low-flow dual-flush toilets, faucet aerators, and low-flow showerheads.
- Stormwater and pollution control.
- Net-metering.



Best Practices

With a year of monthly utility costs in hand, AHA was eager to discover more about the costs and savings associated with their commitment to renewable energy in the new units. A Sustainable Construction in Indian Country initiative team conducted a comprehensive energy analysis comparing Phase 1 and Phase 2 of Sunrise Acres. The data show the newly constructed units in Phase 2 of Sunrise Acres are much more energy efficient and substantially less expensive to operate: the annual energy cost for Phase 2 is $4,110 per building, which is one-half the cost per building for Phase 1 ($8,176). When actual energy savings are calculated by converting all energy measurements to Btus (British thermal units), 58 percent in utility costs were saved, despite the fact that electricity use is much higher in Phase 2 because of geothermal pumps. Utility bills show wide variation in energy use from building to building, however, suggesting that resident education may help decrease usage even more.

The picture is complex and not entirely to be answered by model calculations; the usual calculations of payback do not evaluate the benefit to the environment of carbon reduction, a benefit of importance to the St. Regis Mohawk. A simple payback calculation suggests that the geothermal system will pay for itself by the end of its estimated lifetime. Halperin suggests a more optimistic view that weighs two sets of costs: the geothermal system may take 7 to 10 years to realize overall cost reductions as compared with a conventional mechanical system.

The solar panels allow the Tribe to exercise greater energy independence. As mentioned, the panels have provided approximately 20 percent of the energy used by the Phase 2 buildings. This is energy that the AHA does not need to purchase. The AHA participates in the National Grid's (the local utility company) net-metering program, which can further decrease electricity costs. The utility company's net-metering policy allows customers to connect their renewable energy sources to the electric grid. Customers save money by offsetting electrical costs with their own renewable energy or by contributing excess production to the grid.

Herne indicated that the usage meets the hot water needs of the unit with electric hot water backup. The unit size and number of occupants play a role in this success. "This has been successful, partly because there are only one or two occupants in each unit so they do not use a lot of utilities."

With solar technologies, upfront cost is also significant. Calculations of cost recovery on the DHW are promising, with simple payback within an estimated 4 years and positive returns on more complicated calculations as well. The solar arrays fare less well in payback models. With the Tribe taking advantage of federal tax credits, simple payback shows the solar arrays pay for themselves only within the lifetime of the system.

The units are popular with the community, according to Herne: "Some people were concerned that we wouldn't fill the units. But we finished the project in July and it was filled by August." As of January 2013, the AHA had a 15-unit waiting list for these units, partially because of positive reports from residents. At just over 1,000 square feet, units are smaller than many residents' former houses, but she added, "the tradeoff is that they don't have to mow the grass or shovel snow. It's a worry-free environment close enough to neighbors but far enough apart that it is comfortable. The ICF construction means they don't hear each other. So residents are happy with these apartments."

Another positive outcome is that the AHA has more confidence in its ability to design projects that meet community needs and expectations. Herne noted, "The grand opening made us realize that the housing authority can do a good job of creating a neighborhood. There is more community trust in what we do."

Herne also emphasized, "This time around we really wanted to do responsible housing development. We introduced some green development and sustainable construction." Barry Halperin, the project manager for the design firm and the chief architect, confirmed this assertion: "I think it was a success because the Tribe was committed to the sustainable elements."

Herne's advice to other tribes: "Just do it! It's not going to get done unless you jump in there and do it and see where you end up!"

Next Steps

In the long term, renewable energy strategies are part of the AHA plan. Herne said, "Now that we touched on green building practice, we want to continue it." But, she has some qualifiers. First she wants to monitor the continued cost efficiency and system performance of the Phase 2 units.

Although the AHA has rehabbed 10 of the Phase 1 apartments by upgrading the kitchens and lighting, it did not yet make any of the energy-efficient improvements featured in Phase 2. Herne said the Tribe's first priority is multifamily tax-credit projects. If Phase 2 is successful, AHA would like to make more extensive energy-efficient changes to Phase 1. The proposed work would not take place within the units themselves, rather in the boiler rooms and mechanical rooms.

Another area of research for the AHA, according to Herne: "We want to find affordable ways to bring renewable energy efficiency to single family housing. We would like to tap into programs to bring in funding to do hot water heat with solar panels on single family homes."

In future projects, she added, the AHA would also like to incorporate wind energy, "but for now we have done a lot, we know what we can do, it came out positive, we have more capacity and experience in green building. I'm happy with what we've done so far."

For more information:

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How To Get Started

To learn more about geothermal systems, solar panels, DHW, sustainable construction efficiency determinations, and the Sunrise Acres Energy Assessment, check out these resources.

EPA on geothermal energy:
http://www.epa.gov/region1/eco/energy/re_geothermal.html

DOE, Energy Saver on solar water heaters:
http://energy.gov/energysaver/articles/solar-water-heaters

DOE EERE on solar systems:
http://www.eere.energy.gov/topics/solar.html

DOE, National Renewable Energy Laboratory photovoltaic array calculator:
http://www.nrel.gov/rredc/pvwatts/

U.S. Department of the Interior, simple payback worksheet:
http://www.doi.gov/greening/energy/efficiency.cfm

Federal Energy Management Program's energy and cost savings calculators for energy-efficient products:
http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html

NAHB Toolbase.org on ICFs:
http://toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=602&BucketID=6&CategoryID=54

HUD, Office of Sustainable Housing and Communities:
http://portal.hud.gov/hudportal/HUD?src=/program_offices/sustainable_housing_communities

Institute for Sustainable Communities:
http://www.iscvt.org/what_we_do/sustainable_community/

Energy Efficiency Evaluation and Recommendations: Elder Housing Sunrise Acres:
http://www.huduser.org/portal/SCinIC/resources.html

Akwesasne Housing Authority:
http://www.akwehsg.org/

This best practice case study is one in a series that examines how Native American and Alaska Native communities have incorporated sustainable technologies and strategies into their housing development.

The Sustainable Construction in Indian Country initiative was created to support and increase sustainable construction practices in Native American communities. It is administered through the U.S. Department of Housing and Urban Development's Office of Policy Development and Research in partnership with the Office of Native American Programs.

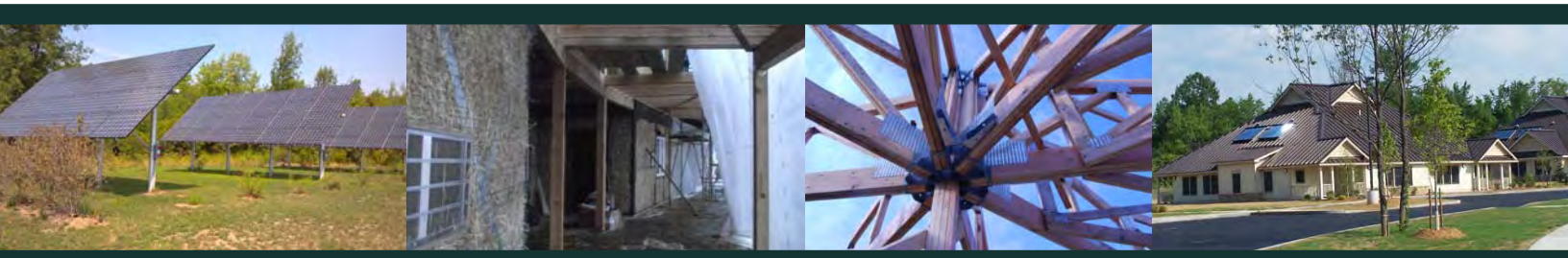
Produced April 2013

Appendix D:
Training Materials

U.S. Department of Housing and Urban Development
Office of Policy Development and Research

Sustainable Construction in Indian Country

Assessing Conventional-Built and Sustainable Buildings



February 14, 2013
Albuquerque, NM

Defining Sustainable Construction and Sustainable Communities in Indian Country

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Sustainable Construction in Indian Country

Albuquerque, NM
February 14, 2013

Sustainable Construction in Indian Country (SCinIC)Initiative

- Created to support and increase sustainable construction practices in Native communities.
- Administered through HUD's Office of Policy Development and Research (PD&R) in partnership with HUD's Office of Native American Programs (ONAP).
- Congressionally mandated initiative.
- Initiative runs to May 2013.

Sustainable Construction Building Practices

- Supports housing that is "healthier, more comfortable, more durable, and more energy efficient and [has] a much smaller environmental footprint than conventional homes." (U.S. Green Building Council)
- Broad areas of sustainable construction practices include:
  - Master planning
  - Siting and design
  - Water management
  - Energy efficiency
  - Environmental sustainability
  - Local cultural relevance and ties to traditional sustainability

Activities under SCinIC

- National focus group – held during Greener Homes National Summit, September 2011.
- Technical assistance for the demonstration sites.
- Training
- Best practice case studies

Keep Up on SCinIC Activities?

- Visit PD&R's HUD User Web site: http://www.huduser.org/portal/native_american/sustainable_construction.html
- Sign up there for e-list updates.

Defining Sustainability in Construction

LEED Gold Certified multifamily developed by Little Traverse Bay Bands of Odawa Indians, MI

Defining Sustainability in Construction

How is sustainable construction defined?

- Often called “green construction” or "green building."
- The U.S. Environmental Protection Agency defines green building as "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements building design concerns of economy, utility, durability, and comfort. A green building is also known as a sustainable or high performance building.”
- The U.S. Green Building Council believes that green homes are generally "healthier, more comfortable, more durable, and more energy efficient and have a much smaller environmental footprint than conventional homes."
- The Sustainable Native Communities Collaborative defines sustainable housing as: “culturally appropriate, green, and affordable.”

Sustainability Definitions for SCinIC

- Uses the U.S. Green Building Council definition.
- Focuses on sustainable technologies.
- Includes durability of housing, affordability, life cycle costs.

Sustainability in housing can include:

- Improvement to health
- Care for the environment
- Attention to life-cycle of materials or building
- Durability
- Financially feasible
- Increased comfort for residents
- Provides long-term support for residents

What are the benefits of sustainable construction?

- It is generally accepted that there are environmental, economical, and social benefits to building more sustainably:
- ***Environmental benefits***—Sustainable construction enhances and protects biodiversity and ecosystems, improves air and water quality, reduces waste streams, and helps conserve and restore natural resources.
- ***Economic benefits***—Green building practices help to reduce operating costs (such as fuel costs); create, expand, and shape markets for green products and services; and optimize life-cycle economic performance of buildings.
- ***Social benefits***—Sustainable design practices enhance occupant comfort and health, minimize strain on local infrastructure, and improve overall quality of life.

http://www.epa.gov/greenbuilding/pubs/whybuild.htm

Examples Of Sustainable Construction Practices in Different Categories

Examples range from simple, inexpensive and do-it-yourself or complex and costly

Energy Efficiency

- Blown cellulose, foam, or other insulation (not fiberglass batts) meeting 2012 International Energy conservation Codes for Residential Energy Efficiency (R-value) standards
- Structural Insulated Panels (SIPS)
- Façade differentiation designed for passive solar heating/cooling
- Aerated Concrete
- Advanced Wood Framing
- Insulated Concrete Forms (ICF)
- Straw bale technology
- Adobe
- Modular construction
- Low-E windows (low emissivity windows)
- Heat and Energy Recovery Ventilators (HRVs and ERVs)
- High efficiency heating and cooling systems (heat pumps)
- Radiant floor heating
- Thorough caulking and weather-stripping

Renewable Energy

- Geothermal heating/cooling
- Photovoltaic panels (solar panels)
- Domestic solar water heating (DSWH)
- Bio Fuels

Materials

- Long-term, durable materials such as metal roofs, cementitious siding, masonry, etc.
- Recycled/waste products incorporated into construction materials and interiors
- Low volatile organic compound (VOC) products and paints
- Use of regional or local materials and labor

Water Efficiency

- Green roofs
- Landscaping to reduce water usage/plants that thrive in regional conditions
- Gray water systems/wastewater systems
- Rainwater harvesting and storage
- Xeriscaping
- Rain barrels/cisterns
- Permeable pavement
- Bioswales
- Low-flow plumbing fixtures

Site/Community Planning

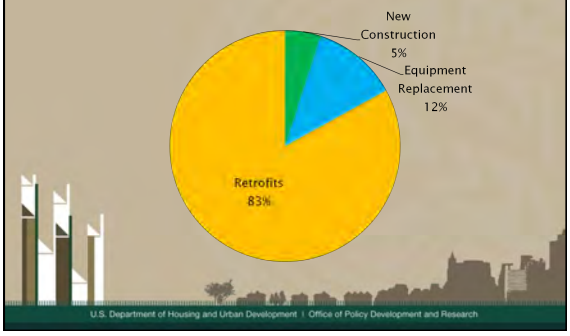
- Project on a brownfield site
- Building orientation
- Project near public transportation or car sharing implemented to minimize car trips to and from the site for everyday needs
- Project part of larger master plan that includes other non-residential uses
- Low-impact development
- Soil erosion control
- Plan for future expansion
- Green maintenance plan

Increasing Energy Efficiency in the Built Environment

Existing buildings represent the most cost effective opportunity to reduce CO2 emissions.

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Untapped Energy Efficiency Opportunities



Multifamily Retrofit Opportunities

- Cost cost-effective upgrades in multifamily buildings can achieve savings of 15–30% in buildings with five or more residential units.
- If these upgrades were made in multifamily buildings nationally, it "would translate into annual utility bill cost savings of almost $3.4 billion."

Source: American Council for an Energy Efficient Economy, report, January 2012

Impacts of Energy & Buildings

- Residential & Commercial Buildings in the United States are responsible for:
  - 74.5% of electricity production.
  - 50.1% of total energy flows.
  - 49.1% of CO2 emissions.
- Overall energy consumption by the building sector continues to increase.

Creating the Green Sustainable Community in Indian Country

Planning Healthy Communities

Physical and Social Considerations

University of Illinois at Urbana-Champaign

What Does a Green Sustainable Community in Indian Country Look Like?

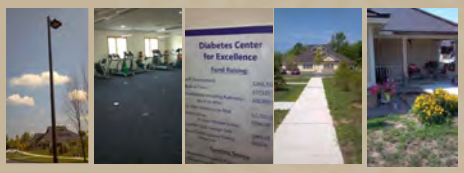
- Varies enormously because tribal communities vary enormously
- Shaped by needs and desires of each community
- Integrates housing, transportation, economic development, healthy lifestyle, environmental concerns
- Grows and changes over time
- Requires intentional planning

Social Considerations in Planning Healthy Communities

- Offer multiple residential choices
  - Unit types
  - Tenure options
- Integrate residential choices that support existing social structures
  - Support broad age range
  - Support range of incomes
  - Support variety of lifestyles
- Provide details that allow positive interaction between neighbors
- Augment available social supports

Examples of Sustainable Community Features in Native American Communities

- St. Regis Mohawk – landscaping and paths that promote exercise, Diabetes Center for Excellence, and training center within a seniors housing development.



Examples of Sustainable Community Features (2)

Pokagon Band of Potawatomi – master plan that includes housing, rain gardens, walking paths, community center.

Examples of Sustainable Community Features (3)

Oglala Sioux Tribe –recently adopted the Oyate Omniciye | Oglala Lakota Plan as the official Regional Plan for Sustainable Development

- What communities do you know that are exploring sustainability at a community level?

Exploring Elements of Sustainable Communities

- What is our community? Is it a reservation? What if we are a "checkerboard" community?
- What are the physical locations that are considered our community? How can we define those better for our residents (and perhaps for people outside our community)? How can we create our own boundaries if we want these?
- How can we show a physical sense of pride in our community?

Cultural Requirements

- Use of domestic or exterior space: where do we live and how do we use our space?
- Maintaining space or creating new space for old traditions
- Cultural center for celebrating and educating
- Subsistence rights
- Keeping family or families together

Housing

- How do we build our housing to be durable, energy efficient, and use materials that are kinder to the environment?
- Type. Is it all single family? Is it multifamily? How do we support different types of families with different needs?
- Does it provide supportive services? How do residents get to community services and amenities?
- How close are the units? If each sits on an acre, what does community look like? If closer together, what do communal spaces look like?

Structural Insulated Panels (SIPs)

Roof: R44
Sidewalls: R24
Basement Walls: R10
Air Leakage: 360 CFM50
(equivalent to a 4" x 9" hole)

Annual Space Heating Cost: $250 to $300

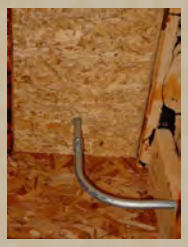
Construction Cost: $95/ft^2

Structural Insulated Panels (SIPs)

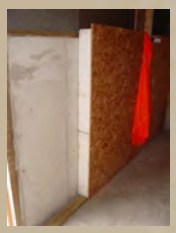
Structural Insulated Panels (SIPs)

Structural Insulated Panels (SIPs)

Electrical



Structural Insulated Panels (SIPs)

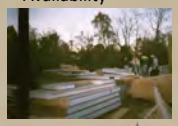


Basement Wall

Window rough-opening

Structural Insulated Panels (SIPs)

- Benefits
  - Easy to work
  - Assembles quickly
  - Air-tightness
  - High R-values
  - Reduction in lumber
  - Structural strength
- Potential Drawbacks
  - May cost more than standard frame construction
  - Availability



Insulated Concrete Forms (ICF's)

R20 insulation

Insulated Concrete Forms (ICFs)

- Benefits
  - High R-values above and below grade
  - Air-tightness
  - Durable
  - Reduction in lumber
- Potential Drawbacks
  - Higher cost for above grade walls
  - Additional engineering may be required
  - Availability

Strawbale Construction

From Red Feather Development Group

www.redfeather.org

Strawbale Construction

- Benefits
  - Exceptional R-values
  - Air-tightness
  - Durable
  - Turns waste product into a building product
- Potential Drawbacks
  - Restrictive wall finishes
  - Availability

Transportation

- How do people get to amenities and services?
- What do people without cars do? How can we make them safe?
- Do people want other options?
- Where are cars parked?

Landscaping and Space

- How do people use the outdoors?
- How is private and public outdoor space related?
- What does a rural community look like?
- Who cares for space?
- How do people more through the outdoors?

Economic Development

- Where do people go to work?
- Do we need more places to work?
- Can these be woven into our residential communities? Do we want them to be?
- Do our communities support work for family members with responsibility for children or elders?
- Are there places in our communities that can be developed into work places to fill community needs?

Health

- Where do residents get their health care? Is this easy to get to?
- Where do they get education on healthy lifestyle?
- Does our community make it easy to live a healthy lifestyle? Are there physical changes we could make to support this?
- Are there safe places for children to play?

Services

What other services would we like inside our community? Do we have enough people to use that service?

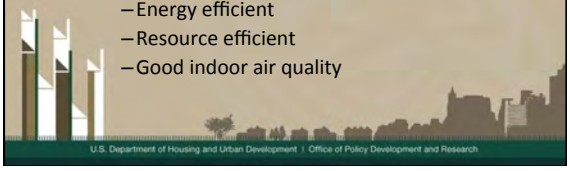
- Grocery store
- Bank
- Library
- Entertainment
- Restaurant
- Gas Station
- Religious/Spiritual Institutions

Keys to Success

- One go-to person
- Buy-In from tribal leadership
- A team made of different critical departments, leaders, and organizations
- Local measures of sustainability, unique to your community
- Thorough research into options, costs, and consequences
- On-going communication at all levels of tribal life
- Many voices

Key to Success

- Build to your climate
  - Builder Field Guide (www.eeba.org)
  - www.buildingscience.com
- Review alternative building systems
  - Less expensive
  - Energy efficient
  - Resource efficient
  - Good indoor air quality



Leveraging Utility Resources to Fund ECRMs and Renewable Energy Sources

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

Utility Resources for Funding Energy Efficient Improvements and Renewable Energy Projects

Typical Incentives Offered by Utility Providers

- Incentives – partially or fully underwritten reductions in energy conservation measures
- Rebates – Cash after purchase of energy efficient measure such as ENERGY STAR Refrigerator
- Net metering – Credit on bill for excess energy generated by renewable resources.
- Tax credits – for installation energy efficient systems and renewable energy sources.

Who are these incentives for?

- Customers of the utility provider
  - Residential
  - Commercial
  - Tribal Housing Entities
- Your residents may be eligible in some incentives; the housing authority may be eligible in other incentives.

How can I find out about incentives offered by my utility provider?

- Search for your state:
  - http://www.dsireusa.org/
- Information will include commercial and residential incentives, Federal incentives, State incentives, regulations and policies, as well as utility provider incentives.
- Closely check for eligibility and get more information if you are not sure!

Database of State Incentives for Renewables & Efficiency (DSIRE)

- DSIRE is a comprehensive source of information on state, local, utility, and federal incentives and policies that promote renewable energy and energy efficiency.
- Established in 1995.
- Funded by the U.S. Department of Energy, DSIRE is an ongoing project of the N.C. Solar Center and the Interstate Renewable Energy Council.

Example of Solar System Project

Grid-Tied Solar System

Installation of PV System

Steps to Size and Install Solar Energy System

- Size the solar system based on anticipated load
  - Recommend version 1 of "PV Watts" from NREL
- Receive utility approval for system design (should be simple for systems less than 10kW…..residential systems in Illinois should be less than 10kW for all energy needs)
- Install!

PV Watts Output for Equinox House

Station Identification	
City:	Peoria
State:	Illinois
Latitude:	40.67° N
Longitude:	89.68° W
Elevation:	199 m
PV System Specifications	
DC Rating:	8.2 kW
DC to AC Derate Factor:	0.770
AC Rating:	6.3 kW
Array Type:	Fixed Tilt
Array Tilt:	30.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	8.4 ¢/kWh

Results

Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.09	633	53.17
2	4.07	741	62.24
3	4.42	871	73.16
4	5.33	965	81.06
5	5.95	1086	91.22
6	6.29	1074	90.22
7	6.26	1090	91.56
8	5.76	1004	84.34
9	5.28	901	75.68
10	4.58	859	72.16
11	3.13	582	48.89
12	2.52	505	42.42
Year	4.73	10311	866.12

Nominal system "size"

Annual output

We need 8000kWh for 100% of Equinox House requirements and 2000kWh for 8000 miles of driving

Utility Process (Ameren)

Distributed Generation Facility ("Facility") Information

Facility Address: 1103 N Hickory Crest Rd

City: Urbana State: IL Zip Code: 61802

Electric Distribution Company (EDC) serving Facility site: Ameren IP

Electric Supplier (if different from EDC): _____

Account Number of Facility site (existing EDC customers): 6622C-1543

Inverter Manufacturer: Fronius Model: IG 4000

Is the inverter lab certified as that term is defined in the Illinois Distributed Generation Interconnection Standard? Yes ☒ No ☐
(If yes, attach manufacturer's technical specifications and label information from a nationally recognized testing laboratory.)

Generation Facility Nameplate Rating: 3.2 (kW) 3.6 (kVA) 240 (AC Volts)

Prime Mover: Photovoltaic ☒ Reciprocating Engine ☐ Fuel Cell ☐ Turbine ☐ Other _____

Energy Source: Solar ☒ Wind ☐ Hydro ☐ Diesel ☐ Natural Gas Fuel Oil ☐ Other _____

Estimated Commissioning Date: ~~[illegible]~~ July 1, 2008

Three Steps:

- Fill out form to become a "distributed" generator (small power plant less than 10kW)
- Fill out application for a "bi-directional" meter
- Inspection by utility before permission to come on line

- $25 application fee
- Most utilities require accessible disconnect near meter box

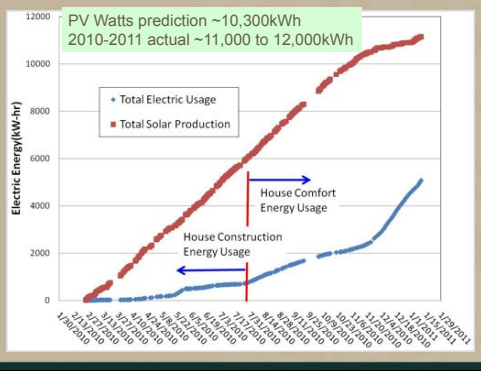
Net Meter Credit

ELECTRIC SERVICE BILLING DETAIL - Rate Zone III

DS - Residential (DS-1)
Net Metering 0-40 kW Non-TOU April
Service From 11/17/2010 to 12/17/2010
Customer Charge $13.60
Meter Charge $4.72
Total Delivery Service Amount $18.32
Electric Supply (BGS-1)
Service From 11/17/2010 to 12/17/2010
Purchased Electric Adj 0.00 kWh @ $.00210332 $0.00
Total Supply Amount $0.00
Total Electric Charges $18.32

- In Illinois, no checks are written for excess electricity (some states have "feed-in" rates, 3 or 4 times their sell rate to encourage growth)
- "Excess" solar energy generated is credited to your account
  - Summer is time to "grow" energy credit
  - Good synergism with Utility demand
- At end of "solar year" (April), credit is zeroed….this is time when house load should be very low, so new credit will begin growing
- Can convert to "time-of-day" pricing in Ameren region through "Power Smart Pricing" program … this gives '$" credit, which benefits solar because excess in sunny afternoons when energy is $$$, and house needs can be shifted to time when energy is $ (eg, AC and hot water at night)…should be able to pay "fees" with $ credits

Total Solar Energy Production



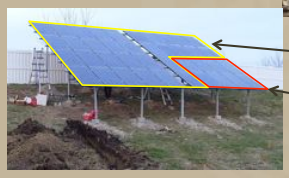
Equinox House 8.2kW System

•40 panel packaged system	**28,000**
•Labor (100 hrs @ $35/hr)	**3,500**
•Steel, wire, post holes, concrete	**3,500**
•Total System Cost	**$35,000**
•Federal Rebate (30%, no limit)	**- 10,500**
•Net System Cost	**$24,500**

~Twice the system in 2009 as in 2008 for the same price!
-Cost over 20 years is ~12.5 cents per kWh
-no escalation of price over lifetime
-Solar powered Electric Vehicle cost less than $2 per gallon gas

Solar System Installation

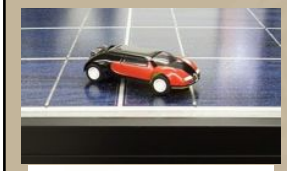
8.2kW nominal system size
~4 days to install rack and panels
~600 to 750 sqft
~10,000kWh per year
8000kWh for house
2000kWh for electric car



House panel area

Car panel area (8000 miles per year)

Solar Powered Electric Vehicles 25% less than Gas



- "Good" electric vehicles (Chevy Volt, Nissan Leaf, Tesla Roadster) obtain 3-5 miles (5-7km) per kWh
- Solar electric cost $0.125/kWh
- ~$0.03-0.04 per mile
  - ~$0.02-0.03 per km
- Gas car cost ($3/gal=$0.8/liter)
  - ~50mpg=22km/liter
  - ~$0.045-0.06 per mile
    - ~$0.027-0.036 per km

And, EVs will be less $$$ than Gas Vehicles

Using Utility Incentives: Case Study

- Cocopah Indian Housing and Development (CIHAD) in Arizona.
- Seeking cost-effective ways to rehabilitate multifamily building for energy efficiency.
- Contacted utility provider Arizona Public Service (APS)
- Multifamily Energy Efficiency Program: provides assessment and FREE products.

MEEP installed:

- Three hundred sixty CFLs
- Twenty-four kitchen aerators
- Thirty-six bathroom aerators
- Thirty-eight low flow showerheads

APS also offers incentives for solar thermal domestic hot water, and photovoltaic array installation. These are residential incentives and would require residents to take lead in implementing.

State Energy Efficiency Ranking

http://aceee.org/sector/state-policy/scorecard

DSIRE database shows:

- Corporate Tax Credit Industry Recruitment/Support
- Local Loan Program
- PACE Financing Personal Tax Credit
- Property Tax Incentive
- State Loan Program
- Utility Loan
- Utility Rebate Program
- Rules, Regulations, and Policies

Example Of New Mexico Electricity– Residential Efficiency Rebates

- State: New Mexico
- Incentive Type: Utility Rebate Program Eligible Efficiency Technologies: Refrigerators, Lighting, Central Air conditioners
- Applicable Sectors: Residential, Multi-Family Residential
- Amount:+Refrigerator/Freezer Recycling: $50/unit
  Compact Fluorescent Light Bulbs (CFLs): point-of-purchase discounts
  AC Cycling: $25 sign-up and $25/year
- Maximum Incentive: Refrigerator/Freezer Recycling: 2 units per household
- Equipment Requirements: Refrigerator/Freezer Recycling: must be 10 to 27 cubic feet in size and in working condition
- Web Site: http://www.pnm.com/rebates/rebates.htm

Example: continued

Summary: PNM offers incentives for residential customers to improve the efficiency of eligible homes. PNM will provide a $50 rebate for the proper recycling of old refrigerators or freezers. Customers who agree to cycle the operation of residential air conditioning systems are also eligible for a $25 check annually. Additionally, PNM sponsors discounts on standard and specialty CFLs at a variety of retailers. For a complete list of participating stores, as well as additional program details and requirements, visit the program web site.

Contact: Customer Service, PNM
Alvarado Square MS 1110
Albuquerque, NM 87158-0001
Phone: (888) 342-5766
Phone 2: (505) 241-2700
Web Site: http://www.pnm.com

Emma van Moorsel
PNM
Phone: (505) 241-4425
Phone 2: (888) 342-5766
Web site:
http://PNM.com/rebates

New Mexico and Net Metering

- Net metering is available to "Qualifying Facilities" or QFs with systems up to 80 megawatts.
- Applicable utilities include investor owned utilities and electric cooperatives.
- All utilities subject to New Mexico Public Regulation Commission (PRC) jurisdiction must offer net metering.

New Mexico State Energy Policy Profile

- NM Utility Policies
- NM Appliance Standards
- NM Building Codes
- NM Clean Distributed Generation
- NM Vehicle Policies
- NM Transport System Efficiency
- NM Lead by Example Initiatives
- NM Financial Incentives
- NM Climate Change Policies
- State Spending and Savings Tables

State Energy Office

- New Mexico Energy Conservation and Management Division
  - http://www.emnrd.state.nm.us/ECMD/
- Kenneth Hughes, Clean Energy Specialist
  - *Building Energy Efficiency (Schools/Local Gov)*
  - *Clean Energy Revenue Bond Program*
  - *Efficient Use of Energy - Utility Programs*
  - *Sustainable Building Tax Credit*
  - (505) 476-3320
  - ken.hughes@state.nm.us

Case Study 1: Cold Climate Energy Evaluation of Existing and Newly Constructed Units

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

ST. REGIS SUNRISE ACRES ELDER DEVELOPMENT

A Cold Climate Case Study of Energy Efficiency and Sustainable Developments

St. Regis Mohawk Tribe

- Location: St. Regis Mohawk Indian Reservation, Hogansburg, NY

A Case Study of Energy Evaluation and Recommendations for Affordable Housing

Sunrise Acres Elder Housing

- The Akwesasne Housing Authority manages the Sunrise Acres elderly housing development. The development was constructed in two phases.

Phase I and II Development

Tribal Philosophy

- Tribal and housing authority leadership believes: a quality home is the foundation of society and that provides a pathway to achieving a quality lifestyle.
- Sunrise Acres Phase Two illustrates the tribe and the housing authority's leadership role in the successful design and development of a sustainable neighborhood, Sunrise acres. Work completed in Phase One illustrates the tribe's commitment to updating an existing neighborhood to a green, sustainable neighborhood.

Phase One Site Description

- Built in 1998
- 6 apartment buildings with 20 units
- Administration building and warehouse
- Each unit is two bedrooms, 3,497 sq ft.
- Stick Built with 2 X 6 wood frame construction
- Kerosene is the primary heating source.

Building Envelope

- **Walls:** Each unit is separated by a 1-hour fire rated wall. The typical wall construction: 1/2" gypsum board over 2" x 6" wood frame, Tyvek over OSB, and exerior siding. Estimated thermal resistance rating (R-value) of R-20.
- **Roof:** The roof is hipped with an 3.5:12 slope. It is constructed with wood trusses, dark brown asphalt shingles, metal roof system. R38 insulation fiberglass Batt insulation above the ceiling.
- **Floor:** The ground floor is a 4" reinforced concrete slab on grade with 1" polystyrene rigid insulation under the slab. The main living areas of the apartments have carpet. The kitchen, bath, and laundry room have sheet vinyl.
- **Windows:** Andersen double pane glass with vinyl frame windows

HVAC

Heating

- The primary heating source for each apartment unit: radiant floor slab system powered by a cast-iron boiler in each building.
- Most of the boilers are a Weil McLain Gold Oil Model P-WTGO-3 with an Annual Fuel Utilization Efficiency (AFUE) of 85%
- Provides roughly 100,000 BTU.
- Fuel tank outside of each building connects to the cast-iron boiler
- Holds approximately 250 gallons of kerosene.
- Additional heating is supplied by space heaters.

HVAC

Cooling

- The primary cooling source: window air conditioning units.
- Each apartment has roughly one AC unit with an estimated cooling efficiency, or Energy Efficiency Ratio (EER) of 8.5
- Ceiling insulation: R-38

Ventilation

- Ventilation air: building infiltration and the residents opening windows.
- Each bathroom exhaust fan is estimated to be performing at 35-50 CFM.
- Building plans for Phase 1 Sunrise Acres shows bathroom exhaust fans and the dryer vents are located in the attic.

Domestic Hot Water

- Each apartment has a Reliance 40-gallon electric domestic water heater with model number 5-40-2DRT4-Z
- Each estimated to have 53-gallon first hour rating
- Uses approximately 4,773 kWh per year.

Lighting in Units

- Lighting: a 2'x4' florescent light in the kitchen and light fixtures throughout the apartment.
- Currently retrofitting the 60W incandescent lamps with CFLs and the T12s with T8s.
- Each of the Phase 1 apartments are the same size: it was assumed that each unit uses the lighting as in the Table.

Location	Fixture Type	Watts	Operating Hours	kWh Usage
2 Bedrooms	2-lamp 60W Inc.	240	1,460	350
Kitchen	2-lamp 34W 4' T12	72	2,190	158
Kitchen sink	2-lamp 20W 2' T12	50	730	37
Living room	3-lamp 60W Inc.	180	2,920	526
Bathroom	1-lamp 60W Inc.	60	365	22
Bathroom sink	2-lamp 60W Inc.	120	365	44
Laundry	1-lamp 60W Inc.	60	365	22
Hallway/ stair	1-lamp 60W Inc.	60	365	22
Exterior	1-lamp 60W Inc.	60	1,095	66
Total Watts per Unit		902	9,855	1,245
1,245 kWh * 16 cents = $199.20		$199.20 - $74.76 = $124.44 over Phase 2 costs		

Additional Plug Loads

- Additional plug loads in the building include typical residential appliances: TVs, washer/dryer, refrigerators, stoves, microwaves, and task lighting.
- AHA is currently replacing refrigerators, microwaves, and washers with ENERGY STAR appliances
- Project base model assumes no ENERGY STAR appliances.

Phase Two Site Description

- Built in 2011.
- Total project cost $7 million: $4 million in Recovery Act Funds and $3 million NAHASDA funds.
- Total of five one-story apartment buildings each approximately 4,050 ft^2 with an identical floor plan as the Phase 1 buildings
- Includes four apartments for a total of 20 units.
- The expansion project also included a training center, parking area, outdoor pavilion and outdoor LED lighting.

Building Envelope

- **Walls:** Each unit is separated by a 2-hour fire rated wall. The typical wall construction:5/8" gypsum board over a Buildblock 6" ICF wall system, over 1/2" OSB sheathing with exterior siding. Estimated thermal resistance rating (R-value) of R-20.
- **Roof:** The roof is hipped with an 8:12 slope. It is constructed with wood trusses, is covered in a standing seam metal roof system, and has 6" of blown in cellulose insulation over 6" R-21 fiberglass Batt insulation above the ceiling. Total R-value:46
- **Floor:** The ground floor is a 4" reinforced concrete slab on grade with 2" polystyrene rigid insulation under the slab. The main living areas of the apartments have carpet while the kitchen, bath, and laundry room have sheet vinyl.
- **Windows:** Architectural drawings show Andersen tilt-wash double hung 400 series windows with low-e glazing. Vertical blinds on all windows.

HVAC

Heating/Cooling

- The primary heating and cooling source: a radiant floor heating from the geothermal system.
- A total of 44 wells were dug: each apartment building has 7 wells, the training center has 9 wells.

Ventilation

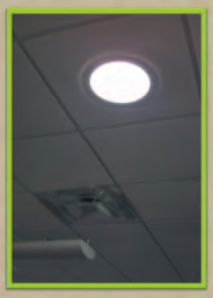
- Ventilation air: building infiltration and the residents opening windows.
- Each bathroom is also assumed to have an exhaust fan originally rated at 70 CFM.

Solar Domestic Hot Water

- Each apartment building is provided domestic hot water from a solar tube system
- System in mechanical room includes two tanks with a holding capacity of 80 gallons: one holding tank for the water heated by the solar system, and one electric hot water tank. Water from the solar holding tank goes into the electric tank.
- Provides a 50% savings compared to the Phase 1 buildings

Interior Lighting

- Natural lighting: windows and solar tube lighting in each apartment.
- Additional lighting: a 2'x4' florescent light in the kitchen and light fixtures with CFL bulbs throughout the apartment.
- Lighting assumption the same for each apartment (see table).

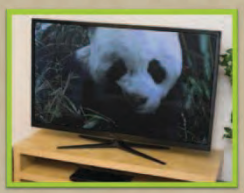


Interior Unit Lighting Consumption

Location	Fixture Type	Watts	Operating Hours	kWh Usage
Living room	(5) 1-lamp 13W CFL	65	1,460	95
Kitchen	2-4', 1-42", and 2-12" T8	130	2,190	285
Hallway	(2) 2-lamp 13W CFL	52	730	38
Laundry	1-2' T8 fixture	13	2,920	38
Bathroom	1-lamp & 3-lamp 13W CFL	52	365	19
3 Closets	1-lamp 34W 2' T8	34	365	12
Bedroom 1	2-lamp 13W CFL	26	365	9
Bedroom 2	2-lamp 13W CFL	26	365	9
2 Exterior	1-lamp 13W CFL	26	1,095	28
Total Watts per Unit		424	9,855	534
534 kWh * 14 cents = $74.76		$199.20 - $74.76 = $124.44 savings over Phase 1		

Additional Plug Loads

- Include typical residential appliances: TVs, washer/dryer, refrigerators, stoves, microwaves, and task lighting.
- All appliances installed were ENERGY STAR rated.



Energy Analysis and Evaluation

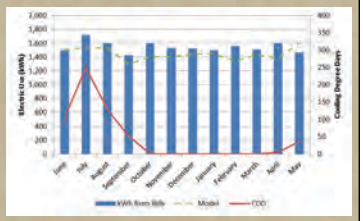
A comprehensive energy analysis was conducted on the two sites. The approach involved several steps.

- Initial information collected from AHA about each building's design, occupancy data, energy consumption, and energy costs. Included:
  - Building plans
  - Utility consumption data for the last 12 months
  - Geographical location and climate data
  - Details about unit occupancy, mechanical equipment, HVAC systems, and lighting fixtures from interviews with AHA staff and during a site visit

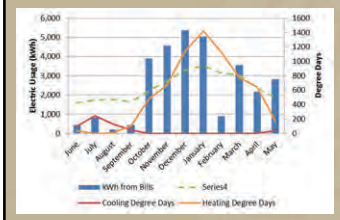
Electricity Consumption Profiles

Phase 1 units:

The kWh usage above the modeled usage in the winter months may be caused by the building being drafty and occupants using supplementary space heaters.



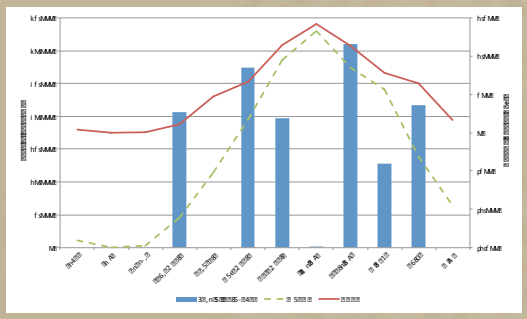
Electricity Consumption Profiles



Phase 2 units:

- Use more kWh than Phase 1 because geothermal systems are electric.
- Low use in February is due to a billing error.

Kerosene Consumption Profiles



Computer Energy Modeling: eQUEST Version 3.64

- Modeled data was calibrated to match the actual building energy usage from the utility bills.
- This baseline then used for evaluating the energy cost reduction measures (ECRMs).
- The program uses these measures to calculate the energy consumption and energy costs the building is expected to use over an entire typical weather year.

Assumptions For The eQUEST Model

- Because these units are for elders, it is estimated that the tenants will be in the units 80% of the time (approximately 134 hours/week).
- Winter temperature setting of 72 degrees (F); summer, 75 degrees (F).
- 0.5 air changes per hour (ACH).
- Base model assumes that the Phase 1 units had non-ENERGY STAR appliances.
- Lighting power density of approximately 0.90 W/ft^2 for each unit

Energy Analysis Findings: Phase 1 Buildings

Average Annual Consumption			Annual Costs		Average Unit Cost	
Electricity	18,520	kWh	$ 2,948	36%	$ 0.16	$/kWh
Kerosene	1,340	gallons delivered	$ 5,229	64%	$ 3.90	$/gal delivered
Total:			$ 8,176	x 4 buildings = $32,705 total		
Total Facilities Area	3,497	ft²				
Electricity Use Intensity	5	kWh/ft²/yr	Kerosene Use Intensity		0.38	Gallons/ft²/yr
Energy Use Intensity	70	kBtu/ft²/yr	Energy Cost Intensity		$ 2.34	ft²/yr

Electricity is provided by National Grid and kerosene is supplied by #9 Fuels

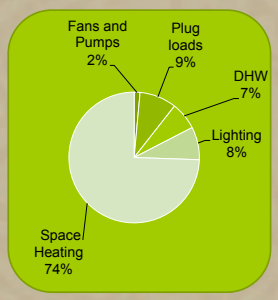
Energy Analysis Findings: Phase 2 Buildings

Average Annual Consumption			Annual Costs		Average Unit Cost	
Electricity	30,181	kWh	$ 4,110	100%	$ 0.14	$/kWh
Kerosene	0	gallons delivered	$ 0	0%	$ 0.00	$/gal delivered
Total:			$ 4,110	x 5 buildings = $20,552 total		
Total Facilities Area	4,050	ft²				
Electricity Use Intensity	7	kWh/ft²/yr	Kerosene Use Intensity		0	Gallons/ft²/yr
Energy Use Intensity	25	kBtu/ft²/yr	Energy Cost Intensity		$ 1.01	ft²/yr

Electricity is provided by National Grid and kerosene is supplied by #9 Fuels

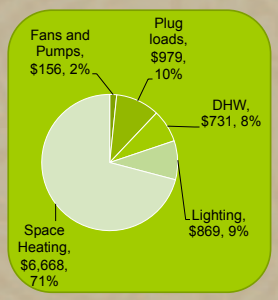
Energy Consumption for Phase 1 Buildings

- From eQUEST modeled energy data.
- Energy consumption breakdown for a typical 4-unit apartment building.
- The largest category of energy usage is space heating (74%), the second largest is plug loads (9%), and the third largest is lighting (8%).



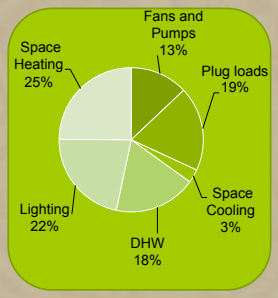
Energy Costs for Phase 1 Buildings

- When energy consumption is converted to cost, the most costly operational categories are:
  - space heating ($6,668)
  - plug loads ($979)
  - lighting ($869).
- Areas to target first for energy savings



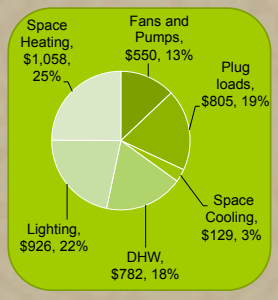
Energy Consumption for Phase 2 Buildings

- From eQUEST modeled energy data
- Energy consumption breakdown for a typical 4-unit apartment building.
- The largest category of energy usage is space heating (25%), the second largest is lighting (22%), and the third largest is plug loads (19%).



Energy Costs for Phase 2 Buildings

- The energy cost breakdown.
- When energy consumption is converted to cost, the most costly operational categories are:
  - space heating ($1,058)
  - lighting ($926)
  - plug loads ($805)
- First areas to target for energy savings.



Energy Cost Reduction Measures

Energy conservation is best achieved through a multifaceted approach that involves:

1. Load reduction, whether no cost or low cost
2. Energy efficiency improvements
3. Energy generation.

ECRM: Lighting Upgrade

Phase 1 Older Units: $199.20

	i p2 6lkM	i BM	hsBKM	kf M
	i p2 6lk	di	i sh9M	hf H
	i p2 6l M	f M	dkM	kd
	kp2 6lkM	hHM	i sKi M	f i K
	hp2 6lkM	KM	kkf	i i
	i p2 6lkM	hi M	kkf	BB
	hp2 6lkM	KM	kkf	i i
	hp2 6lkM	KM	kkf	i i
	hp2 6lkM	KM	hsMf	KK
		ors	**otiit t**	**ytiBt**
hs Bf	Dh99ti MpbDdBtdK			

Phase 2 New Units: $74.76

	bf rlhp2 6lhk	Kf	hsBKM	9f
	i pBslhpBi od	hkM	i sh9M	i Hf
	bi rll p2 6lhk	f i	dkM	kH
	hp 4l9A	hk	i sKi M	kH
	hp2 6lNlkp2 6lhk	f i	kKf	h9
	hp2 6lk	kB	kKf	hi
	i p2 6lhk	i K	kKf	9
	i p2 6lhk	i K	kKf	9
	hp2 6lhk	i K	hsMf	i H
		BsB	**otiit t**	**t kB**
f kBl	Dh99ti MpbDdBtdK			

Internal Rate of Return (IRR)

- The Annual Yield on an equivalent investment.
- Project is rated a good investment if the IRR is greater than could be earned through a different investment such as other projects, bonds, bank accounts.
- Currently 5% is the assumed rate of return.

Net Present Value (NPV)

- Uses a discount rate to the find the present value of savings occurring at a future date.
- The discount rate is the minimum acceptable rate of return – also 5% is the assumed rate of return.
- Investments with a positive NPV are considered good investments.

ECRM 1: Lighting Upgrade

- The electrical plans for Phase 1 indicated that there are a total of 68 lamps in the building.
- Lighting provided by a 2 lamp 4' 34W T12 florescent fixture and a 2 lamp 2' 20W T12 (over the sink) in the kitchen and from the ceiling fixtures in the living room and bedrooms.
- Baseline model assumes that each light fixture would have a 60W incandescent lamp providing a total average of 1.03 W/sq. ft. for the whole building.

ECRM 1: CFL Lighting						
Annual Energy Savings				Economic Analysis		
kWh	Gallons of Kerosene	Cost	% Energy	Investment	IRR	NPV
3,696	-30	$591	4%	$69	860%	$4,283

ECRM 2: ENERGY STAR Refrigerator Replacement

- The refrigerator currently in use in each of the four units of the building is a 1989 Westinghouse RT143GCDA
- Costs $206 annually to run
- An equivalent new ENERGY STAR model would only cost $39 annually to run.

ECRM 2: ENERGY STAR Refrigerator Replacement					
Annual Energy Savings			Economic Analysis		
kWh	Cost	% Energy	Investment	IRR	NPV
2,992	$479	4%	$1,600	27%	$1,997

Install Low-Flow Fixtures

- Research shows that access to fresh, clean water is also becoming a dwindling resource. Shortages in certain areas of the United States are already causing water to be the next leading concern.
- Reducing water consumption will save water **and** reduce energy to heat hot water.
- Low-flow showerheads and aerators are inexpensive, simple to install, and save hot water heating costs.
- Recommended: low flow showerheads (1.6 GPM or less), faucet aerators (1.0 GPM or less) and kitchen sink aerators (1.8 GPM or less). Some faucet aerators will reduce flow to 0.5 GPM.

ECRM 3: Low-Flow Showerheads

- The 4 units of each building have standard showerheads.
- Figuring $0.16 per kWh, in addition to the $195 saved on annual water heating costs (in table), it should also save $41 on water usage costs (at $3.70/1000 gallons) totaling $236 in savings.

ECRM 3: Low-Flow Showerheads						
Annual Energy Savings				Economic Analysis		
kWh	Gallons of Water	Cost	% Energy	Investment	IRR	NPV
1,219	10,950	$236	2%	$200	118%	$2,605

ECRM 4: Low-Flow Aerators

- All of the units' sinks have standard aerators.
- Switching to 8 low flow units will save approximately 697 kWh and 8,760 gallons of water annually.
- Figuring $0.16 per kWh, this will save $112 on annual water heating costs and $32 on water usage costs (at $3.70/1000 gallons) totaling $144 in savings.

ECRM 4: Low-Flow Aerators						
Annual Energy Savings				Economic Analysis		
kWh	Gallons of Water	Cost	% Energy	Investment	IRR	NPV
697	8,760	$144	1%	$160	90%	$1,556

ECRM 5: Water-Saver Toilets

- Toilets should be replaced with high efficiency units using ≤ 1.28 gallons per flush.
- Switching to 4 low flow units will save approximately 13,105 gallons of water annually.
- Figuring $3.70 per 1,000 gallons, this will save $48 on annual water usage costs.

ECRM 5: Water-Saver Toilets					
Annual Energy Savings			Economic Analysis		
Gallons of Water	Cost	% Energy	Investment	IRR	NPV
13,105	$48	<1%	$1,200	78%	$11,344

ECRM 6: Boiler Upgrade

- The current boiler system in each of the four units of the building is a Weil Mclain Gold Oil Model P-WTGO-3 with an AFUE of 85.
- An ENERGY STAR rated system with a 3.6 Coefficient of Performance (COP) may save 140 gallons of kerosene annually resulting in an annual cost savings of $547.
- The lifespan of boiler is calculated at 20 years. This upgrade will pay back within its lifespan (15 years), therefore implementation of this measure is recommended.

ECRM 6: Boiler Upgrade					
Annual Energy Savings			Economic Analysis		
Gallons of Kerosene	Cost	% Energy	Investment	IRR	NPV
140	$547	8%	$8,000	3%	-$1,128

Renewable Energy Sources

- May be use to either supplement or create complete energy independence.
- Three renewable energy sources were modeled and recommended:
  - Geothermal
  - Solar Thermal Domestic Hot Water
  - Photovoltaic Array

ECRM 7: Geothermal

- Replacing the current kerosene boiler system with a geothermal heat pump system with a 14.5 Seasonal Energy Efficiency Ratio (SEER) for cooling and a 3.6 COP for heating, may save 1.262 gallons of kerosene annually. Annual cost savings of $2,346.
- The lifespan of the geothermal system is calculated at 20 years. This upgrade will pay back in just under its lifespan (19 years); therefore, implementation of this measure is recommended.

ECRM 7: Geothermal Upgrade						
Annual Energy Savings				Economic Analysis		
kWh	Gallons of Kerosene	Cost	% Energy	Investment	IRR	NPV
-16,090	1,262	$2,346	50%	$45,000	0%	-$15,014
With 30% Tax Credit:				$31,500	4%	-$2,156

ECRM 8: Solar Thermal Domestic Hot Water

- Current use: around 4,600 kWh to heat water per year.
- Evacuated-tube solar collectors could offset most of the electricity used for heating hot water.
- Panels are available capable of producing 14,700 Btus/day in the Northern New York region. The panel size is around 41ft² (varies by manufacturer) and the building would need two to produce all of the building's hot water needs.
- Panel first cost estimated at nearly $2,000.
- The economics of this are favorable with a 4-year payback before incentives. If the 30% federal tax credit is taken advantage of, the cost would be reduced to $1,400 and would pay back in 3 years.

ECRM 8: Solar Thermal DHW Upgrade					
Annual Energy Savings			Economic Analysis		
kWh	Cost	% Energy	Investment	IRR	NPV
3,214	$514	5%	$2,000	25%	$4,199
With 30% Tax Credit:			$1,400	37%	$4,770

ECRM 9: Photovoltaic Array

- The purpose of a photovoltaic array is to reduce the use of traditional energy sources and create renewable energy.
- Captures solar energy and converts it to electricity for home use. This cuts down on the amount of energy that must be purchased from the utility company.
- The PV Watts calculator indicated that a 5.0 kW array in the Massena, NY, area will produce 5,814 kWh annually.
- The investment cost is calculated with the $9,000 federal/state tax credit. This array would pay back within the photovoltaic 25 year lifespan (23 years). Therefore, the measure is recommended for implementation.

ECRM 9: Photovoltaic Array					
Annual Energy Savings			Economic Analysis		
kWh	Cost	% Energy	Investment	IRR	NPV
5,814	$930	9%	$30,000	-2%	-$16,085
With 30% Tax Credit:			$21,000	1%	-$7,514

ECRM Recommendation Summary

ECRM		Savings					Economic Analysis			
		kWh	Gallons of Kerosene	Gallons of Water	Cost	% Energy	Investment	IRR	NPV	SP
ECRM 1	CFL upgrades	3,696			$591	5%	$69	860%	$4,283	0
ECRM 2	ENERGY STAR Refrigerators	2,992			$479	4%	$1,600	27%	$1,997	3
ECRM 3	Low-Flow Showerheads	1,219		10,950	$236	2%	$200	118%	$2,605	1
ECRM 4	Low-Flow Aerators	697		8,760	$144	1%	$160	90%	$1,556	1
ECRM 5	Low-Flow Toilets			13,105	$48	<1%	$1,200	78%	$11,344	25
ECRM 6	Boiler Upgrade		140		$547	8%	$8,000	3%	-$1,128	15
ECRM 7	Geothermal	-16,090	1,262		$2,346	50%	$45,000	0%	-$15,014	19
	With Incentives						$31,500	4%	-$2,156	13
ECRM 8	Solar Thermal DHW	3,214			$514	5%	$2,000	25%	$4,199	4
	With Incentives						$1,400	37%	$4,770	3
ECRM 9	Photovoltaic Array	5,814			$930	9%	$30,000	-2%	-$16,085	32
	With Incentives						$21,000	1%	-$7,514	23
Package 1	All Recommend ECRMs - Boiler Upgrade	17,632	140		$3,489	34%	$43,229	5%	$245	12
	With Incentives						$22,400	15%	$20,082	6
Package 2	All Recommend ECRMs - Geothermal	1,542	1,262		$5,288	77%	$80,229	3%	-$13,640	15
	With Incentives						$53,900	8%	$11,435	10

Note

- With any ECRM, be sure to do your research.
  - How much will it cost you?
  - How much energy do you need?
  - What is the lifespan of the unit or building in question?
  - Especially when considering the renewable energy ECRMs, seek expert advice to ensure that you know all of the considerations, pitfalls, and available incentives!

Getting the Most Out of ECRMs

- Follow maintenance instructions to keep equipment functioning at its peak.
- Ensure that your housing staff is educated in maintenance of new systems.
- Bring in experts to maintain systems or train your staff.
- Provide residents with education on how use or care for equipment, what to expect, and how to get assistance.

Case Study 2: Warm Climate Energy Efficiency Upgrades in Existing Multifamily Building

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

COCOPAH EXISTING MULTIFAMILY BUILDING

A Warm Climate Case Study of Energy Efficiency and Sustainable Developments

Cocopah Tribe

- The Cocopah Reservation is located in southwestern Arizona, near the town of Somerton, 13 miles south of Yuma.

A Case Study of Energy Evaluation and Recommendations for Affordable Housing

Cocopah Site Image

- Cocopah Indian Housing and Development (CIHAD) manages the units.
- The three eight-unit garden-style buildings and a community building were constructed in 2003
- Building B was evaluated.

Tribal Philosophy

- The Cocopah Indian Tribe's commitment to providing its members with safe, affordable, healthy and energy efficient housing encourages members living on the Reservation to remain and encourages members now living off-Reservation to return.
- As part of this vision, the CIHAD decided to explore options to retrofit this development with more energy efficient sustainable features.

Traditional Cocopah Home

Site Description

- Constructed in 2003
- Three apartment buildings with 24 units, and community building
- Each building has four two-bedroom (855 SF each) and four three-bedroom (1,107 SF each) units totaling 8,532 SF.
- Stick Built with 2 X 6 wood frame construction
- The buildings are all electric.

Building Envelope

- **Walls:** The typical wall construction is 5/8" gypsum board, 2x6 wood stud construction at 16" on center with R-19 fiberglass batt insulation, 60 MIL building paper, and 7/16" oriented strand board sheathing with stucco and mesh. Estimated thermal resistance rating (R-value) of R-22.
- **Roof:** The roof is gabled with a 4:12 slope. It is constructed with 2x6 pre-engineered wood trusses at 24" on center, covered in 7/16" oriented strand board, #15 felt, and 240# fiberglass shingles. There is R-32 blown insulation above the ceiling.
- **Floor:** The main floor is a 5" reinforced concrete slab on 2" of clean sand. The second floor is 2x10 wood floor joists at 16" on center with ¾" gypsum concrete subfloor and ¾" tongue and groove CDX plywood. The bedrooms, hall, dining room, and living room are carpeted. The kitchen, storage, and bathrooms are vinyl composite tile.
- **Windows:** clear double pane glazing

HVAC

Heating/Cooling

- Amana split system heat pumps that are 3 to 3.5 ton (1000 to 1200 cubic feet per minute or CFM) depending on unit size.
- Ambient temperature 115 °F cooling, 40 °F heating, and minimum SEER of 12.0.

Ventilation

- Ventilation air is provided by infiltration and operable windows.
- Each bathroom also has an exhaust fan rated at 100 CFM.

Domestic Hot Water

- The units have 40 gallon electric water heaters (Whirlpool E1F40RD045V)
- Energy factor (EF) of 0.92.

Lighting in Units

- Lighting: incandescent light fixtures throughout each unit.
- Assumption of 60 watt incandescent lamps

Location	Fixture Type	Watts	Operating Hours	kWh Usage
(4) 2 Bedrooms	2-lamp 60W	960	365	350
(4) 3 Bedrooms	2-lamp 60W	1,440	365	526
(8) Kitchen	1-lamp 60W	480	365	175
(8) Living room	1-lamp 60W	480	365	175
(4) 1 Bathroom	3-lamp 60W	720	730	526
(4) 2 Bathrooms	3-lamp 60W	1,440	730	1,051
(8) Hall	1-lamp 60W	480	2,190	1,051
Totals per Building:		6,000	5,110	3,854

3,854 kWh * 13 cents = $501.02

Additional Plug Loads

- Additional plug loads in the building include typical residential appliances: TVs, refrigerators, stoves, microwaves, and task lighting.

Energy Analysis and Evaluation

A comprehensive energy analysis was conducted on Building B. The approach involved several steps.

- Initial information was collected from the tribal housing authority about each building's design, occupancy data, energy consumption, and energy costs. This included the following:
  - Building plans
  - Utility consumption data for the last 12 months
  - Geographical location and climate data
  - Details about unit occupancy, mechanical equipment, HVAC systems, and lighting fixtures from interviews with Tribal Housing Authority staff and during a site visit

Computer Energy Modeling: eQUEST Version 3.64

- Modeled data was calibrated to match the actual building energy usage from the utility bills.
- This baseline was then used for evaluating the energy cost reduction measures (ECRMs).
- The program uses these measures to calculate the energy consumption and energy costs the building is expected to use over an entire typical weather year.

Assumptions of the eQUEST Model

- It is assumed that 40 people will be living in each building (two people per bedroom). While occupancy is highly dependent on the individual lifestyles of the families, it is assumed that half of the household will spend most of their time at home. Therefore it is assumed that the families will primarily be in the units 75 percent of the time (approximately 126 hours/week).
- Air changes per hour (ACH) of 0.5.
- Non-ENERGY STAR appliances.
- Lighting power density of approximately 0.76 W/ft^2 for the building.

Energy Analysis Findings: Building B (before CFL upgrade)

	Average Annual Consumption			Annual Costs		Average Unit Cost	
Electricity	70,509	kWh		$9,295	100%	0.13	$/kWh
Natural Gas		therms					$/therm
			Total:	$9,295			
Total Conditioned Area	5,574	ft^2					
Electricity Use Intensity	13	kWh/ft^2/yr	Natural Gas Use Intensity				Therms/ft^2/yr
Energy Use Intensity	43	kBtu/ft^2/yr	Energy Cost Intensity			$1.67	$/ft^2/yr

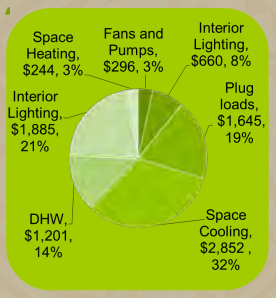
Electricity is provided by APS Electric

Energy Analysis Findings: Building B (after CFL upgrade)

	Average Annual Consumption			Annual Costs		Average Unit Cost	
Electricity	67,604	kWh		$8,789	100%	0.13	$/kWh
Natural Gas		therms					$/therm
			Total:	$8,789			
Total Conditioned Area	5,574	ft^2					
Electricity Use Intensity	12	kWh/ft^2/yr	Natural Gas Use Intensity				Therms/ft^2/yr
Energy Use Intensity	41	kBtu/ft^2/yr	Energy Cost Intensity			$1.58	$/ft^2/yr

Energy Consumption and Cost for Building B

- Uses eQUEST modeled energy data to create energy consumption profile for Building B.
- The largest category of energy usage is space cooling (32%), the second largest is interior lighting (21%), and the third largest is plug loads (19%).
- Areas to target for energy savings.



Energy Cost Reduction Measures

Energy conservation is best achieved through a multifaceted approach that involves:

1. Load reduction, whether no cost or low cost
2. Energy efficiency improvements
3. Energy generation.

ECRM: Lighting Upgrade

Building B with incandescent lamps: $501.02

Location	Fixture Type	Watts	Operating Hours	kWh Usage
(4) 2 Bedrooms	2-lamp 60W	960	365	350
(4) 3 Bedrooms	2-lamp 60W	1,440	365	526
(8) Kitchen	1-lamp 60W	480	365	175
(8) Living room	1-lamp 60W	480	365	175
(4) 1 Bathroom	3-lamp 60W	720	730	526
(4) 2 Bathrooms	3-lamp 60W	1,440	730	1,051
(8) Hall	1-lamp 60W	480	2,190	1,051
Totals per Building:		6,000	5,110	3,854

Building B with CFLs: $123.37

Location	Fixture Type	Watts	Operating Hours	kWh Usage
(4) 2 Bedrooms	2-lamp 13W	224	365	82
(4) 3 Bedrooms	2-lamp 13W	336	365	123
(8) Kitchen	1-lamp 13W	120	365	44
(8) Living room	1-lamp 13W	120	365	44
(4) 1 Bathroom	3-lamp 13W	180	730	131
(4) 2 Bathrooms	3-lamp 13W	360	730	263
(8) Hall	1-lamp 13W	120	2,190	263
Totals per Building:		1,460	5,110	949

949 kWh * 13 cents = $123.37

$377.65 savings over 60W incandescent

ECRM 1: Lighting Upgrade

- Lighting is currently provided by incandescent light fixtures.
- A 60W incandescent lamp in each fixture calculates to a lighting power density of 0.76 W/ft^2.
- 13W CFLs may save 2,171 kWh annually. Cost savings of $282.
- The lifespan of lighting: 5 years. The replacement of the incandescent lamps with CFLs will pay back in just over a year.

ECRM 1: CFL Lighting Upgrade						
Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
2,171	$282	3%	$395	66%	$788	1.40

ECRM 2: ENERGY STAR Refrigerator Replacement

- The refrigerator currently in use is a 1995 GE CTX18CAX.
- Costs $112 annually to run.
- An equivalent new ENERGY STAR model would only cost $51 annually to run.

ECRM 2: Refrigerator Upgrade						
Annual Energy Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
3,754	$488	6%	$3,200	9%	$541	6.56

Window Shades

- Adding shading devices to the exterior on the south of the building can best prevent sun from heating a space.
- Interior window shades help, but allow the heat to enter through the window.
- Exterior shades prevent some of the solar radiation from reaching the window and therefore entering the building.

Window Shades

The windows on the south side of the building currently have no exterior shading device other than the 2' overhang for the windows on the second floor.

ECRM 3: Exterior Window Shade Upgrade

- Option 1: Adding 4' louvered shades above the windows on the south side of the building may save 1,860 kWh annually. Annual cost savings: $242.
- Option 2: If 8' decks were added for the second floor that shaded the 1st floor windows, 2,240 kWh could be saved annually. Annual cost savings: $291.
- The lifespan of the shading: 20 years. The additional 4' shading will pay back in far less time than the 6' decks.

ECRM 3: Exterior Window Shade Upgrade							
	Annual Savings			Economic Analysis			
Options	kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
4' Window Shades	1,860	$242	3%	$2,000	10%	$965	8.27
Decks/Window Shades	2,240	$291	3%	$6,000	0%	-$2,258	20.60

ECRM 4: Triple Pane Low-E Window Upgrade

- The current windows of the building are typical double pane windows with clear glazing.
- New triple pane window that have low emissivity may save 2,100 kWh annually. Annual cost savings: $273.
- The lifespan of windows: 20 years. The window replacement with triple pane windows will pay back in just over the 20 year lifespan.

ECRM 4: Triple Pane Low-E Window Upgrade						
Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
2,100	$273	3%	$6,000	-1%	-$2,474	21.98

ECRM 5: HVAC Upgrade

- The current HVAC system: a split system single zone with an air source heat pump. It has a cooling efficiency of 12 SEER, and a heating efficiency of 3 coefficient of performance (COP).
- An ENERGY STAR rated system with a 14.5 SEER and a 3.6 COP, may save 4,720 kWh annually. Annual cost savings of $614.
- The lifespan of HVAC is calculated at 20 years.

ECRM 5: HVAC Upgrade						
Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
4,720	$614	7%	$16,000	-2%	-$7,955	26.08

ECRM 6: Radiant Barrier Upgrade

- The existing attic insulation is blown-in R-32.
- By adding a radiant barrier with additional attic insulation of R-11 (a combined total of R-43), heating and cooling losses may be minimized.
- The calculations below use $1.20/ sq. ft. for insulation and labor. If this cost could be reduced to under $0.40/sq. ft. the additional insulation would pay for itself within its 25-year lifespan.

ECRM 6: Radiant Barrier Upgrade						
Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
450	$59	1%	$4,608	-7%	-$3,603	78.77

Renewable Energy Sources

- Renewable energy sources may be use to either supplement or create complete energy independence.
- Three renewable energy sources were modeled:
  - Solar Thermal Domestic Hot Water
  - Photovoltaic Array
  - Geothermal

ECRM 7: Solar Thermal Domestic Hot Water

- Building B currently uses around 9,200 kWh to heat water per year.
- Evacuated-tube solar collectors could offset most of the electricity used for heating hot water. Panels are available capable of producing 28,000 British thermal units (BTUs)/ day in the southern Arizona region. The panel size is around 55ft² (varies by manufacturer).
- The building needs two panels to meet hot water needs. The panels would have a first cost of nearly $3,000. The economics of this are favorable with a 4-year payback before incentives.
- If the 30 percent federal tax credit and the $0.50/kWh saved APS incentive (up to half of the project cost) can be used, the cost would be reduced to $600 and would pay back in less than a year.

ECRM 7: Solar Thermal

Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
6,465	$840	10%	$3,000	28%	$8,424	3.57
With tax credit and incentive:			$600	140%	$10,710	0.71

ECRM 8: Photovoltaic Array

A photovoltaic array (PVs) can reduce the use of traditional energy sources. This system captures solar energy and converts it to electricity for use in the home. It cuts down on the amount of energy that must be purchased from the utility company.

PV Watts calculator analysis indicates that a 4.0 kW array in the Somerton, AZ, area will produce 6,221 kWh annually.

The investment cost is calculated with the $8,400 federal/state tax credit and the $800 state utility rebate. With the tax credit, the calculator shows that this array would pay back within the photovoltaic 25-year lifespan.

ECRM 8: Photovoltaic Array Upgrade

Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
6,221	$809	9%	$17,800	1%	-$6,097	22.01

ECRM 9: Geothermal

- The purpose of a geothermal system is to reduce the use of traditional energy sources. This system uses the temperature of the earth to heat and cool buildings.
- There is a federal tax credit (30 percent of measure cost) available for implementing a geothermal system.
- The e-Quest model indicates that this measure should not be implemented as the measure will not pay off in its lifetime (20 years).

ECRM 9: Geothermal System Upgrade

Annual Savings			Economic Analysis			
kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
-940	-$122	-1%	$48,000		-$47,165	-392.8
with 30% Federal Tax Credit:			$33,600		-$33,478	-269.8

ECRM Recommendation Summary

Energy Cost Reduction Measure (ECRM)	Number of ECRMs	Annual Energy Savings			Economic Analysis			
		kWh	Cost	% Energy	Investment	IRR	NPV	Simple Payback (years)
CFLs	79	2,171	$282	3%	$395	66%	$788	1.40
Refrigerators	8	3,754	$488	6%	$3,200	9%	$541	6.56
Window Shades	20	1,860	$242	3%	$2,000	10%	$965	8.27
Window Shades 2	4	2,240	$291	3%	$6,000	0%	-$2,258	20.60
Triple low-e windows	20	2,100	$273	3%	$6,000	-1%	-$2,474	21.98
HVAC Upgrade	8	4,720	$614	7%	$16,000	-2%	-$7,955	26.08
Radiant Barrier	3,840 ft²	450	$59	1%	$4,608	-7%	-$3,603	78.77
Solar Thermal	2	6,465	$840	10%	$600	140%	$10,710	0.71
Photovoltaic Array	4 KW	6,221	$809	9%	$17,800	1%	-$6,097	22.01
Geothermal	32 wells	-940	-$122	-1%	$48,000	0%	-$47,165	-392.80
All Recommend ECRMs		20,471	$2,661	30%	$23,995	9%	$8,733	9.02

Package of Recommended ECRMs

- The purpose of this package is to combine the ECRMs recommended for implementation, and calculate the combined energy savings for these measures. This package includes CFL, refrigerator, and exterior window shades. It also includes the renewable energy sources: photovoltaic array and solar thermal. When analyzed in the e-Quest model, the package of ECRMs will pay off well within the lifetime of the photovoltaic array and solar thermal (25 years).
- After implementing the ECRM package, the utility consumption analysis would be estimated as:

Utility Consumption Analysis of Building B after Upgrade						
Average Annual Consumption			Annual Costs		Average Unit Cost	
Electricity	50,038	kWh	$6,505	100%	0.13	$/kWh
Natural Gas		therms				$/therm
		Total:	$6,505			
Total Conditioned Area	5,574	ft²				
Electricity Use Intensity	9	kWh/ft²/yr	Natural Gas Use Intensity			Therms/ft²/yr
Energy Use Intensity	31	kBtu/ft²/yr	Energy Cost Intensity		$1.17	$/ft²/yr

Leveraging ECRMs with Utility Resources

Local utility companies may offer energy efficiency incentives and on-site energy assessments of buildings to eligible customers. The Database of State Incentives for Renewables & Efficiency: http://www.dsireusa.org/ provides a summary of available and eligible state and utility resources.

- APS provides a Multifamily Energy Efficiency Program (MEEP). The program provides a free on-site energy assessment to identify areas of upgrade for energy savings, free energy cost reduction measures (ECRMs), and technical and field support to assist with installation to eligible building owners. In May 2012, the Tribe requested an on-site energy assessment of Building B to determine eligible ECRMs. In June, MEEP installed, at no cost the following ECRMs:
- **24 Kitchen Faucet Aerators and 36 Bathroom Faucet Aerators**
- **38 Low-Flow Showerheads**
- **360 Compact Fluorescent Lamps**
- Incentives are offered for solar thermal domestic hot water, and photovoltaic array installation.

Energy Cost Reduction Measures and Benchmarking in Existing (with exercise in energy use)

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

ENERGY COST REDUCTION MEASURES IN EXISTING HOMES AND BENCHMARKING

Energy Cost Reduction Measures (ECRMS)

There are three types of ECRMs.

- Load reductions
- Energy efficiency improvements
- Renewable energy improvements

Load Reduction

- First step
- Low- or no-cost strategies
- Turn it off!
- Resident education
- Example: thermostat set-backs, turning off lights

Energy Efficiency Improvements

- Includes some cost
- Replacing old or failing systems with newer or more effective systems that will save in utility costs and usage
- May result in load reduction as well
- Examples include: replacing refrigerators, heating systems, lighting fixtures

Renewable Energy Improvements

- Most expensive strategy
- Offsets some of remaining energy consumption with energy generation
- Step toward energy independence, but requires careful planning
- Done after the first two strategies
- Examples include geothermal systems, solar domestic hot water, photovoltaic arrays

Renewable Energy Improvements

- Part of long-term tribal community energy strategy
- Consider after other ECRMs
- Seek expert advice
- Carefully research incentives

Primary Barriers to ECRM

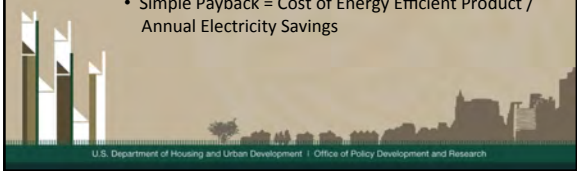
Lack of information on:

- Reliability
- Costs
- Savings and paybacks

Tools for Determining Useful ECRMs

Simple Payback

- Determines when the savings from an investment will cover the (extra) cost of the investment.
- Simple payback does not consider compounded savings, discount rates, or inflation rates –which play a role in calculating the precise payback over many years or decades.
- Simple Payback = Cost of Energy Efficient Product / Annual Electricity Savings



Internal Rate of Return (IRR)

- The Annual Yield on an equivalent investment.
- Project is rated a good investment if the IRR is greater than could be earned through a different investment such as other projects, bonds, bank accounts.
- Currently 5% is the assumed rate of return.

Net Present Value (NPV)

- Uses a discount rate to the find the present value of savings occurring at a future date.
- The discount rate is the minimum acceptable rate of return –also 5% is the assumed rate of return.
- Investments with a positive NPV are considered good investments.

Energy Use Intensity (EUI)

- A unit of measurement that describes a building's energy use. The calculation is: total energy consumed for 12 months/total flour space of the building.

Example of EUI per kBtu/sq ft

Energy Costs	Sq FT	EUI	K-12 School
$7,500,000	50,000	150	169
$ 9,000,000	50,000	180	169

Cold Climate – Conventional Built

Ranch: Built 1987 1,176 sqft
Basement Windows: SG with storms
Wood frame construction

Roof: R33
Sidewalls: R11
Basement Walls: R10
Window U-value: 0.65
Air Leakage: 11.48 ACH50
Furnace: 80% AFUE (propane)
Water Heater: 56% EF (propane)
Refrigerator: 1100 kWh/yr
Lighting: Incandescent
Dishwasher: Old

HERS Index: 114

Cold Climate – Energy Efficient

Ranch: Built 1987 1,176 sqft
Basement Windows: SG with storms
Wood frame construction

Roof: R43
Sidewalls: R11
Basement Walls: R10
Window U-value: 0.65
Air Leakage: 7.01 ACH50
Furnace: 92% AFUE (propane)
Water Heater: 62% EF (propane)
Refrigerator: 420 kWh/yr
Lighting: 50% CFLs
Dishwasher: *Energy Star*
HERS Index: 87
Annual Savings: $613

Find Out More?

- Hire an expert.
- Find simple payback calculation worksheet at the Department of the Interior
  - http://www.doi.gov/greening/energy/efficiency.cfm
- Federal Energy Management Program's Energy and Cost Savings Calculators for Energy-Efficient Products
  - http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html
  - These are for government agencies and may calculate based on bulk purchases. Some are web applications and some are downloadable Excel files.

Summary: Put Your Home on Energy Diet

- Mix and match choices with energy saving habits and technology
- Conduct a Power$mart assessment of your home at:
  - Energy Star Home Energy Yardstick
  - https://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted
  - Home Energy Saver
  - http://homeenergysaver.lbl.gov/consumer/

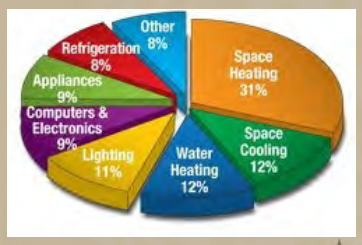
Understanding Utility Data, Developing Baselines and Benchmarking

Home Energy Fundamentals

- How much do you spend on heating each year?
- How much do you spend on electricity each year?
- What is your total annual utility cost?

Reminder: Energy use within the Home

The annual energy bill for a typical single family home is approximately $2,200



What Does Data Tell TDHE?

How to Collect Benchmarking Data

St. Regis example

- TDHE pays bills.
- Collect bills for each unit for 12 months

Cocopah example

- Occupants pay bills.
- Each occupant signed form from utility and utility sent 12-months of data to CIHAD.
- Data identified unit but not name.

Annual Electricity Use By Apartment

	Phase 1						Phase 2				
Bldg #	Unit #	# of Occupants	Kerosene Use (Gallons)	Electricity Use (kWh)	Total Use in kBtu	Bldg #	Unit #	# of Occupants	Electricity Use (kWh)	Total Use in kBtu
	1	1		2,924			21	1	9,431	
	2	1		2,136			22	1	9,431	
	3	1		4,049			23	1	9,431	
1	4	1	1419	4,560	238,224	9	24	1	9,431	128,714
	5	1		3,049			25	1	8,770	
2	6	1	1150	4,216	179,977		26	1	8,770	
	7	1		4,001			27	1	8,770	
	8	1		6,798		10	28	1	8,770	119,693
	9	2		4,098			29	1	8,870	
3	10	1	1213	6,872	238,024		30	1	8,870	
	15	1		7,116			31	1	8,870	
	16	1		4,291		11	32	1	8,870	121,058
	17	1		3,520			33	1	8,510	
5	18	1	1226	3,227	227,391		34	1	8,510	
	19	2		3,289			35	1	8,510	
6	20	1	945	2,175	146,272	12	36	1	8,510	116,144
	11	1		5,498			37	1	10,555	
	12	1		3,853			38	1	10,555	
	13	1		6,776			39	1	10,555	
7	14	1	1501	4,362	272,584	13	40	1	10,555	144,058

Building 1: Phase 1

Utility	Cost	Annual Cost	YR 1: 10% Savings	YR 2: 20% Savings	Total Savings
Kerosene	$ 3.90	$1,419/4 = $354.75 per unit average	$141.90/4 = $35.48 per unit	$283.80/4 = $70.95 per unit	$425.70/4 = $106.43 per unit
Electric	.16 cents	$2,187/4 = $546.76 per unit average	$218.70/4 = $54.68 per unit	$437.40/4 = $109.35 per unit	$656.10/4 = $164.03 per unit
Total:		$3,606/4 = $901.50 per unit average	$360.60/4 = $90.15 per unit	$721.20/4 = $180.30 per unit	$1,081.80/4 = $270.45 per unit

Benchmarking Energy

kBtu/sq ft/yr	Ranking
$ 1/sq ft per year	good
$1 to $2/ sq ft per year	fair to slightly poor (typical)
$ 2 to $ 3/ sq ft per year	probably room for improvement
$ 3/ sq ft per year and above	Leaky dog

Benchmarking example

	Average Annual Consumption		Annual Costs		Average Unit Cost	
Electricity	18,520	kWh	$ 2,948	36%	$ 0.16	$/kWh
Kerosene	1,340	gallons delivered	$ 5,229	64%	$ 3.90	$/gal delivered
		Total:	$ 8,176		x 4 buildings = $32,705 total	
Total Facilities Area	3,497	ft²				
Electricity Use Intensity	5	kWh/ft²/yr	Kerosene Use Intenstiy		0.38	Gallons/ft²/yr
Energy Use Intensity	70	kBtu/ft²/yr	Energy Cost Intensity		$ 2.34	ft²/yr

Electricity is provided by National Grid and kerosene is supplied by #9 Fuels

Btu/ft Energy Use Intensity

	Average Annual Consumption		Annual Costs		Average Unit Cost	
Electricity	18,520	kWh	$ 2,948	36%	$ 0.16	$/kWh
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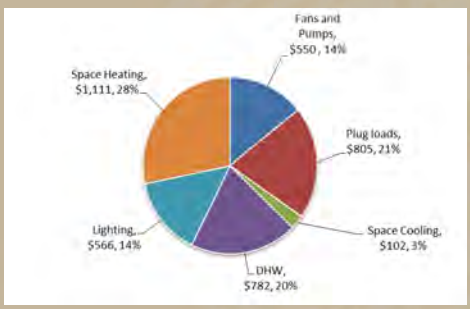
Energy Use Intensity	70	kBtu/ft²/yr	Energy Cost Intensity		$ 2.34	ft²/yr

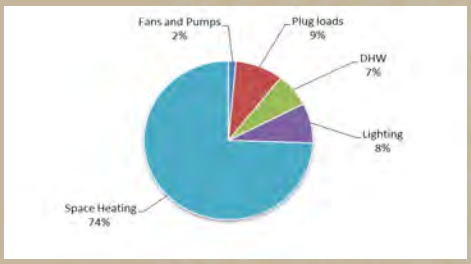
Electricity is provided by National Grid and kerosene is supplied by #9 Fuels

	Average Annual Consumption		Annual Costs		Average Unit Cost	
Electricity	30,181	kWh	$ 4,110	100%	$ 0.14	$/kWh
Kerosene	0	gallons delivered	$ 0	0%	$ 0.00	$/gal delivered
		Total:	$ 4,110		x 5 buildings = $20,552 total	
Total Facilities Area	4,050	ft²				
Electricity Use Intensity	7	kWh/ft²/yr	Kerosene Use Intensity		0	Gallons/ft²/yr
Energy Use Intensity	25	kBtu/ft²/yr	Energy Cost Intensity		$ 1.01	ft²/yr

Breakdown Of Estimated Average Annual Energy Consumption In Green Sustainable Unit: Cold Climate



Breakdown Of Estimated Average Annual Energy Consumption In 1937 Act Unit: Cold Climate



Exercise 1: online benchmarking

- **Walk through the Energy Star Home Energy Yardstick**
- **What you need to know to get started:**
  - **Your energy use and costs for the last year:** You'll need your last 12 months of utility bills OR a 12-month summary statement from your utility company.
  - **Energy sources for your home:** natural gas, electricity, fuel oil, propane, coal, wood and/ or kerosene?
  - **The square footage of your home.**

Exercise 1a: Online Home Energy Calculation

- Walk through Home Energy Saver, quick input

SCinIC
Demonstration Projects

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

SCinIC Demonstration Projects and Their Sustainable Technologies

Eight Demonstration Projects

- At different stages of completion
- Some in planning stage, some under construction, some completed.
- Covers different ONAP regions and also different climates
- Some differentiation in housing type
- Variety of sustainable technologies

Mississippi Band of Choctaw Indians

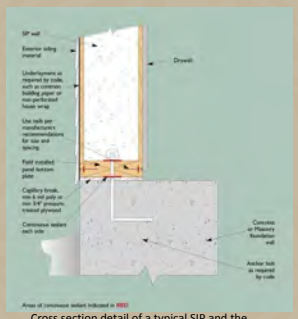
- Climate: warm temperate humid with hot summers.
- Has completed 86 single family and duplex units in the last 2 years using structural insulated panels (SIPs) for envelope including roof.
- Also Energy Star certified.
- Currently constructing 13 more units.
- Exploring issues of site planning to control erosion, maintain wetlands and habitat.

SIPs Features

- Typically foam or straw insulation between oriented stand board (OSB).
- Increased efficiency over standard framing techniques.
- Reduced air infiltration and heat loss.
- Saves energy, reduces wood use, increases comfort.

Source: Daniel D. Chiras, *The New Ecological Home*

- High wind resistance
- Life-cycle analysis reports available at Structural Insulated Panel Association (http://www.sips.org/green-building/life-cycle-analysis/)



Cross section detail of a typical SIP and the wall to foundation connection. (***Source: www.sips.org***)

Native Village of Kwinhagak

Design 1: Quinhagak Prototype, "octagon house"

http://www.cchrc.org/quinhagak-prototype-home

Design 2: Adapted Crooked Creek Prototype, "rectangle" house"

http://cchrc.org/crooked-creek-prototype-home

Climate: wet, snowy (43 in a year) with cool summers. Precipitation averages 22 inches a year.

Shared features

- Steel walls set off with plastic bracing and filled with soy- based spray foam insulation- prevents heat conduction. R-40
- Venmar air exchanger
- Lightweight materials for transportation ease.
- Steel frame foundation filled with foam and thermally isolated from the ground.
- Triple glazed windows, low-e, argon gas.

Octagon features

- Traditional arctic entry
- Rounded shape echoes tradition and prevent drifting
- Used 160 gallons of heating oil compared with norm of 600-800.

Rectangle features

- Integrated truss includes floor, walls, and roof.
- Frame erected in 1 day

Navajo Housing Authority

- In the process of building 153 new reside ntial units. A number of these will be built using Navajo Flexcrete.
- They may conduct a pilot program testing ductless electricity-based heat pumps due to high cost of using propane.
- Additionally, we are working with NHA as they start a master planning process and assisting with development to green standards to guide their design and construction in the future.

Climate: hot summers and cold winters, lots of sun, drought conditions due to lower winter precipitation last 11 of 15 years.

Ductless Mini-Split Electric Heat Pumps

- Heating and cooling.
- Uses refrigeration technology.
- Very efficient.
- Easy to retrofit.
- http://energy.gov/ energysaver/articles/ ductless-mini -split-heat- pumps

Navajo Flexcrete Blocks

- Solid fiber reinforced aerated concrete
- Reduces construction time and work site waste.
- Good insulation and heat storage.
- Fire, pest, and mold/ mildew resistant.
- Largely made of recycled material (fly ash)
- http:// www.navajoflexcrete.biz/

Housing Authority of the Pawnee Tribe of Oklahoma

- Climate: warm, humid with hot summers. Averages 55 tornados a year (National Oceanic and Atmospheric Administration).
- Planning to build two duplexes or a quadplex
- Exploring Insulating Concrete Forms (ICFs)

ICF Features

- Plastic foam forms that are filled with concrete (can mix in fly ash)
- Increased insulation and decreased air infiltration
- For hurricane safety, ICFs harden the entire structure so that an extra safe room would not be needed. Also earthquake and fire resistant
- Mold/moisture and pest resistant

Source: http://www.toolbase.org/ToolbaseResources/level4DG.aspx? ContentDetailID=3893&BucketID=4&CategoryID=61

Cocopah Indian Housing and Development

- Climate: arid, dry winter, hot
- Rehabilitating three multifamily buildings with eight units each
- Seeking ways to lower utility costs

Energy Assessment Recommendations

- Add exterior window shade to decrease heat entering window.
- Add other features

Nez Perce Tribal Housing Authority

- Climate: Cool summers with snowy, cold winters
- Planning a development with 18-20 duplex units
- Selected hybrid straw bale construction

Straw Bale Wall Assembly Features

- Light-framed straw bale (non- load bearing)-quicker
- Natural material minimizes wood use.
- Can be local
- Good insulation value: R-34 to R-45
- Straw bale can also be load- bearing
- Fire resistant

Source: Chiras, *The New Ecological Home*

Additional features

- Cultural eastern orientation, wood carports echoing Nez Perce shade structures, duplex shape to echo extended teepee.
- Low impact site design
- Frost protected shallow foundation

Pokagon Band of Potawatomi Indians

- Climate
  : hot summers and cold winters with heavy snow
- Already developed master plan and implemented low impact site development.
- Currently constructing four four-unit buildings
- Two buildings will serve as a geothermal system pilot program.
- Part of sustainable neighborhood: LEED-Gold community center

Low Impact Site Development Features

- Bioswales
- Rain gardens
- Native plant and tree restoration
- Permeable pavement
- Cluster design housing

Pokagon Band (continued)

- Beginning construction on four multifamily buildings to contain four units each.
- Two will pilot a geothermal system heating and two will use forced air furnaces, fueled by natural gas.

Exterior proposed by NDG

To Find Out More:

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