Phillips Neighborhood Project:

Working Towards Energy Independence

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Executive Summary

Today we are facing an essential moment for the future of energy infrastructure. The energy systems currently in place in Minneapolis and across the country are often outdated and unsustainable, but they continue to be used and supported by large energy companies, leaving communities with few alternatives for cleaner energy options. The Phillips Neighborhood Community of South Minneapolis presents one example of this situation.

Due to high peak demand requirements for all of South Minneapolis as a result of large population and business increases within the area, Xcel Energy is proposing to install a 115-kilovolt high voltage power line in the Phillips Neighborhood Community, as well as two new substations at the end of the line. The purpose of this is to reduce the risk of blackouts and low power quality during peak energy hours for the entire South Minneapolis area, a demand capacity of 55 megawatts. Called the Hiawatha Project, this proposed transmission line would place the Phillips area and most of South Minneapolis, home to about half of the entire city's population, in a situation of outdated, unclean energy infrastructure. Although the company is supportive of alternative energy technology, most of Xcel's power is produced by coal, natural gas, nuclear, and hydroelectric power plants delivered through high voltage transmission lines. This presents two separate issues, both very important. First is the source of power and whether it is clean or dirty, and second, where this power is produced, either centralized distantly or distributed locally. In spite of evidence that these lines could increase power reliability, they will not solve the problem of a poor energy system nor the increase in electricity demand, which is why we must move to a better system, and now is the time to do it.

The Phillips Community is home to one of the most diverse urban populations in the Twin Cities area and has served as a hub for immigrant and Native populations for many years. Unfortunately, for years this area has also been the home to many contaminated sites. This injustice provides an incentive to reform the energy system within this area to make it clean, sustainable, and economically and environmentally just so that the community does not bear the brunt of the negative consequences of the proposed transmission line.

A coalition of community groups and activists has been discussing possible energy alternatives for increased efficiency and sustainability within South Minneapolis and more specifically the Phillips Community since this is the area that would bear the brunt of the proposed transmission line's negative consequences. Elements that should be incorporated into this alternative infrastructure are affordability, reliability, clean infrastructure, resilience, local opportunity, and sustainability. If all of this can be successfully accomplished and put in place instead of the high voltage transmission line, the Phillips Community could become an example for the rest of the nation to follow in clean energy systems, which would be a strong source of empowerment for this local community.

Action has already occurred for Xcel's project to move forward. Xcel's routing permit application, with the proposed route for the transmission line being about the Midtown Greenway, was completed on May 21, 2009. However, the Minnesota Public Utilities Commission (PUC) has not officially accepted this location as of yet, allowing for public and evidentiary hearings to occur before the route is determined with any finality.

On October 8, 2010, Administrative Law Judge Beverly Heydinger recommended that the transmission line be buried underground East 28th Street. This would be located in the middle of the street so as to reduce the impact of the line on residents and trees on this street. As this is a

recommendation, it is not yet legally binding. Currently the final decision is still in the hands of the PUC, and is scheduled to be made in February 2011.

Students at the University of Minnesota have compiled research about many different clean energy technologies and their specific financing options for Phillips. Of the technologies researched, we have concluded that white roofing (roof restoration) and solar panels are applicable in both residential houses as well as small- and large-scale businesses. Ice energy and water-fired chillers could be implemented in either small- or large-scale businesses, but not residential buildings. Combined cooling, heating, and power, fuel cells, and sodium sulfur batteries are applicable only in industrial-scale buildings, and lithium ion battery storage is applicable only in residential homes. We also researched bluegen, natural gas, and vanadium redox battery storage, but due to limited implementation options or not being renewable resources, we have determined that these technologies are not applicable to meet South Minneapolis's energy needs.

Although several of these technologies could feasibly provide enough energy to meet the peak demand energy needs and enable the community to move forward instead of backward in energy infrastructure, accessing the energy audits necessary to finance these options remains a fundamental barrier to incorporating these renewable energy systems. The investment in such energy audits is essential for families in poorer communities, as Phillips historically is, to be able to pay their electrical bills, because the high voltage transmission line does not present a less expensive energy option for the community. It merely enables Xcel to meet South Minneapolis's peak energy demand.

In order for the future of South Minneapolis energy infrastructure to be sustainable and accessible to families of disproportionately lower income, investments in quality retrofit options must be made. We suggest that the City of Minneapolis invest in an energy auditor in order to work within the poorer communities to enable them to overcome the first step in sustainable energy, which is overcoming the financing barriers of renewable energy systems. By implementing renewable technologies, we could prove that sustainable energy is not only a feasible option for the future of energy in South Minneapolis, but in urban areas across the nation.

Introduction

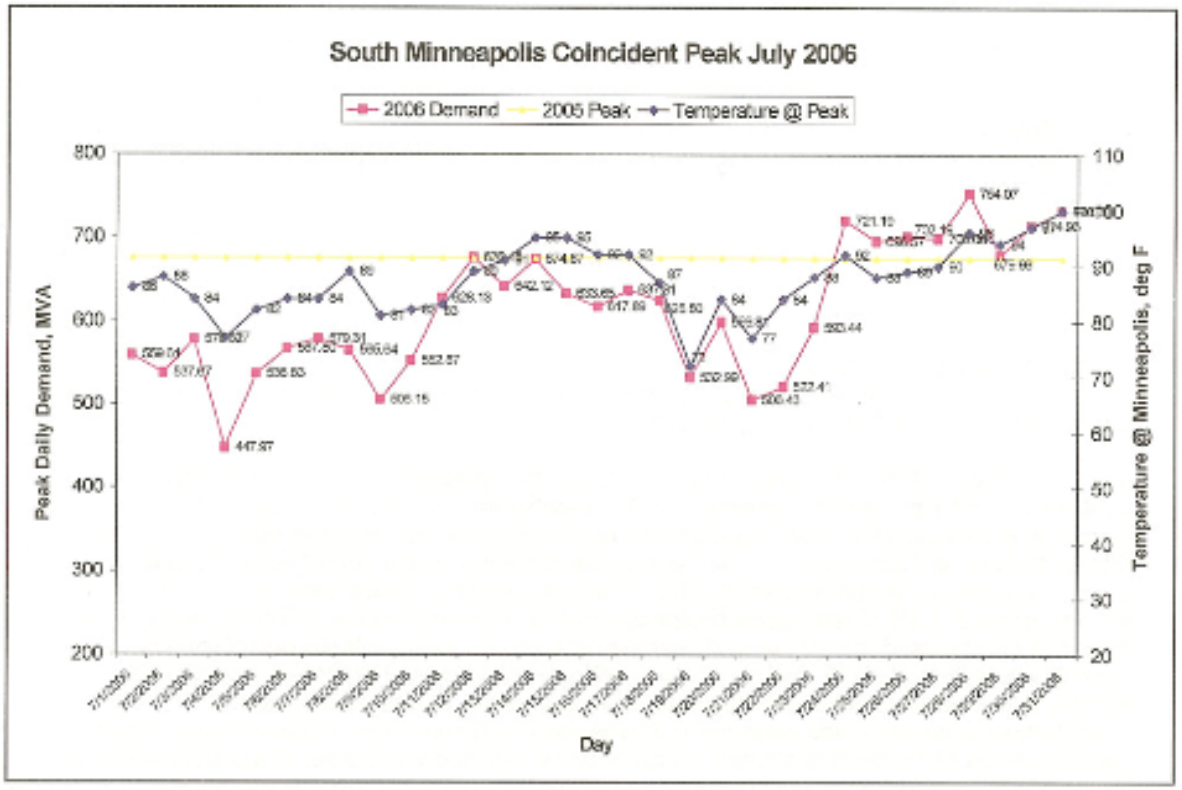
The Phillips Neighborhood Project was originally described to our group as a project that would allow us to contribute to a real grassroots effort involving energy justice and environmental integrity within the Minneapolis area. The central issue for our project concerns the Xcel transmission line that was proposed to intersect the low income area of the greater Phillips neighborhood. Xcel maintains that this enormous, fossil-fuel dependent development project is necessary for providing the increasing energy demands for the greater Minneapolis area, while the more impoverished Phillips neighborhood would be forced to specifically suffer from the adverse social and economic effects that the transmission line would create. Thus, our project was directed at supplementing the team of researchers who are attempting to create awareness on this complex political, social, and financial issue by investigating and supporting alternative energy resources or practices that would provide the necessary energy use without utilizing the same fossil fuel technologies for the area. In this way, our project was basically the last hope for a low income area without the political or financial clout to intimidate a huge company like Xcel Energy from developing a technologically outdated transmission line that could impede social and economic activity for the citizens who live and work there.

Over the course of the semester, our project's goal did seem to change, as it became gradually clear that there was simply not enough time or money available to successfully promote our long-term and lofty ideals. In this sense, instead of maintaining that the only goal would be to stop the Xcel transmission line from being built in the Phillips Neighborhood, it became a positive goal to begin the research that could provide strong support for future plans and energy changes in small, low income areas like the Phillips Neighborhood. Discussions shifted from merely considering how to quickly get information about the detrimental affects of the Xcel transmission line out to community members, to instead making certain that a well-developed and clear argument for alternative energy sources and efficiency projects could be possible for future communities wishing to attain energy independence. Considering the limited amount of work that a team of college students could produce by the February deadline for the Public Utilities Commission meeting, it became a top priority to create succinct information about the positive economic and social impacts that energy security and energy efficiency measures can generate for low income areas all over the United States, and thus our project can also act as a case study for other cities and communities that are seeking alternatives to the centrally bound, outdated energy system that currently dominates American culture.

Throughout the course of the project, our group encountered the challenges of not enough time or expertise in the field, which caused the dynamics of the project to change and gave our group a better understanding of the politics and challenges of sustainability. In order to reach our goal of more energy independence for the Phillips neighborhood, energy sustainability was key. When dealing with becoming sustainable in a large scale, roadblocks arise and demonstrate the political nature of sustainability. With the original goal of resisting the construction of the transmission line, the Phillips neighborhood could not simply state their opposition of the line to Xcel and expect results. The construction, or lack of, is a political system that has to make its way through a bureaucratic stepladder. Having the Phillips neighborhood and the rest of South Minneapolis become energy independent does not rely on the transmission line, but it greatly effected by the politics of it. Once the project changed to focusing more on Phillips as an experimental neighborhood for energy independence, the goal of sustainability is still politicized. In order to have the neighborhood becoming energy independent, there has to be a realization that they are not independent followed by a will, as well as the ability and knowledge on how to be energy independent. These same steps are necessary when dealing with conscious sustainability on a personal level, but when working with sustainability on a community level, this process is much

more difficult. This project has helped our group to realize that sustainability on a community level involves more than just a will to be sustainable. There are rules and regulations that need to be meet when working with an energy system. There are different incentives for members of the community, which may clash. In the example of the Phillips neighborhood it is the interest of Xcel to put in the transmission line, while it is in the interest of the community to become energy independent. In trying to be sustainable, all parties involved have to be addressed, which may prove to be a task of negotiation, a skill not immediately linked to sustainability at first thought.

The graph below demonstrates the correlation between the temperature and the energy demand. It shows the importance of reducing the energy demand on the grid during peak hours.



(Mirzayi, Betty)

Project Description

"Innovation— any new idea—by definition will not be accepted at first. It takes repeated attempts, endless demonstrations, monotonous rehearsals before innovation can be accepted and internalized."

— Warren Bennis

Satisfying the growing energy demand in the United States in ways that are not detrimental to people or the planet requires our generation to overcome the inertia of the established energy infrastructure. For centuries the norm has been, and largely continues to be, to invest in carbon based energy sources, delivering centralized power through antiquated unidirectional energy infrastructure that is dependent upon a vulnerable network. This current system is not sustainable and will fail in a post-peak oil world. Now is the time to invest and model alternatives to the existing means of producing and distributing energy and demonstrate the potential of energy conservation through property retrofitting and the communal value in decentralized energy production. Meeting energy needs can continue to be meet with the current energy practices, but only for so long. To have energy independence, sustainable energy technologies and behaviors should be implemented by communities empowering and engaging their citizens.

Xcel Energy's Hiawatha Project proposed for the Phillips Neighborhood is the most current extension of the outmoded grid to meet a very real energy need, but it is not the only option. When it comes to meeting a burgeoning energy demand, conservation, modes of distribution, and point source generation is key.

Located south of downtown Minneapolis, the Phillips Community is bound by Interstate 94 to the north, Lake Street to the south, and Interstate 35 to Hiawatha Avenue on the west and east. In the late 19th and early 20th century, many Scandinavian immigrants developed the neighborhood, creating much of the building stock that exists today. The Phillips Community has consistently served as a gateway community for many immigrant populations establishing themselves within the Twin Cities. This diversity of the neighborhood has since expanded to include African Americans, Native peoples, Latino communities, and most recently East African immigrants. The American Indian population here is one of the largest and most diverse urban communities in the country, stemming from the 1952 federal Urban Relocation Program that brought over a dozen tribes into Phillips. Over the years the community has been burdened by many contaminated sites.

Over the past half century, South Minneapolis has since expanded and increased its demand on the aging electrical infrastructure. Operating on a 1920s energy grid, blackouts and low power quality have become frequent occurrences and have taken a major toll on both businesses and neighborhoods in this area. Xcel supplies South Minneapolis with electricity primarily from coal, natural gas, nuclear, and hydroelectric power plants and delivers it through long-distance, high-voltage transmission lines. The energy wattage is then reduced and distributed through a number of substations and feeder lines to individual homes and businesses.

Assistant secretary for electricity delivery and energy reliability at the Department of Energy Kevin Kolevar has said, "Our grids today are more stressed than they have been in the past three decades, and if we don't expand our capacity to keep up with an increase in demand of 40 percent over the next 25 years, we're going to see healthy grids become increasingly less reliable" (Letter that Paul Lehman, manager of regulatory projects for Xcel, stated on October 29, 2010 in a letter to neighborhood

residents). While local failures in individual transformers happen regularly due to the aging local infrastructure, high peak demands, particularly during very hot summer days, bring large parts of South Minneapolis very close to grid failure. Xcel claims that the need to build the transmission line and two substations comes from the increase in economic activity along Hiawatha Avenue and Lake Street, and that the Hiawatha project will meet the electric capacity needs of the community, especially during peak loads. The larger scope of the project, according to Xcel, is that it will improve power reliability across all of South Minneapolis and reduce the risk and frequency of large power outages.

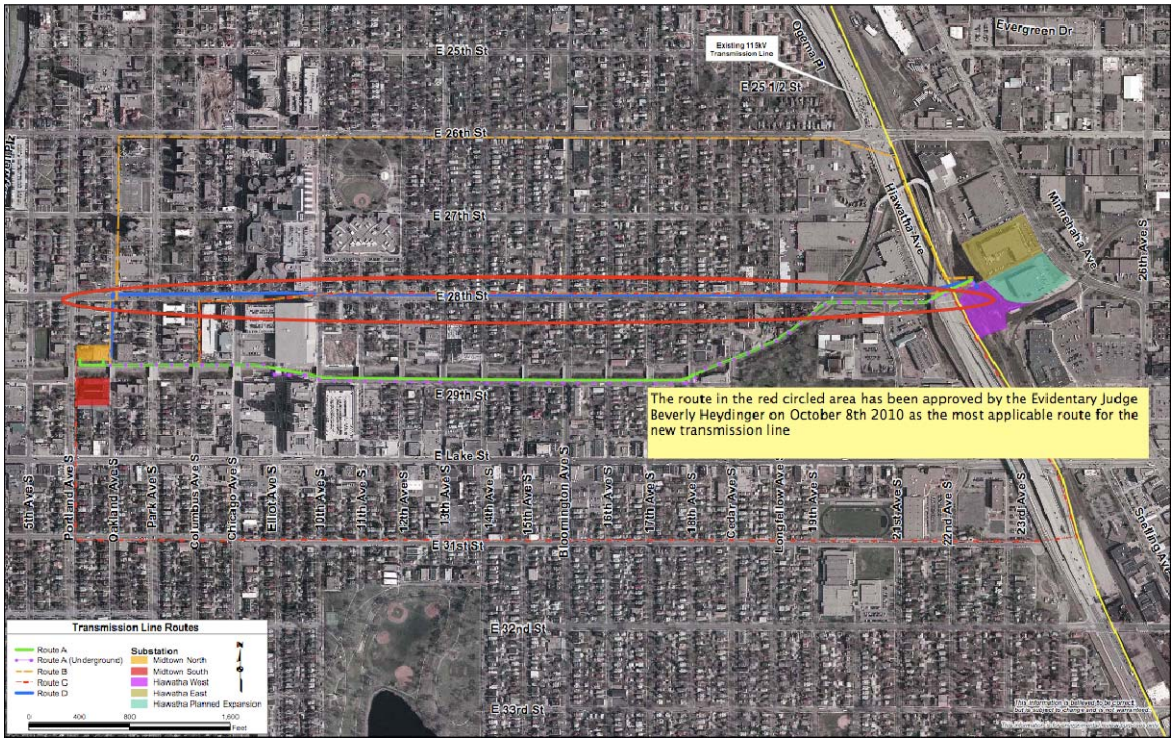
Through not building the transmission line and using the Phillips community, this project hopes to come to the conclusion that out dated transmission lines can be replaced by energy efficiency, demand management technologies, and renewable generating systems. The Phillips projects goal is to demonstrate that not only can energy security needs be meet, but can literally empower a community while modeling an opportunity for renewable energy systems across the nation.

Initially, Xcel had attempted to develop the project above land rather than below it, but in a recent decision by an evidentiary judge in Minneapolis, it was found that below ground transmission lines would best fit the community. The evidentiary ruling is not binding for the Minnesota Public Utilities Commission (MPUC), but the findings hold much weight and are largely followed. In order to have the transmission line built, the Minnesota State Legislature required that Xcel obtain a Certificate of Need, however due to the size of this project, Xcel was able to be permitted prior to the certificate. The Certificate of Need is a positive move for implementing alternative energy because the certificate "will require Xcel to prove that they cannot serve local electricity demand through alternative means, such as conservation and locally produced power" (Midtown Greenway Collation). Xcel has two reasons for largely opposing the underground lines. The first is increased expenses. According to the Star Tribune, "But the utility told the Public Utility Commission that the line could be run either overhead for $3 million or underground for $15.6 million" (Steve Brandt, Star Tribune) The second reason is that they do not want to set precedent with building underground for all new urban high-power transmission. The question still remains of how will the cost of the project be distributed among all Xcel electricity payers.

During the entire process Xcel has been transparent, has followed policy ruling, and has informed the community of their plans, although it has been presented in forms that are not very accessible to the public. The Hiawatha project as proposed by Xcel is not a malicious attack on the Phillips Community; it is a representation of continued investment in a dated power grid system and their overall conception of power. In general, Xcel Energy is supportive of renewable energy and property retrofitting, as they offer many quality financing options for both and are the nations leading wind energy provider, but they remain bound by an approach that has yet to evolve. However, these financing options can be largely inaccessible to the members of the Phillips communities due to the large amount of renters over owners. With the proper source of funding, the Phillips community can lay the foundation of clean and renewable power while conserving the energy available.

The coalition of community groups that seeks an alternative to the Hiawatha Project has taken this opportunity to begin discussing energy consumption reduction within the Phillips area. Engaging in this dialogue opens up the conservation for the potential of retrofitting, which could serve to address the need to reduce power usage, as well as create jobs, lower energy bills in the long run, and prepare for the future of energy independence. This idea of preparing for the future is at the heart of Xcel's rationale for investing in these power distribution systems. Steps must be taken to develop a comprehensive retrofitting and renewable financing program in partnership with Xcel to create solutions benefitting all parts of the city, not just those with the financial means to do so or the political clout to fight against it. Instead of being host to these inner city transmission lines, the Phillips

neighborhood could be the test site model for a city wide retrofitting program for Minneapolis, though this would not be simple to accomplish. While the transmission lines will provide a partial and temporary solution to rising energy demand in South Minneapolis, it will do so to the cost of energy users without changing the root causes – an aging energy grid and poorly-managed energy use. South Minneapolis has the opportunity to demonstrate a long-term solution by investing in energy efficiency, demand management technology, and clean energy that will generate savings, revenue, and jobs for the community while addressing the problem at its root.



(Hiawatha 115 kilovolt)

Our Power

Our Power is a proposal by local organizer Timothy Denherder Thomas to establish a community-wide campaign uniting residents, businesses, organizations, and elected officials around a better energy future for South Minneapolis. Building on an inclusive process that engages the diverse perspectives and backgrounds of private and public institutions and peoples, the Our Power Project hopes to empower and connect residents in a broad-based collaboration that syncs information, resources, and a collective energy vision. According to Timothy, the most important thing that Our Power will focus on will be creating a collaborative and opportunity-focused approach to meet the energy needs of South Minneapolis, help all parties move beyond antagonism and blame while creating a win-win agenda for local economic development and job creation, community empowerment, multi-cultural collaboration, and environmental sustainability. Absent community scale organized projects such as the Our Power proposal, property retrofitting and renewable energy will continue in a piecemeal fashion, appearing as independent projects. The significance of connecting these projects as a part of a larger future energy framework is that alone, they appear logical and economical, but together they project a model for the future.

Our Power Residents and Businesses United for a Better Energy Future in South Minneapolis – Timothy DHT

Our Power is about standing together to create the energy future that truly fills the needs of our community and builds a solid foundation for South Minneapolis. We seek a better energy future based on:

- Affordability – we must ensure that everyone can afford to meet their basic energy needs; currently, paying for energy bills is a burden for many.
- Reliability – we must ensure reliable power quality. Our businesses and homes cannot afford the damages currently caused by outages and poor power quality
- Clean Infrastructure – we must ensure that our energy infrastructure is clean and benign. If our energy system negatively impacts the health, economic opportunity, or vitality of our neighbors or other communities nearby and far away, that energy system needs to be better.
- Resiliency – we must ensure that we are protected from the increasingly volatile price shocks in energy markets and retain stability in the face of disruptions of energy supply.
- Local opportunity – we must ensure that our energy dollars create jobs, businesses, and revenue streams for people in our community to avoid being shut out of the opportunities of the energy economy.
- Sustainability – we must ensure that our energy choices sustain a healthy and productive environment for ourselves, our neighbors, and future generations. Our current energy system compromises the health of many and threatens our planet.

Program Elements

Each interface will help potential participants walk through the five steps of engagement:

1. **Signing On:** signing a statement or declaration affirming agreement and participation in Our Power. This statement should be constructed based on the values identified above as something

that appeals to the interests of all constituencies. After signing-on, participants should receive an appropriate, desirable, and visible notice (lawn-sign, window cling, bumper sticker, notice for a business/institution). Signing-on should be communicated as the first of the five steps and leading to the rest.

2. **Education:** All participants will be invited to engage in activities and events that allow them to better understand how our energy system works and what we can do to improve it. These would include free one-time forums and classes tailored to various constituent groups (renter, homeowner, business, non-profit, educational, etc.). Less time-intensive opportunities such as user-friendly printed and online materials or short videos would also be available. Materials and educational events would be tailored to the concrete needs and interests of groups (focusing on why this is relevant to you, why this is a challenge for you, what the opportunity is for you), and telling the story of how energy issues affect us all.

3. **Energy Upgrades**: All participants will be connected with resources to take immediate action in their own home/business/workplace to improve our energy system. These services will be provided through a network of non-profit and business service providers to provide comprehensive service to participants with very different needs. Common principals for service delivery (and guidelines for how program partners are selected) will be followed, such as:
    a. Providing cost-effective services that recommend improvements that will reduce cost of living/operating costs, improve quality of life/operational functionality, generate revenue streams through ownership, management, or sale of energy efficiency, peak shaving, or clean energy generation, and/or create business/job opportunities for those they serve (ie, it creates relevant economic benefit).
    b. Focus on timely, streamlined, participant-oriented service that helps participants become empowered and in charge of their energy systems.
    c. Focus on skill building, training, and creating competency in energy-smart operations/lifestyles – not just making a technical improvement, but teaching people to integrate better technology, better behavior, and better management into a pathway for better energy.
    d. Transparency in technology, pricing, contracting, hiring, and other details of business management to build community trust and a sense of partnership.
    e. Community benefit and income/racial equity in employment and job creation through this process. This campaign will generate business for energy assessment, project management, and contracting firms, and guarantees that jobs created through this process are accessible and have community benefits agreement that give local, low-income, and minority individuals a fair share of the jobs.
    f. Potentially creating a contract with for-profit service providers who are part of it that a certain portion of profits from leads generated through this program are donated back to the program (creating a sustainable revenue stream).

    Some potential partners who may be interested in participating to service various sectors including Cooperative Energy Futures (residential, renter, small business efficiency – community aggregation of small-scale energy users as managers and producers), Green Institute (business and community workshops on efficiency), HK and Johnson Controls (large institutional/commercial efficiency), MyCore Industries (apartment complexes, mid-large commercial/industrial with a focus on financing efficiency and clean energy solutions), Innovative Power Systems (residential and commercial solar), SolarFlow (solar leasing), Affordable Energy Solutions (residential efficiency), Inner Earth Energy (ground source heat

projects), and Center for Energy and the Environment (commercial efficiency, especially lighting and HVAC). These partners should have clearly identified roles (which types of participating individuals/entities do they serve, are they available from a list of options to those types of customers or do they actively organize participants in Our Power, how do they work together on differentiated project management, financing, and implementation functions) so that they will synergize rather than compete.

These service providers will help participants take effective action, save energy, reduce peak demand, take ownership of clean energy, and harness the emerging market benefits (efficiency credits, carbon credits, demand management, power generation) of an Our Power system. We will develop common system for tracking the individual and collective impact of Our Power in terms of real actions taken – possibly the Minnesota Energy Challenge if it is flexible enough to accommodate large commercial/institutional users. The success stories of Our Power participants and the growing impact of the whole should be regularly shared through these interfaces.

4. **Community Engagement** – Participants would be encouraged to refer/invite peers (neighbors, friends, other businesses, allied organizations, etc.) to join in Our Power. Easy-to-use vehicles for schools, congregations, businesses, and community centers to reach out to and engage others in their circle would be create to harness the power of social diffusion. As much as possible, the face of Our Power to new participants should be their peers, creating a norm of engagement and familiarity that makes action in Our Power accessible and inviting.

   Participants would also be invited to participate in community forums and visioning sessions developing and planning collaborative solutions that extend beyond the level of changing their home/place of business. This could include developing community-based energy projects, cooperative energy development plans, coordinated weatherization projects, and other similar collaborative efforts. This process can connect and synergize with existing efforts like the Transition Towns Open Spaces, Cultural Wellness Center CHAT Teams, community listening sessions, and other similar community dialogues as those groups desire. Results and ongoing initiatives from these collaborative planning and visioning sessions would be publically shared through the various program interfaces to ensure idea-sharing, collaboration, and transparency. Spaces for “difficult dialogues” around local energy infrastructure, working across cultural barriers, and area-wide demand management could also be hosted.

Solutions-Oriented Policy – Specific policy actions that reflect the interests of the whole community and create opportunities to expand access and benefits of a clean energy future may be advanced through the cross-sector base of support built through Our Power. Care should be taken to avoid advocating policies that will alienate any part of the cross-sector base. An example of what seems like a good win-win policy avenue would be efforts to expand and implement PACE financing, which would create optional financing opportunities for businesses and neighborhoods to finance energy improvements at low interests rates. Other possibilities could include other capital access initiatives, or rules that would allow aggregated marketing of energy services by distributed energy customers to utilities or to each other in a cooperative fashion. Opportunities to work at the municipal, county, state, or even national level in collaboration with elected officials to create win-win opportunities will be developed in a collaborative fashion with thorough processes of educating participants about these measures and providing abundant opportunities for feedback through all available interfaces.

Project Results

Based on our research of alternative energy technologies, we determined the applicability of each for the focus area of South Minneapolis. White roofing and solar panels are the only options that would function both in residential homes and small- and large-scale businesses. Ice energy and water-fired chillers could be installed in small- or large-scale businesses. Combined cooling, heating, and power, fuel cells, and sodium sulfur batteries are only possible to be implemented in industrial-sized buildings. Lithium ion battery storage is only applicable in residential homes. The other technologies researched (bluegen, natural gas, and vanadium redox battery storage) are not feasible options for South Minneapolis due to current limitations to the accessibility of their implementation.

In spite of the applicability of several of these technologies in the focus area, without feasible financial options, it will not be possible for any of the technologies researched to be implemented. Residents must have access to quality energy audits in order to receive loans and grants for new energy infrastructure. These audits are very expensive and difficult to receive, but the real expense lies in the current unclean and unsustainable energy system that is in place today that places an unjust cost upon residents of low-income communities as well as the environment. Although the cost of energy audits is very high, this is merely an initial cost that would result in long-term energy and monetary savings. Therefore, generating financial incentives is key to creating a new sustainable energy infrastructure.

Conclusion

In order to move beyond the current inefficient and expensive dirty power system to a dynamic energy future, we must not only change our infrastructure, but our societal norms of over-consumption as well. Incorporating a systems approach that embraces the interconnections between society, the environment, and the economy, is critical to move us beyond the traditional emphasis of cheapest energy first, the same that has hidden the resulting social and environmental costs of the modern grid. Through small changes that yield significant improvements, such as property retrofitting and small renewable energy systems, as opposed to large-scale centralized projects, the diverse benefits of the new energy economy can be calculated and used as leverage. This requires new definitions of the dirty energy problem and of our energy addiction, as well as a clarification of the opportunities that can be had with localized energy production and conservation. This new framing can help generate the need for solutions that enhance the existing system and promote investment in the community through collaborative work. As the cost of traditional fossil fuel based energy sources rise due to global depletion, the viability to incorporate a new economy centered on efficient, clean, and locally owned energy will become even more widely accepted. In order for these small changes to be integrated into the beginnings of a smart, community operated, interactive grid, a significant amount of coordination of resources and between all the diverse stakeholders within the area is crucial. The Our Power piece illustrates the potential to coordinate a broad-based coalition and articulates a viable framework for South Minneapolis.

Achieving a community-wide systems approach, while ideal, will be extremely difficult. It will be essential to get members of any neighborhood, from businesses to homeowners, invested in the visioning process and informed of the payback in changing. Because many people are only know the traditional means of energy production, consumption, and distribution, it will be important to consolidate the benefits to alternative and decentralized energy implementations, such as we attempted in our paper. It should be noted that while we incorporate a number of financing and energy options, our document is still not as user friendly as would be needed. If a project were to be pursued on a large scale, the key values and benefits of community power need to be emphasized so that they are not lost as the community receives more and more information on the topic. The public needs to reclaim their role as producers instead of consumers and transform the popular discourse of American consumerism that has permeated all aspects of civic life. In this way, change can occur in the energy sector when integrated systems work together and people recognize the connection between the energy system and larger societal issues. Utilities will need to be honest about the transmission constraints and wastes that are indicative of the current, outdated central-station energy model. When utilities recognize that such overproduction of energy creates unnecessary costs, see the economic benefits to change, and a community is ready and organized, it will be possible to draft a utility integrated solution that provides localized energy production and efficiency services as a large-scale project.

Access to capital remains the most central barrier to integrating the multifaceted elements of the new energy economy, especially in poor neighborhoods such as Phillips that have an older housing stock. As such, the new energy economy must include bankers, lenders, and structured financial innovations to bring about the capital flow needed. Long-term loans will be crucial to pay for deep retrofits and renewable energy systems, as the current one to three year current payback expectancy for many programs limits investment. One thing that our research illuminated is that in order to utilize many of the financing options available to fix up ones home, the citizen would need to receive an energy audit first. While this may not seem like a big deal, it can be a significant upfront expense for lower

income communities needing it most. Even the discounted program offered through corporations such as Xcel and Centerpoint fail to provide the quality of service. A potential solution could be developed from a collaboration of graduate level University of Minnesota students pursuing an education as a licensed energy auditor and the lower income communities in need of these services.

A secure and clean energy future is feasible, but the coordination to bring it to fruition will be difficult. The “low-hanging fruit” available in many energy efficiency opportunities must be taken, but there also must be the promotion of deep retrofit installations and the proper funding allocated. A possibility that could be incorporated into South Minneapolis is the development of a localized cooperative project that includes direct tax incentives and funding for energy efficiency implementation. Creating programs that allow for customers the freedom to package their own retrofits while also buying into a commonwealth issue could be the unifying factor to jumpstart community scale retrofitting. While complicated and difficult to achieve, financing is available for new energy technologies, but may need to be synced. Uncovering the means to eliminating upfront costs for local infrastructure improvements is our best hope for a sustainable and energy independent future.

Appendix 1: Technologies

As Department of Energy Secretary Steven Chu said this past September at the GridWise Global Forum, if Thomas Edison were to come back to the United States today, he would still be able to understand our electricity grid system because very little has changed since his first grid installation in 1882. The elements that compose the grid system include: the fuel source that supply the energy, the power plants where the energy is generated, the transmission substations (including the transformers and generators), the high voltage transmission lines and towers that traverse the country, local area substations/primary feeders, the distribution lines that bring the power to homes and businesses, and finally the service panel that directs the power into buildings.

All of the technology used in our daily lives, from modern medicine to food production, has all been largely contingent upon fossil fuel energy and the ability to distribute it. Power has become to the city what blood is in the body: without a constant flow, there will be complete system failure. Without power our streets would not have working sensors or traffic lights, our municipal services wouldn't have the pumping capacity or processing capability to treat water, electric transportation systems would become inoperable, industries and businesses would have no way to develop, store, or advertise, most everyone wouldn't be able to light their home, our whole electronically based financial system would become completely illusory, and we would no longer have our precious internet, for all of these are largely built on the grid system. It is surprising that despite energy's role as one of the most integral parts of modern society, the evolution of energy distribution has not truly developed. Somewhere along the way, the intended purpose of power became overshadowed by an addiction to the cheapest fuel possible.

There are many interconnections involved in this grid system, and this is where the Midtown Greenway Coalition has the greatest ability to make change. The first set of these interconnections lies in the reality of rising fossil fuel prices. The entire grid system is largely based on centralized power plants, which predominantly use coal and natural gas. These power sources are serving as the glue that holds all the other elements in this system, as well as many other systems, together. Because they are viewed as "stable" and have historically been inexpensive, many have not recognized the insecurity of these sources. There are many flows of information and vested profitable interests set on maintaining this outdated grid system.

Xcel's persistence on this project stems from their legal obligations to shareholders and customers to provide a constant flow of energy, as well as meet the demands of the projected population growth for South Minneapolis. The fact that they are developing this line in a low-income community with a large minority population demonstrates the interconnections of race, class, and environmental injustices with the current grid system and cities. Unable to invest in renewable energy systems or retrofitting properties, the cycle of debt prevents many members of this community from accessing secure energy options.

Although financing energy systems remains a barrier in altering the future of localized energy infrastructure, there are technologies available that will enable Phillips and other communities to achieve energy independence and security. The following information presents some of these technologies that were researched by students at the University of Minnesota and their financing options, beginning with those we believe to be the most feasible for the focus area.

Solar Panels

Applicable in Residential Homes and Businesses

Name of Technology: Solar panels

Description of Practice: Changing your home from grid power to renewable solar electricity is easier than most home owners believe once the basics secrets for making solar panels or building a home wind power generator, when following the guides that are available on the internet. DIY Home solar power panel system is a cost effective way to power your home than the expensive installations from the commercial sector. The aim of homeowners is to construct a solar power system that will handle the total power load of the home at peak times. The other important part of the home solar power system is working out the homes total power usage during peak load (Create Free Solar Electricity)

Category (efficiency, demand management, renewable): renewable energy generation

Specific description of product, method, etc.: Solar Electric (or Solar PV) systems convert sunlight to electricity. The systems consist of modules - or solar panels - inverter, charger and batteries. The PV modules generate DC electricity and send it to the inverter, the inverter transforms DC power into AC electricity and regulates the charge of batteries. The batteries store electricity that can be used at night or during blackouts. (Solar Photovoltaic (PV) Electric)

There are different types of residential solar. Grid-Tie Solar Systems (GTS), Grid-Tie with Battery Backup (GTB) and Off-Grid Stand Alone Systems. (Solar Photovoltaic (PV) Electric)

Grid-Tie Solar Systems (GTS) A valuable feature of grid-tie or grid-connected photovoltaic systems is the ability to connect with the existing power grid and sell excessive electricity back to the utility with a plan known as Net Metering. At times when you are not using all of the electricity produced by your system, your meter will spin backwards selling the electricity back to the grid at retail rate. This systems do not include a battery. Power is obtained from the utility grid when the system is not producing electricity. (Solar Photovoltaic (PV) Electric)

A grid-connected system allows you to power your home or small business with renewable energy during those periods (diurnal as well as seasonal) when the sun is shining, the water is running, or the wind is blowing. Any excess electricity you produce is fed back into the grid. When renewable resources are unavailable, electricity from the grid supplies your needs, thus eliminating the expense of electricity storage devices like batteries.

In addition, power providers (i.e., electric utilities) in most states allow net metering, an arrangement where the excess electricity generated by grid-connected renewable energy systems "turns back" your electricity meter as it is fed back into the grid. Thus, if you use more electricity than your system feeds into the grid during a given month, you pay your power provider only for the difference between what you used and what you produced. (Connecting Your System to the Electricity Grid).

Grid-Tie Systems with Battery Backup (GTB) Grid-Tie Solar Electric Systems with Battery Backup have all the features of the Grid-Tie Systems with the addition of a Battery. The battery can store power for use when the system is not producing electricity such as during the night or during blackouts. (Solar Photovoltaic (PV) Electric)

Off-Grid Successful stand-alone systems generally take advantage of a combination of techniques and technologies to generate reliable power, reduce costs, and minimize inconvenience. Some of these strategies include using fossil fuel or renewable hybrid systems and reducing the amount of electricity required to meet your needs**.** (Operating Your System Off-Grid)

A solar panel will produce electricity from the sun, and then put it back into the gird. The website above has solar cells which increase the conversion efficiency of solar cells up to 66%.

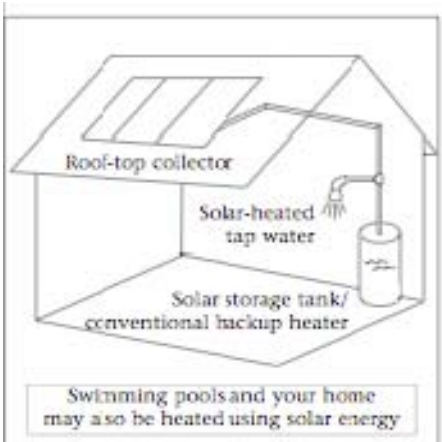
There are three different types of solar power used from residential purposes.

1: Flat-plate

2:integral collection storage (ICS)

3:Evacuated-tube collectors

Here is a simplified diagram of solar water heater system for a residential setting



Simplified representation of a solar water-heating system

Upfront price: A high end estimate is $12 per kw (or $12 million per MW, from

general Internet research), Ralf Jacobson (solar panel installer) says they do instillation's for $7-8 a kw for residential homes and for $5-6 a kw for commercial cells. However there are many rebats avalabe for solar instilations- including PACE and a possible 60% rebate for cells made in MN.

If the people buying are property owners participating in Make Mine Solar (link found in **Other** section below) it would cost:

Locally manufactured Solar Skies system: $5180.00 Or German manufactured Buderus system: $5100.00

However, without a rebate it could cost a family of four $11,000 for a two-collector solar water heater (about 60 square feet) will provide for about 2/3 of their yearly hot water needs (Make Mine Solar H20).

Solar hot water systems are significantly more affordable than PV systems. Residential solar hot water systems usually cost $6,000-$8,000 after incentives, while PV systems could cost three to four times as much (Solar Hot Water).

Another estimate was found in "A Consumer's Guide: Heat You Water With the Sun" says that most thermal systems cost between $2,000 and $4,500 (6).

Payback: Depends greatly on how much you would actually have to pay for them- often in the decades. A call placed to Excel on 10/24/2010 said that in

Minneapolis the cost in cents per kilowatt hour in October 2010 was $.06365 and in September 2010 it was $.0763. The price of energy changes monthly, however this will impact the payback. Payback also depends if the panel will be industrial scale for large businesses or residential.

According to the Oregon Department of Energy in an Active Solar Space Heating Information, "If done correctly, the home will use 20 to 50 percent less energy during the heating season and remain cool during the summer months."

Energy production varies- often 2 or so kw arrays on residential roofs

could be much larger for commercial buildings. A two-collector solar water heater (about 60 square feet) will provide for about 2/3 of their yearly hot water needs (Make Mine Solar)

Demand on peak load: sun light hours- corresponds to peak power hours. More hours in the summer then winter. Using solar panels can take demand off the peak load. Using the hot water heaters and panels during peak hours, especially in the summer when the energy from the sun is it's strongest, can take demand off the grid.

Space requirements: depends how much energy need- roughly 330sq feet per kw. Also depends on type of system. A two-collector solar water heater is about 60 ft.

Current Viability: Very viable, we know of solar installers in MN (Ralph Jacobson), many people have already installed. Make Mine Solar, (Make Mine Solar) is another options for property owners in the twin cities and is readily available.

Case studies or examples of effective use: Possibility of a Macalester employee who installed $30,000 worth of Solar Cells on his house for ~$5,000. There is a PDF attached titled Solar Pinoeers that deals with the Southeast Como Neighborhood Improvement Association (SECIA) that initiated the Southeast Como Neighborhood Thermal Pilot Project. They installed 20 residentail solar hot water systems. The study concludes that solar hot water systems can be more economic than solar electric systems. This is especially true for high occupancy households or apartment buildings with a large hot water demand.

Conditions in which it can be installed or applied (i.e., residential, commercial,

south facing roofs): residential, commercial, preferably south facing roofs with maximum solar exposure. Can also cover parking lots and other man made surfaces. They can be installed in a few different types of settings. The water heaters are best from residential settings or buildings that use a large amount of water. There are also systems that work with electricity, not just water.

Other: Since the Phillips neighborhood is located in Minneapolis, as well as the rest of South Minneapolis, residents could participate in Make Mine Solar (Make Mine Solar). This project is trying to buy panels in bulk for residents in the Twin Cities. This could be a great opportunity for the Phillips neighborhood residence to start working toward energy independence.

White Roofing/Roof restoration:

Applicable in Residential Homes and Businesses

Name of Technology/ Practice: White Roofing/Roof restoration

Producer/Source of this Technology/Practice: The costs for reflective roof coatings vary from $0.75 per square foot for acrylic paints to over $3 USD per square foot for PVC single-ply membranes. White coatings can be applied to practically any roofing surfaces, membranes, or substrates. Commonly applied to sprayed polyurethane roofs to provide waterproofing, they are compatible with metal roofs, single-ply rubber roofs, modified bitumen roofs, as well as can be applied to certain kinds of asphalt roofs. There are many roof coatings and membranes, with very different efficiencies. Elastomeric coatings (namely the white ones), white rubber membranes and white EPDM rubber membranes are the roofing products with the best reflectance.

<u>Heat-reflecting roof paint</u>

-The most active supplier of this type of paint is HyperSeal with their Hyperglass Cool Top Coat.
-Another supplier is Melbourne, Florida-based HyTech, with their Insul Cool-Coat #2000.
-Hytech claims that 10 actual properties retrofitted in California and Florida with cool roofing have shown 20% to 70% reduction in cooling energy use.

<u>Reflective Membrane Coating</u>

-Sarnafil is a respected Energy Star certified provider of reflective roof membranes
- Elastospray is a closed-cell Spray Polyurethane Roofing Foam Insulation

Upfront Cost: Using reflective paint for a 2,000 square foot calculation, an approximate size for a small business, one would need to apply about 14 gallons for the first coat. At current prices, this would cost $466 with shipping not included. Since two coats are necessary, applying seven gallons for the second coat would bring the cost up to $735, once again with shipping not included. Recommended to include audit roof insulation, especially in colder climate. Reflective roof membranes from $1.50 to over $3.00 per square foot.

Installation/Implementation Cost: Can be easily applied by property owner with little professional expertise needed.

Operation Cost: Little to no operational costs, and cool coatings can also help the lifespan of the roof. Ultraviolet (UV) rays from the sun break down many conventional dark roofing materials. White coatings can cool surfaces significantly by reflecting the sun's ultraviolet rays, and consequently slow down the roof's aging. Roofing materials also contract and expand daily as they heat up during the day and cool down at night. A roof with a cool coating doesn't experience such large daily temperature fluctuations so it undergoes less thermal fatigue. Lower roof temperatures also reduce the rate of any chemical breakdown. A cool coating can increase roof life and significantly decrease roof maintenance and expenditures.
Gartland, Dr. Lisa. *Cool Roof Design Brief*. Issue brief. Pacific Grove: Pacific Gas and Electric, 2005. Print.

Maintenance Cost: Little to no maintenance cost for the painting.

Peak Demand Reduction: In 1994 peak load reduction study published in the Home Energy Magazine, Danny Parker and Steve Barkaszi from the Florida Solar Energy Center in Cape Canaveral executed a number of experiments studying roof reflectivity. The study found a decrease in energy use amongst all projects with a range of 11% to 43% reduction.

Table 1. Results of Reflective Roof Retrofit Field Tests

Test Site and Description	Albedo before	Albedo after	Energy use (kWh/day) Before	After	Savings	Reduction in utility coincident peak demand (5-6 pm)
Site #0 Merritt Island -- white ceramic coating on asphalt shingles, concrete block with R-25 ceiling insulation, attic duct system	0.22	0.73	38.7	34.7	4.0 (11%)	Not Measured
Site #1 Cocoa Beach -- white elastomeric coating on asphalt shingles and flat gravel, R-11 attic insulation, attic duct system	0.21	0.73	40.6	30.3	10.3 (25%)	661 W (28%)
Site #2 Cocoa Beach -- white elastomeric coating on tar paper; flat roof and no attic insulation, attic duct system	0.20	0.73	35.5	20.1	15.4 (43%)	858 W (38%)
Site #3 West Florida -- white elastomeric coating on asphalt shingles, no attic insulation, no attic duct system	0.08	0.61	22.4	16.8	5.6 (25%)	496 W (30%)
Site #4 Miami -- white coating for gravel roof, R-11 attic insulation, attic duct system	0.31	0.61	51.9	43.9	8.0 (15%)	444 W (16%)
Site #5 Merritt Island -- white elastomeric coating on tile roof, R-7 attic insulation, attic duct system	0.20	0.64	57.5	45.9	11.6 (20%)	988 W (23%)
Averages	0.20	0.68	41.1	31.5	9.2 (23%)	683 W (27%)

"Saving Energy with Reflective Roof Coatings." *Home Energy Magazine Online*. Web. 06 Nov. 2010. <http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/94/940509.html>.

Long-term Savings/Production: The investment in a reflective membrane or will not only lower one's energy cost, but also extends the life of a properties roof. These minimal investments will have significant long-term savings. Between 1980 and 1984, the University of Texas installed BASF Polyurethane foam to the roofs of 27 different on their campus. The results showed that the university was able to cover the complete cost of the roof application through energy savings in an average of **4.5** years.

Contact Information:

Hyperseal, Inc -Customer Service email: sales@hypersealinc.com - ph: 760.324.7900

Mail: 34901 Spyder Circle
Palm Desert, CA 92211
Hy-Tech Thermal Solution - Fax: 1-321-984-1022 - Phone: 1-321-984-9777
Email: info @ hytechsales.com
Please include the State/Country you live in,
Type of construction, i.e. Concrete block, wood frame, etc
BASF Polyurethane Foam Enterprise LLC – Phone: 1-888-900-FOAM Fax: 713-383-4592
13630 Watertower Circle Minneapolis, MN 55441

Applicable Conditions: Cool coatings work best over the flat or "low-slope" roofs found on most commercial buildings and some homes. Painting shingles will not work, but reflective shingles can be bought.

Maximum Technical Potential for the Focused Study Area: Estimating that ¼ of 84,240 residents in the South Minneapolis focus area will have the proper style of roof, and then the 21,060 particpating buildings could each see a reduced summer energy demand, assuming similar results with the study, to see approximately 20% reduction. This would cumulatively amount to 4212 buildings worth of energy being removed from Xcel's focus area.

Feasible Potential for the Focused Study Area: Very viable for commercial/industrial operations, as well as flat surfaced residential. High renter density of residents living in flat roofed buildings within the area makes this an issue of self-interested action by the property owner. Maintenance is greatly reduced with the application of the reflective sealants.

Financing Mechanism

Federal

Drawing on federal stimulus dollars earmarked for energy-efficiency projects, one can qualify for cool roof financing tax credits if the roofing materials pass with the Environmental Protection Agency's Energy Star Program prior to construction. Under the section on roofing, a resident could see a reduction in 30% of a project up to $1500 if it is installed by December 31, 2010.

Xcel Energy Custom Efficiency Rebate –

Custom Efficiency rebate amounts vary according to the project's energy savings. Current rebates are up to $400/kW of electricity saved, and/or up to $5/Mcf saved for natural-gas projects. Xcel Energy requires preapproval prior to purchase and installation to any custom efficiency project before a rebate estimate is given.

Ice Energy (ICE BEAR® 30)

Applicable in Small- and Large-scale Businesses

Producer/Source of this Technology/Practice: The headquarters for Ice Energy is Windsor, Colorado, and there are additional sales and operations offices in California (12).

Description of this Technology/Practice: The ICE BEAR® 30 unit is an off-the-shelf distributed energy storage system that is designed to store energy at night (or off-peak times) in order to decrease the on-peak electrical energy demand. Ice Bear is used with direct expansion air conditioning units, where a typical application will electrically shift approximately 30 kW-hours of energy to the off-peak, thus reducing the on-peak demand by about 6 kW for six hours (14). The Ice Bear unit runs its integral condensing unit for about 10 hours continuously, during the coolest part of the night, to store energy in the form of ice (30 latent ton-hours). Here, the "ton" is a measurement of refrigeration, which is defined as the cooling power of one short ton (2,000 pounds) of ice melting within a 24-hour period (15). Based on the time-of-day, or upon a command to shed electrical demand initiated by the utility, the Ice Bear unit's CoolData® controller determines if the Ice Bear hybrid condensing unit or the electrically operated condensing unit will operate. "In the case of the Ice Bear unit, it pumps enough oil free R-410A refrigerant to an Ice-Coil evaporator to provide effective cooling for up to 5 tons of continuous load for six hours, using less than 300 watts of power" (14). One important design feature of the Ice Bear especially relevant to an outside application unit, is that the cooling performance is independent of outdoor ambient or rooftop temperature, so therefore it can be 75 °F or 140 °F and the Ice Bear unit's cooling capability remains constant.

Upfront Cost of this Technology/Practice: $5,000 for each appliance, which is 1007/16" W x 603/8"D x 481/8" H, with a total storage capacity of 30 ton-hours (13).

Installation/Implementation Cost of this Technology/Practice:

Installation includes:

1. Field Piping
2. Leak Testing
3. Evacuation
4. Releasing Unit Refrigerant Charge (14)

as well as lifting the Ice Bear Unit onto the designated area with shackles and straps. There is also transportation costs to assess that involve shipping the Ice Bear unit to entities in Minneapolis.

Operation Cost of this Technology/Practice: "To facilitate rapid, large-scale implementation, Ice Energy has developed relationships with and will implement projects with leading energy service companies, including Johnson Controls, Honeywell, Carrier, Lennox and Trane" (18). There is no cost to the customers or building owners who choose to invest in the Ice Bear units at their sites because this solution is fully funded by participating utility companies. Moreover, there are no complicated rebate programs or incentives because Ice Bear units are purchased by participating utilities and therefore the installation cost is left to the utilities. Thus, there is no

cost to receive the Ice Bear equipment, installation and maintenance for qualified customers (17).

Maintenance Cost of this Technology/Practice: The Ice Bear unit requires very low maintenance, as well as no chemicals or heavy metals, and around a 25-year asset life (16). General maintenance includes following industry standards for the service and maintenance of evaporator coils, and the condensate drain, which the user must check and clean each year at the start of cooling season. In winter, the user must keep the drain dry to protect it against freeze-up. Moreover, periodic maintenance is involved with the Ice Bear as it is essential to keep the condenser coil fins clean and the inside of the condenser free of debris, following standard practices and maintaining adequate water level where the user must inspect the water level annually (14).

Peak Demand Reduction: "Each Ice Bear distributed energy storage unit reduces an average of 7.2 kW of source equivalent peak demand for a minimum of 6 hours daily, shifting 32 kW-hours of on-peak energy to off-peak hours" (17).

Long-term Savings Production with Technology/Practice: The Ice Bear unit is widely compatible for long-term savings where a building can reduce its carbon footprint by at least 10 percent, with a capacity of up to 30 ton- hours of cooling: 5 tons for 6 hours, or 4 tons for 7.5 hours, or 3 tons for 10 hours (16).

Contact Information: Mary Vickerman (vicke050@umn.edu)

Applicable Conditions: Ice Bear is designed for the majority of today's retail and commercial businesses. Specifically, it is applicable to about 80% of the US commercial market, primarily for small to mid-sized commercial buildings less than three stories served by conventional, refrigerant-based, packaged rooftop, split systems, or mini-split central air conditioners (17). It is also important to note that the Ice Bear unit should not be used as the only source of cooling for the typical restaurant, retail shop, and office building due to its limited amount of cooling capacity.

Maximum Technical Potential for the Focus Area: Because Ice Bear is mainly applicable to mid-sized commercial buildings with available air conditioners, it would be wise to look closely at the businesses and hospitals throughout Phillips and South Minneapolis in order to find maximum potential. By designating which entities could house the Ice Bear appliances, we could calculate how many would be needed to address the 55MW minimum dictated by Xcel. Moreover, one of the last steps in the startup sequence is to fill the Ice Bear unit with about 450 gallons of tap water- it will be important to make sure the large amount of water is applicable for all entities.

Feasible Potential for the Focused Area: Potentially, the Ice Bear unit can electrically shift approximately 30 kW-hours of energy to the off-peak times, which can reduce the on-peak demand by about 6 kW for six hours.

Financing Mechanisms: Energy Efficiency Mortgage Programs (pg.), because mechanisms are dependent upon whether or not utilities in Minnesota will provide for Ice Bear units.

Water Fired Chillers

Applicable in Small- and Large-scale Businesses

Name of Technology/ Practice: Water Fired Chillers

Producer/Source of this Technology/Practice: Yazaki Energy Systems (17)

Description: Produces cool water for cooling or hot water for heating in air conditioners. Solar energy or another heat source will heat water between 158 and 203 degrees F to energize absorption cycle. A cooling tower cools water for the condenser. Will cool by 10 degrees or heat by 15 degrees. Provide 208V/60Hz/3ph of energy while consuming 210-310 W of energy. Operating weight 1329-3975ob.

Operation Cost: Cost per refrigerant ton varies by size of chillers:

10 Tons will cost about $3,000 per Refrigerant ton.

20 Tons will cost about $1,900 per RTon.

30 Tons will cost about $1,700 per RTon.

5 tons will cost about $4,200 per RTon.

*note: does not include installation, plumbing, pumps, piping, valves, actuators, cooling tower(s), external controls etc.

Actual cooling capacity for mode WFC-SC30/SH30

Cooling Capacity Factor = 1.12

Heat Medium Flow Correction = 1.0

Standard Cooling Capacity = 360.0 MBH

Qe = 1.12 x 1.0 x 360.0 = 403.2 MBH (33.6 tons)

Chilled Water T = 403.2 0.5 x 72.6 = 11.1 °F

Chilled Water P= 10.1 psi (Standard)

Chilled Water P= 10.1 psi (Standard)

(18)

Maintenance Cost: very low – Yazaki coolers only have one moving part that is a "very reliable 3 phase solution pump"; only about 8 hours per year of maintenance work

Long-term Savings/Production: 97% heating efficiency

Contact Information: Ellen Schneeberger (schne629@umn.edu) began emailing Bud Leavell, who is the sales engineer at the U.S. Yazaki firm; he should be contacted for further information:

Email: bleavell@yazakienergy.com

Phone: (469) 229-5443 HQ or (214) 206-1133 direct

Applicable Conditions: Larger Buildings, produces energy when desired, requires 5X7X5.5 ft

Maximum Technical Potential for the Study Area: First the number of large commercial buildings that are able and willing to house one of these chillers must be identified. This research has not been completed as of yet.

Financing Mechanisms: Xcel Energy Solar Rewards Program (pg. 29), Xcel Business Energy Efficiency Rebate Programs (pg. 30), Xcel Residential Energy Efficiency Rebate Program (pg. 31), Xcel Energy Audits (pg. 33), Centerpoint Commercial Energy Efficiancy Rebate Program (pg. 34), Centerpoint Residential Energy Efficiency Rebate Program (pg. 36), Minnesota Energy Efficiency Loan Program (pg. 37), Community Fix-Up Fund Loan Program (pg. 38), Renewable Equipment Grant Program (pg. 39), Solar Sales Tax Exemption (pg. 39), Minnesota Rental Energy Loan (pg. 40), Minnesota Home Energy Loan Program (pg. 40), Weatherization Assistance Program (pg. 43), Residential Renewable Energy Tax Credit (pg. 44), Residential Energy Conservation Subsidy Exclusion (pg. 45), Low Income Home Energy Assistance Program (pg. 46), Energy Efficiency Mortgages (pg. 47), Energy Efficiency Commercial Buildings Tax Deductions (pg. 49), Renewable Energy Production Incentive (pg. 50).

Fuel Cells

Applicable in Large-Scale Industrial Businesses

Name of Technology/Practice: PureCell fuel cell systems

Producer/Source of this Technology/Practice: UTC Power (1)

Description of this Technology/Practice: Generate electricity as a bi-product of a controlled chemical reaction (2). Two different units depending on how much energy is needed. They use natural gas and convert it to hydrogen to power the system. Used as heat/AC and overall power source. The cells Cconsist of three main parts: negatively charged anode, positively charged cathode, and electrolyte. Can provide energy indefinitely as long as hydrogen fuel is provided so it can take the oxygen from the air to complete the chemical reaction (3). Typically used for rural off-grid areas or for vehicles.

Upfront cost of this Technology/Practice: $1,500,000 purchase price

Installation/Implementation cost of this Technology/Practice: California case study: Installation cost $2,084,000- $2,249,000; installation expenses $584,000 for one 300kW fuel cell (4)

Operation cost of this Technology/Practice: $3-4000 per kilowatt peak, 10-15 cents per kilowatt hour (5)

Maintenance cost of this Technology/Practice: $150,000 annually

Peak Demand Reduction: PureCell® Model 400 Fuel Cell System -400 kilowatts of electricity and heat (approximately 1,700,000 Btu per hour. PureCell® Model 200 Fuel Cell System (Legacy System)- 200 kilowatts of electricity and heat (approximately 900,000 Btu per hour)

Long-term savings/production: Ultra-low emissions

Low sound profile

Designed to meet or exceed the most stringent air emission standards in the United States as established by the California Air Resources Board (CARB) 2007.

By using both the heat and power the fuel cell generates, your carbon footprint can be significantly reduced

No ozone-depleting fluorocarbons

Low maintenance resulting from innovative design and few moving parts

Contact Information: Ellen Schneeberger (schne629@umn.edu)

Applicable conditions: Large, industrial buildings. New fuel cells provided by FirstEnergy and Ballard Power Systems are very large (54 feet long)

Alternative maker/model: A new fuel cell technology by FirstEnergy and Ballard Power Systems is currently being tested in Ohio. It could power 600 homes and produce one megawatt of electricity and is a 54-foot long unit mounted on a tractor trailer (6).

Maximum Technical Potential for the Focused Study Area: With the potential new technology being tested in Ohio that can produce 1 Megawatt of energy, 55 of these would be needed to meet the peak demand of the focus study area, which could provide electricity to 33,000 homes in the study area based on the hypothesis of the new fuel cell study. Our study area has 84,240 homes, which means we would need almost three times this amount, if the study being tested in Ohio is accurate as to how many homes each fuel cell could provide energy for.

Feasible Potential for the Focused Study Area: Realistically, 55 fuel cells that are 54 feet long each will not be able to fit in the focus area. More research must be done as to how many commercial businesses/areas are large enough and willing to house these fuel cells.

Financing Mechanisms: Xcel Energy Solar Rewards Program (pg. 29), Xcel Business Energy Efficiency Rebate Programs (pg. 30), Xcel Residential Energy Efficiency Rebate Program (pg. 31), Xcel Energy Audits (pg. 33), Centerpoint Commercial Energy Efficiancy Rebate Program (pg. 34), Centerpoint Residential Energy Efficiency Rebate Program (pg. 36), Minnesota Energy Efficiency Loan Program (pg. 37), Community Fix-Up Fund Loan Program (pg. 38), Renewable Equipment Grant Program (pg. 39), Solar Sales Tax Exemption (pg. 39), Minnesota Rental Energy Loan (pg. 40), Minnesota Home Energy Loan Program (pg. 40), Weatherization Assistance Program (pg. 43), Residential Renewable Energy Tax Credit (pg. 44), Residential Energy Conservation Subsidy Exclusion (pg. 45), Low Income Home Energy Assistance Program (pg. 46), Energy Efficiency Mortgages (pg. 47), Energy Efficiency Commercial Buildings Tax Deductions (pg. 49), Renewable Energy Production Incentive (pg. 50).

Combined cooling, heating, and power

Applicable in Large-Scale Industrial Businesses

Name of technology: Combined cooling, heating and power

*This letter expressed that CHP was potentially the best option available and he outlined some basic principles and estimates for CHP. More research should be done into specific CHP technologies

Producer/Source of this Technology/Practice: Letter from Stenswick, combination of Wikipedia and sites noted after information is presented.

Category (efficiency, demand management, renewable): Demand Management, Effienecy

Specific description of product, method, etc.: Recipricating engines, microturbines, or fuel cells (all examples of CHP). This product works by capturing some or all of the by-product heat for heating purposes. This can be done in a number of ways.

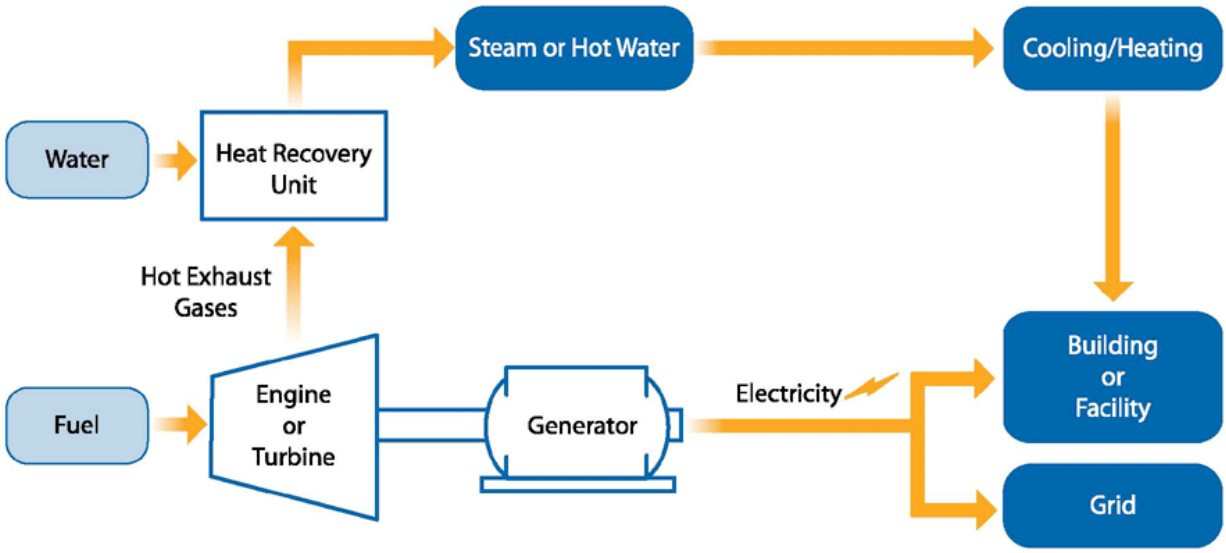
CHP is not a single technology, but an integrated energy system that can be modified depending upon the needs of the energy end user (Combined Heat and Power Partnership).

The two most common CHP system configurations are:

* Gas turbine or engine with heat recovery unit

* Steam boiler with steam turbine (Combined Heat and Power Partnership)

Below is a diagram demonstrating gas turbine or engine with heat recovery unit (Combined Heat and Power Partnership).



Combined heat and power (CHP) or cogeneration is the production of two forms of useful energy from a single fuel source. In most CHP applications, energy from a fuel source such as natural gas or oil is converted to both mechanical and thermal energy. The mechanical energy is used to generate electricity, while the thermal energy or heat is used to produce steam, hot water, or hot air (What is CHP).

Typical CHP prime movers include:

* Combustion turbines
* Reciprocating engines
* Boilers with steam turbines
* Microturbines
* Fuel cells (What is CHP).

Upfront price: $1000 for engines, $1500-$2000 for microturbines, and $4-6k for fuel cells.

Even though the initial cost of CHP systems for buildings is higher than purchasing all electric power needs and using conventional chillers and boilers for cooling, humidity control and heating needs, the life-cycle cost of the CHP systems is often lower because of the energy cost savings over its useful life of more than 20 years. (Economic Benefits).

Operation Cost: CHP Cost to Generate Power

Operating Assumptions	
CHP Electric Efficiency (%)	32.0%
CHP Power to Heat Ratio	0.7
Displaced Thermal Efficiency	80.0%
Thermal Utilization (%)	95.0%
Incremental CHP O&M Costs ($/kWh)	$0.0100
CHP Fuel Cost ($/MMBtu)	$8.30
Displaced Thermal Fuel Cost ($/kWh)	$8.30

Operating Cost to Generate	
CHP Fuel Costs ($/kWh)	$0.0885
Thermal Credit ($/kWh)	($0.0480)

Incremental O&M ($/kWh)	$0.0100
Operating Costs to Generate Power ($/kWh)	$0.0505
Capital Cost	
Installed CHP System Cost ($/kW)	$1,200
Annualized Cost Factor (%)	8%
Operating Hours	8,500
Capital Charge ($/kWh)	$0.0113
Total Costs to Generate Power ($/kWh)	$0.0618

$/kW = dollars per kilowatt, $/kWh = dollars per kilowatt-hour, $/MMBtu = dollars per million British thermal units, O&M = operations and maintenance (Economic Benefits).

Payback: Integrated combined heat and power (CHP) systems significantly increase

efficiency of energy utilization, up to 85%,by using thermal energy from power generation equipment for cooling, heating and humidity control systems. (What is CHP).

CHP systems can offer much higher energy efficiency than conventional stand-alone equipment items for similar degree of power reliability, comfort cooling, heating and indoor air quality. Because of the higher energy efficiency of the CHP system, it consumes nearly 40% less fuel than conventional systems (Economic Benefits).

Long-term Savings/Production

Integrated systems for CHP for buildings improve efficiency of energy utilization to as much as 85% compared to that of about 35% for conventional systems. Increased efficiency of energy utilization decreases the amount of fossil fuel consumed per unit of energy used and leads to 45% reduction in air emissions compared to conventional centralized power plants. (What is CHP).

Peak Demand Reduction

Since CHP systems generate power on-site or near-site, these systems improve power reliability by either reducing or eliminating a building's dependence on the electric power grid, and by providing an additional power option to the building. Also, because CHP systems are located at or near buildings, power outages caused by losing a distribution line are improbable. (Economic Benefits).

The higher the number of buildings that use CHP systems, the lower the demand on the electric grid will be. In areas where the grid is at or near capacity, the reduced demand provided by CHP will result in increased grid reliability**.**

Installation/Implementation

* Industrial manufacturers - chemical, refining, ethanol, pulp and paper, food processing, glass manufacturing

* Institutions - colleges and universities, hospitals, prisons, military bases

* Commercial buildings - hotels and casinos, airports, high-tech campuses, large office buildings, nursing homes

* Municipal - district energy systems, wastewater treatment facilities, K-12 schools

* Residential - multi-family housing, planned communities (What is CHP)

In determining if your building is ready for CHP, you can take a quiz and contact the EPA here: http://www.epa.gov/chp/project-development/qualifier_form.html

When it produces energy: CHP systems reduce power demand in two ways: 1) by generating some of the power at site, and 2) by using thermal energy from power generation equipment, instead of electricity, for operating cooling, heating and/or humidity control equipment. (What is CHP).

Case studies or examples of effective use: ConEdison is a case study for the the

biggest steam district in the world "EPA has presented Energy Star Combined Heat and Power (CHP) awards to two organizations for using highly efficient CHP systems to reduce energy use and lower greenhouse gas emissions and air pollution. CHP (cogneration) is 60 to 80 percent more efficient than producing heat and power separately (Steam Operations)."

Conditions in which it can be installed or applied (i.e., residential, commercial, south facing roofs): Commercial and large businesses.

High-Volume Sodium-Sulfur (NaS) Battery Storage

Applicable in Large-Scale Industrial Businesses

Name of Technology/ Practice: High-Volume Sodium-Sulfur (NAS) Battery Storage

Producer/Source of this Technology/Practice: NGK Insulators Ltd. (Japan) (7)

Description of this Technology/Practice: A sodium-sulfur battery is a type of molten metal battery constructed from sodium (Na) and sulfur (S). This type of battery has a high energy density, high efficiency of charge/discharge (89–92%) and long cycle life, and is fabricated from inexpensive materials. However, because of the operating temperatures of 300 to 350 °C and the highly corrosive nature of the sodium polysulfides, such cells are primarily suitable for large-scale non-mobile applications such as grid energy storage. What makes the NAS battery technology revolutionary is its large energy density, high efficiency and long-term durability. The energy density of the NAS battery is three times larger than conventional lead acid batteries, the battery can be charged in eight hours and its electrical energy can be discharged over a similar period or stored indefinitely if the temperature is maintained at 600 degrees Fahrenheit. By charging the battery during off-peak hours and using the electricity during peaks, an energy provider is able to operate its generation more efficiently. A NaS battery uses a far more durable porcelain-like material to bridge the electrodes, giving it a life span of about 15 years. They come in 50KW units, and are commonly arranged in 1MW storage units. The 1MW Storage units can dispatch a MW of power consistently for over 7 hours and have a lifetime of over 15 years. The cost per MW is around $2.9 million. Xcel has piloted implementation in connection with a wind energy project in SW Minnesota - dozens of mega-watts are available in Japan. The battery stores power when supply exceeds demand and puts power back onto the grid when additional demand is needed. This helps lower peak demand needs and can reduce costs by storing base-load power for peak periods. Xcel Energy Minnesota pilot project: (8) Recent update on a pilot project by Xcel Energy: http://www.marketwatch.com/story/xcel-energy-releases-promising-results-from-wind-to-battery-project-2010-08-03?reflink=MW_news_stmp Information about the manufacturer: http://www.nextenergynews.com/news1/next-energy-news4.14.08a.html

Upfront cost of this Technology/Practice: In the USA, AEP is using the 30-foot-wide by 15-foot-high battery to supply 10% of the electricity needs of 2,600 customers in north Charleston, which cost about $2.5 million. However, the battery cost for the plant located on the northern tip of Japan cost about $2.9 million per MW.

Installation/Implementation cost of this Technology/Practice: The Xcel Energy pilot project report suggests a $3 million cost for a 1MW install (8)

$2500/kW for large (~10MW) system installation (www.oce-ontario.org/.../EnergyWorkshop**Storage**Brandon20080618.ppt) As seen in Presidio, Texas, the battery system cost can rise to over $10 million just to construct the building in which the battery will be housed and the new substation the battery requires. There are also

transportation costs to consider, as with the battery system in Presidio, Texas, the parts for the battery had to be driven by 24 trucks from California to Presidio.

Operation cost of this Technology/Practice: $0.16/kWh + interest = $0.08 for cost of electricity coming out of the battery plus cost of electricity going into the battery. This is an estimate based on math assuming wind energy at $0.06/kWh is being put in with a 75% efficiency rate. With a different source of electricity going into the battery this number would be different. (9) Net Present Value (NPV) Operation and Management cost $0.3M for each megawatt. This varies depending on where the battery is receiving its electricity to run. (www.oce-ontario.org/.../EnergyWorkshop**Storage**Brandon20080618.ppt) Additional costs of the system: The system itself appears to do much of the security work, where abnormalities internal to the battery modules such as cell failure, over current, abnormally low cell voltage, and extreme temperatures are monitored by the battery controllers and can trip the dc breakers to protect the batteries. The NAS battery protection scheme can trip the dc breakers to protect the power electronics and the balance of the system. Moreover, external heaters are needed to keep the battery maintained at an elevated temperature at all times to accomplish energy storage function- they are only needed on start up processes or in an idle state.

Maintenance cost of this Technology/Practice: According to NGK Japan, Sodium sulfur batteries are maintenance free (as opposed to lead acid batteries). Using the case study of the first NAS battery energy storage system (BESS) in New York, the benefits of the BESS are that it is virtually noiseless, produces no emissions and requires minimal maintenance.

Peak Demand Reduction: 1MW for the 1MW array. Can continuously discharge 1MW for 7.2 hours when needed: http://www.marketwatch.com/story/xcel-energy-releases-promising-results-from-wind-to-battery-project-2010-08-03?reflink=MW_news_stmp By allowing entities to utilize stored energy, they can shave peak demand costs and energy use. The sodium-sulfur battery reduces the amount of generation and distribution and transmission infrastructure needed to meet peak demand. It can be used to deliver electricity into areas that previously had restrictions due to transmission or distribution constraints, and the battery can function as a standby source to protect against power disturbances. Therefore, using the case study in New York, when fully charged the BESS is capable of providing one megawatt (mw) of power to the compressors for up to seven hours a day, and it can operate seven days a week. Thus, that MW of power can be used to shave peak demand from the commercial entities using the system and provide energy security from power quality issues.

Long-term savings/production: Does not save or reduce energy on net. May generate financial savings if contracts are developed that allow operators to buy at low off-peak prices and sell back to grid at high peak prices. The performance of the commercial NAS battery includes results that state the efficiency of sodium sulfur batteries throughout cycles and discharges remains greater than 86%. The batteries also have a life expectancy of over 2,500 cycles at 100% depth of discharge. Moreover, at only 80% depth of discharge the life span could last around 4,500 cycles.

Contact Information: Manufacturers (NGK) or case studies (Xcel's project) have not yet been contacted; Mary Vickerman (vicke050@umn.edu); Ellen Schneeberger (schne629@umn.edu)

Applicable conditions: Per MW, these batteries occupy about the same space as two semi trailers and weigh around 80 tons (http://www.marketwatch.com/story/xcel-energy-releases-promising-results-from-wind-to-battery-project-2010-08-03?reflink=MW_news_stmp) Thus, the NAS

battery systems are relevant primarily for large commercial and industrial applications, where it must also be maintained at a high operational temperature.

Maximum Technical Potential for the Focused Study Area: If our focus area is most of South Minneapolis, then it will be necessary to determine the exact number of commercial entities that would be willing to participate in this energy storage battery bank and the amount of energy they would depend upon. In this way, it would be possible to get groups like the hospitals in the Phillips neighborhood as well as the businesses to utilize and promote this source of energy. It would be essential to find a large enough area that could house the battery bank that would provide for South Minneapolis peak load assumptions of 55MW.

Feasible Potential for the Focused Study Area: Assuming that a 1MW NAS battery bank was implemented in South Minneapolis, it would provide for about 1MW of stored energy after charging for 8 hours.

Financing Mechanisms: Minnesota Energy Efficiency Loan Programs (pg. 37), Energy Efficiency Mortgages (pg. 47), Energy Efficiency Commercial Buildings Tax Deductions (pg. 49), Renewable Energy Production Incentive (pg. 50).

Lithium Ion Battery Storage

Applicable in Residential Homes

Producer/Source of this Technology/Practice:

1) A123 Systems located in Livonia, Michigan (6).

2) Indianapolis-based lithium-ion battery manufacturer EnerDel (2).

3) International Battery is a U.S. manufacturer headquartered in Allentown, Pennsylvania that designs and develops large-format Lithium-ion rechargeable cells and batteries (3).

4) Saft, France (9).

Description of this Technology/Practice: The lithium ion battery system allows for private entities to harness solar energy in order to provide for energy security during high peak demand, as well as the ability to negotiate the variability of solar energy. Because prices are falling for lithium batteries and storage capacity is increasing, lithium ion batteries are becoming a realistic alternative for collecting excess energy and discharging it when needed in order to provide an uninterrupted power supply. For example, the IBexus is a 24-volt, 4.1 kilowatt-hour energy storage system that is "highly efficient and well-suited to store solar energy. Made in the U.S., the battery is composed of large individual cells, 70 times larger than those used in typical consumer batteries" (7). Thus, Lithium ion batteries can be used in residential applications and scaled up for large-scale applications and utility projects. The French company, Saft, has developed "large and medium-sized batteries in cylindrical and near-prismatic shapes, with various energy-power trade-offs, from 150 W/kg with full discharge in 2 hours to 65 Wh/kg with full discharge in 15 seconds" (6). Some other remarkable properties of lithium ion battery products include a long calendar life (over 20 years at ambient temperature), low self-discharge (under 5% per year) which allows for more energy use at specific times, and an operating temperature range from –30 °C to +60 °C (6).

Upfront Cost of this Technology/Practice: The initial costs for residential batteries can range from $80 to $200 per kWh (where you need to know the kWh total in order to determine how much energy storage you need) (1).

Installation/Implementation Cost of this Technology/Practice: For example, from a case study in California, the Sacramento Municipal Utility District (SMUD) initiated a $5.9 million pilot project to evaluate how energy storage enhances the value of distributed solar (8). For the project, Saft will provide the lithium ion batteries and the company, Silent Power, will provide the home energy appliance that houses the lithium ion battery. Moreover, in this project, GridPoint's power monitoring and dispatch software will be integrated with the appliance. In this way, the technology of the lithium ion battery will be implemented at the residential level by collaborating with various businesses that address installation costs and risks through state-sponsored incentive programs and tax credits (8).

Operation Cost of this Technology/Practice: Could not find conclusive data.

Maintenance Cost of this Technology/Practice: With lithium ion batteries, the main problems that require the user to conduct regular maintenance are overheating and overcharging. If overheated or overcharges, lithium ion batteries may suffer thermal runaway and cell rupture, and "in extreme cases, these effects may be described as 'explosive'" (10). Moreover, overdischarge can permanently damage a battery, and to reduce these risks, "batteries generally contain a small circuit that shuts down when the battery moves outside the safe range of 3–4.2 V. When stored for long periods, however, the small current drawn by the protection circuitry itself may drain the battery; normal chargers are then ineffective" (5).

Peak Demand Reduction: Depending on the size of the lithium ion battery system, a set amount of energy can be stored from the PV, and used to address peak energy use as well as power quality issues with solar power. For example, the use of Saft's modular Li-ion battery technology makes the concept's ability to store energy highly scalable. "Currently, rated power and capacity are typically in the range of 20 MW for minutes to tens of minutes. However, up to 50 MW for 60 minutes and beyond is possible with an increase in battery units and battery capacity" (11).

Long-term Savings Production with Technology/Practice: The savings amount for lithium ion batteries applies to the significant reduction of peak demand from non-renewable sources. Residential and commercial lithium ion battery storage systems allow for consumers to utilize solar energy in a more stable way, with the added security of back-up energy.

Contact Information: Mary Vickerman (vicke050@umn.edu)

Applicable Conditions: "The IBexus is easily scalable from kilowatt-hours to megawatt-hours, making it ideal for not only residential, commercial, and transportation applications but for utility-scale energy storage, industrial use, military use, and smart grid projects" (7). Saft's lithium ion batteries exhibit: "cycling capability - 3,000 cycles at 80 percent depth of discharge or 1 million cycles at 3 percent depth of discharge, as well as a long calendar life and an intelligent, self-diagnostic design. It also offers high energy density, millisecond-level response time and high power capability - both in charge and discharge. Furthermore, Saft's Li-ion technology provides precise information on the battery's state of charge, which is a vital function in a dynamically operating energy storage system as well as an array of battery modules provide the necessary rated DC voltage and storage capacity for each installation" (11). Thus when supplemented with renewable energy like PV panels, these batteries can diminish energy consumption and promote energy efficiency for Phillips.

Maximum Technical Potential for the Focus Area: The 2000 Census documented that the Phillips neighborhood population was about 20,000, with about 6,300 households. However, it is important to recognize the potential of users that could be capitalized on within the South Minneapolis focus area (**). Taking these amounts, it would seem possible to create a project that would allow the residences as well as the commercial units (even just within Phillips) to adopt the lithium ion batteries for energy storage to help meet the 55MW peak load.

Feasible Potential for the Focused Area: For the focus area, if Xcel is correct in assuming that there is a deficiency of 55MW, then it would seem possible to create a packaged project where residences and commercial entities could purchase the lithium ion batteries to supplement a solar PV implementation. Thus, the lithium ion batteries could store solar energy to be used during peak times (or days without much sun) in order to address the 55MW deficiency throughout South Minneapolis.

Financing Mechanisms: Minnesota Solar Sales Tax Exemption (pg.), Residential Renewable Energy Tax Credit (pg.), Energy Efficiency Mortgage Programs (pg.)

Natural Gas

Not applicable

Name of technology: Natural Gas

Category (efficiency, demand management, renewable): fossil fuel

Specific description of product, method, etc.:

Natural gas is a gas consisting primarily of methane, typically with 0-20% higher hydrocarbons[1] (primarily ethane). It is found under the earth's crust and must be extracted by drilling. Usually after drilling, chemical, water and sand are pumped into the ground to help assist with the extraction process. This is called hydraulic fracturing and is a very controversial topic since the chemicals are not disclosed to the public under the Halliburton Loophole. Once a potential natural gas deposit has been located by a team of exploration geologists and geophysicists, it is up to a team of drilling experts to dig down to where the natural gas is thought to exist. (Extraction)

Like oil, natural gas is a product of decomposed organic matter, typically from ancient marine microorganisms, deposited over the past 550 million years. (How Natural Gas Works). Although it is cleaner than oil, it still is not completely clean.

Upfront cost: skipped, assumption of $10/MMBtuplants

Peak Demand Reduction: Estimate is 129 kwh.

The natural gas is sent to plants, in which a single-cycle gas turbine usually convert gas into electricity of 35-40 percent efficiency. Higher efficiencies of 50 percent or more are possible in natural gas "combined-cycle" (NGCC) plants. NGCC plants first use the combustion gases to drive a gas turbine, after which the hot exhaust from the gas turbine is used to boil water into steam and drive a steam turbine (How Natural Gas Works).

Installation/Implementation: Residential and Commercial

According to the Energy Information Administration, energy from natural gas accounts for 24 percent of total energy consumed in the United States, making it a vital component of the nation's energy supply (Uses of Natural Gas).

It is used in homes and businesses, but needs to travel. This is not an on site production option.

Natural gas travels by pipeline, but when they are not available, Liquefied natural gas, or LNG, offers a means of transporting natural gas across long distances. (How Natural Gas Works).

When it produces energy:

When it is in demand on the grid

However, natural gas plants have greater operational flexibility than coal plants because they can be fired up and turned down rapidly. For these two reasons, many natural gas plants are

used primarily to provide peaking capacity at times when electricity demand is especially high, such as the summer months when air conditioning is widely used. (How Natural Gas Works)

Space requirements:

While some large industrial, commercial, and electric generation customers receive natural gas directly from high capacity interstate and intrastate pipelines (usually contracted through natural gas marketing companies), most other users receive natural gas from their local gas utility, also called a (LDC) local distribution company (Distribution).

Today, pipelines supply more than 98 percent of the United States' natural gas needs from sources in North America (How Natural Gas Works).

Current Viability: Definitely viable at this efficiency level. (Now if you can recover enough of the waste heat to get an overall efficiency of 80% (44% electrical and 36% heat), then you really used $6.40 of natural gas (10 - $3.60) to generate that electricity.

$6.40/129 = $0.0496/kwh versus $0.1356.) - this viability unknown.

Case studies or examples of effective use:

According to the AGA, 51 percent of heated homes in the U.S. (or 49.1 million households), used natural gas heating in 2000. This popularity is also shown through the high proportion of new homes built with natural gas heating. According to the U.S. Census Bureau in their report Characteristics of New Housing, 2003, 70 percent of single family homes completed in 2003 use natural gas heating, followed by 27 percent that use electric heat, and 2 percent that use heating oil. This represents the sixth consecutive year that natural gas has heated 70 percent of new homes. This is compared with 47 percent of new homes using natural gas in 1986. The number of homes heated with natural gas increased 16 percent between 1990 and 2000; 52% of all U.S. homes today are heated and/or cooled with natural gas. (Resident Uses).

Other: Conclusion of cost is the following: $10.00/129 = $0.077/kwh compared to

Xcel's proposed peak rate of $0.1356 at current levels of efficiency. However, the price is always changing. Since Wednesday, November 3 2010, natural gas spot prices rose across the lower 48 States, increasing between $0.25 and $1.12 per million Btu (MMBtu). Prices at the Henry Hub rose $0.41 per MMBtu since last Wednesday, averaging $3.76 per MMBtu in trading on November 9 (Overview).

Vanadium Redox Battery Storage

Not applicable

Name of the Technology/Practice: Vanadium Redox Battery Storage

Producer/Source of this Technology/Practice: Prudent Energy (formerly VRB power),

Golden Energy Fuel Cell is Chinese manufacturer (21)

Description of this Technology/Practice: "A vanadium redox battery consists of an assembly of power cells in which the two electrolytes are separated by a proton exchange membrane. In vanadium flow batteries, both half-cells are additionally connected to storage tanks and pumps so that very large volumes of the electrolytes can be circulated through the cell. This circulation of liquid electrolytes is somewhat cumbersome and does restrict the use of vanadium flow batteries in mobile applications, effectively confining them to large fixed installations, although one company has focused on electric vehicle applications, using rapid replacement of electrolyte to refuel the battery. Other useful properties of vanadium flow batteries are their very fast response to changing loads and their extremely large overload capacities. Studies by the University of New South Wales have shown that they can achieve a response time of under half a millisecond for a 100% load change, and allowed overloads of as much as 400% for 10 seconds. The response time is mostly limited by the electrical equipment. Round trip efficiency in practical applications is around 65-75%" (21). "In small scale alternative energy systems usually found in off-grid houses, lead-acid batteries are commonly used to store energy. The main problem with this storage system is that lead-acid batteries aren't too efficient. In order to obtain the most cycles possible (300-1500), the batteries are designed to only use 10% of their storage capacity. Vanadium Batteries have profound implications for normal households that don't have an alternative energy system supplying power to their house. As Japan is demonstrating, the amount of energy that their power stations produce can be cut by 1/3 simply by storing their previously dumped excess nightly energy into huge Vanadium Batteries. This form of load-leveling can be utilized by every power station throughout the world. On top of all that, it is possible to use 100% of the stored energy without any side effects. The number of times the Vanadium Battery can be recharged/discharged is over 10,000 plus cycles" (20).

Installation Costs of the Technology/Practice: "it is easily scaled to any size, up to 10 MW of stored power. Our systems are modular, making them flexible and customizable, and our engineers will review your situation, site and current systems to ensure every element fits your needs and your budget. Since we are the designer, manufacturer and integrator for the system, you can be assured of expert, effective follow-through from planning through integration and efficient operation" (19).

Operation Cost of the Technology/Practice: For Prudent Energy vanadium battery storage, systems have "few replacement parts…With the longest cycle life in the industry – greater than 10,000 cycles," embodying the best solution for capturing value from a megawatt-class system (19)

Bluegen

Not applicable

Name of Technology/ Practice: Bluegen Natural Gas Home Generator

Producer/Source of this Technology/Practice: Ceramic Fuel Cells Limited

Upfront Cost: There are no clear upfront costs in US markets as the product has not yet been piloted by SoCal Gas in LA. Pricing models for BlueGen™ are being finalisedfinalised by international green retailers Neco and Harvey Norman's commercial division. The company has stated that while no exact figures are available for the current cost of an individual unit, bulk purchases pricing will be available to larger US customers such as energy utilities and Governments for demonstration projects. As costs come down the product will be marketed to residential customers." Ceramic Fuel Cells Limited :: BlueGen." *Ceramic Fuel Cells Limited*. Web. 06 Dec. 2010. <http://www.cfcl.com.au/BlueGen/>.

Installation/Implementation Cost: Unavailable

Operation Cost: Unavailable

Maintenance Cost: Unavailable

Peak Demand Reduction: BlueGen™ will still be connected to the power grid. During peak times in the morning and evening the home will usually need more than 2kW, so the home will import from the grid. When the residence is using less energy it will export to the grid. At its maximum output (2kW of electricity) the BlueGen uses about 12.6 MJ of natural gas per hour. At its typical operation, generating 1.5kW of electricity, BlueGen uses about 9.5 MJ of gas per hour.

Long-term Savings/Production: The BlueGen unit is designed to last the same as a hot water unit – typically 10-15 years.

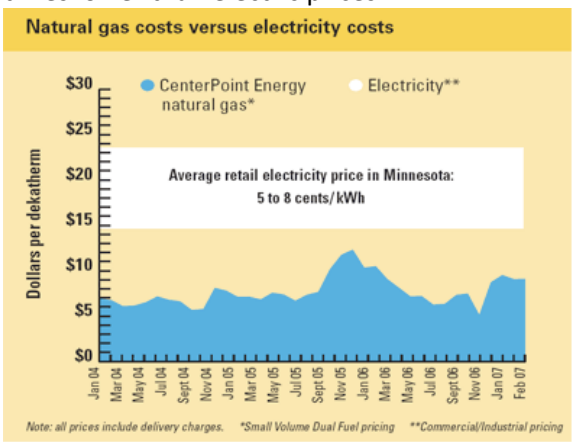
Contact Information: Neco and Harvey Norman Commercial Division are appointed to sell and install BlueGen™ products, but they are limited Victoria and New South Wales.
Neco can be contacted on 1300 88 26 40, or email to bluegen@neco.com.au
Website is www.neco.com.au. For more information on the Harvey Norman company, contact: John Harrison Ph: (02) 9710 4155 or 0457 544 919 or via email: john.harrison@au.harveynorman.com

Applicable Conditions: Ceramic Fuels Limited is working on converting the BlueGen to suit the US power requirements (which are different to Europe), and also to get the appropriate US product safety approvals sometime in 2011.

Maximum Technical Potential for the Focused Study Area: To meet the full 55MW reduction from solely Bluegen generators, South Minneapolis would need to purchase 36,675 units running at

1.5kW. The total number of generators needed was determined by converting the 55 mw demand into kW's, then dividing that by the average expected output of a Bluegen generator.

Feasible Potential for the Focused Study Area: The feasibility potential for the focused study area is limited without knowing the cost of a single unit. To produce 1 mw of energy in South Minneapolis from the Bluegen System, approximately 700 units would need to be running at ¾ capacity. With natural gas rates in Minnesota remaining consistently lower than electric rates, the option of using natural gas to produce electricity at the source of consumption appears more attractive. Because electricity is billed in kilowatt hours (kWh) and natural gas in therms, it can be challenging to compare costs. Below is a graph created by Centerpoint energy comparing natural gas to electricity prices which illustrates natural gas prices are consistently two to three times lower than electric prices.



"Natural Gas and Electricity (Texas)." *CenterPoint Energy*. Web. 06 Nov. 2010. <http://www.centerpointenergy.com/services/naturalgas/business/naturalgasprices/energycostcomparison/715d4f5b7a1c3110VgnVCM10000001a10d0aRCRD/TX/>.

Financing Mechanism: This product does not fit any current subsidy, rebate, or grant currently.

Behavioral Changes

The following information was taken from a Cooperative Energy Futures (CEF) study done by the Humphrey Institute at the University of Minnesota. The information describes how altering residential behavior in South Minneapolis could enable the area to save on energy use and costs.

Name of Technology/Practice: Feedback devices

Producer/Source of this Technology/Practice: PowerCost Monitors

Description of this Technology/Practice: Devices that give continuous feedback on a home's energy use, either for the whole home or specific appliances, telling the consumer how much electricity they are using

Upfront cost of this Technology/Practice: $109

Peak Demand Reduction: Depends on the technology providing the electricity, used in combination with the feedback device

Long-term savings/production: 6.5% savings; Estimating a $1000 annual electricity cost per household, this would save $65 each year in every household, or $5,475,600 saved for the whole focus study area, assuming participation from all households.

Applicable conditions: Possible in any home

Maximum Technical Potential for the Focused Study Area: Could potentially be implemented in all 84,240 homes in South Minneapolis. This would cost $9,182,160.

Financing Mechanisms: Xcel's Business Energy Efficiency Rebate Program (pg. 30), Minnesota Energy Efficiency Loan Program (pg. 37), Community Fix-Up Fund Loan Program (pg. 38), Minnesota Rental Energy Loan (pg. 40), Minnesota Home Energy Loan Program (pg. 40), Weatherization Assistance Program (pg. 43), Residential Renewable Energy Tax Credit (pg. 44), Energy Efficiency Mortgage Programs (pg. 47), Low Income Home Energy Assistance Program (pg. 46)

Feedback Devices

Name of Technology/Practice: Feedback devices

Producer/Source of this Technology/Practice: the Energy Detective (TED)

Description of this Technology/Practice: Devices that give continuous feedback on a home's energy use, either for the whole home or specific appliances, telling the consumer how much electricity they are using

Upfront cost of this Technology/Practice: $119.95-$455.80

Peak Demand Reduction: Depends on the technology providing the electricity, used in combination with the feedback device

Long-term savings/production: 7% savings; study showed range of 9.5% increase in energy use to 27.9% savings; most effective use of feedback devices was by people most interested in saving money or lowering their energy consumption ; Assuming a $1000 annual electricity cost per household and using the 7% savings estimate, each home could save $70 annually, or $5,896,800 saved for the whole study area each year.

Applicable conditions: Possible in all homes

Maximum Technical Potential for the Focused Study Area: Could be implemented in all homes at a total cost ranging from $10,104,588 to 38,396,592 depending on the specific model installed.

Financing Mechanisms: Xcel's Business Energy Efficiency Rebate Program (pg. 30), Minnesota Energy Efficiency Loan Program (pg. 37), Community Fix-Up Fund Loan Program (pg. 38), Minnesota Rental Energy Loan (pg. 40), Minnesota Home Energy Loan Program (pg. 40), Weatherization Assistance Program (pg. 43), Residential Renewable Energy Tax Credit (pg. 44), Energy Efficiency Mortgage Programs (pg. 47), Low Income Home Energy Assistance Program (pg. 46)

Types of Feedback (may pertain to feedback in the form of feedback devices, such as the Energy Detective and PowerCost Monitors, or other mechanisms of informing consumers of their energy use patterns, such as providing this information on bills or in mailings.)**:**

Historical Feedback: compares consumer's current electricity use with past use, savings of 5-10%

Predictive feedback: analyzes one's current energy use in order to estimate how much energy one could be expected to use – 10.5% energy use reduction

Normative feedback: telling people their neighbors are conserving energy – 10% savings

Goal-setting: effective for both individuals and groups; difficult goal – 15.1% savings, easy goal – about 6% savings

Feedback combined with tailored advice: 3-12% energy use reduction

Economic incentives are more effective than feedback information

Feedback is most effective when it is more frequent and more persistent; when comparative data is used; when used in coordination with advice, social norms, historical information, or goal-setting; when information comes from a credible source; when the information is easy to understand/accessible/attractive; when feedback is tailored to meet the needs of the community; and when consumers are included/consulted throughout the design process.

Limitations to feedback benefits: cost, political and policy system that is hesitant to target people's behavior, behavior change does not last/is not sustainable, design may influence people to behave less sustainably, must be paired with other mechanisms/cannot be used in isolation

Smart-metering used in combination with demand response programs: provide incentives for modifying electricity consumption; allows consumers to know when energy is most costly (during peak times) and adjust their consumption accordingly **Peak reduction possibility

> **Cost:** in CA $1.7 billion for 9.3 million devices to serve 5.1 million electric and 4.2 million gas customers (expensive)

Appendix 2: Financing Options for Transmission Alternatives

Accessing a wide variety of financing mechanisms to pay for property retrofit improvements is key to implementing new energy solutions, especially in lower income neighborhoods. Lack of disposable income, aging housing stock, and a high renter population necessitates institutional financing support to address equity in a sustainable energy future. The following research explores a number of governmental and private financing opportunities for South Minneapolis and potentially for other communities in the State of Minnesota. Solutions will not lie in one single rebate or grant, but rather syncing multiple options to pay for both deep and surface level investments. We would like to clarify that Xcel Energy is not opposed to alternative options that would meet the energy demand within the focus area. They have been a leading partner in providing a variety of point source production and energy efficiency improvements, but all the options available to date are not enough for wide-scale neighborhood adoption.

Xcel Energy Rebates

Name of the Financing/Funding Option: Xcel Energy's Solar Rewards Program

Description of what it is/does: Xcel Energy's Solar Rewards Program provides an

incentive for residential and commercial customers that install grid-connected photovoltaic (PV) systems of at least 0.5 kilowatts (kW) and less than 40 kW. Systems larger than 40 kW do not qualify for the program. The incentive takes the form of an up-front rebate of $2.25 per watt In exchange for the up-front incentive, the customer is required to enter into a 20-year contract with Xcel Energy that transfers ownership of all renewable energy credits (RECs) produced by the system to the utility during the life of the contract.

Who offers it: Xcel Energy Minnesota

Who is eligible to receive it/ criteria for receiving it?:

·Applicants must be residential or commercial Minnesota Xcel Energy electric customers.

· Applicants must own the property/building on which the PV system will be installed.

· Applicants must have requested or received an energy audit from Xcel Energy within the past three years.

· For Residential Applications: The house has received an Xcel Energy Home Energy Audit within the past three (3) years, or the home was built to meet the Energy Star Homes Program certification. To schedule a residential audit call 1-800-895-4999.

- Participants must be Xcel Energy electricity customers in Minnesota with an unshaded south, east or west-facing roof in good condition, and they must agree to have the system interconnected to the grid. This program applies to photovoltaic generating systems only.

For Business/Commercial Applications:

The building has participated in an Xcel Energy On-Site Energy Assessment within the past three (3) years, or has participated in one of the following Xcel Energy programs; Commercial Real Estate Efficiency, Energy Design Assistance, Energy Efficient Buildings or Recommissioning.

·The system size must be between 0.5 and 40.00kW. Systems that are slightly over 40.00kW (even 40.01kW) do not qualify.

·Applicants must sign a 20-year contract and pay a $250 application fee

What technologies and practices are eligible to be funded by it: Minnesota

made Photovoltaic Solar Panel. For "Minnesota Made" systems, must be installed, or reviewed and approved, by a person certified as a solar photovoltaic installer by the by North American Board of Certified Energy Practitioners.

What is the interest rate and term: In return for the rebate check, Xcel would

require Solar*Rewards program participants to transfer their Renewable Energy Credits to the utility for a period of 20 years

What is the available amount per project: Through Solar*Rewards, Xcel Energy

will offer a one-time solar rebate of $2.25 per installed watt of generating capacity for solar panel installations from 0.5 to 40 kilowatts in size. A 3.5-kilowatt installation, for example, would receive a $7,875 incentive payment—and that's not including pre-existing state & federal incentives. In return for the rebate check, Xcel would require Solar*Rewards program participants to transfer their Renewable Energy Credits to the utility for a period of 20 years—a small amount to ask for a future of lower electricity bills.

Is there any limit/ceiling on its availability, or a deadline for it:

State funding for the program will be until 2015

Are there any additional benefits in terms of risk reduction and community

benefits: Since Xcel Energy does not own or insure the PV system, they require proof of $300,000 in liability insurance per system occurrence for personal or property damage that may result from the installation, operation or maintenance of the system. The customer must maintain this level of insurance during the term of the Solar*Rewards contract.

Business Energy Efficiency Rebate Programs

Name of the Financing/Funding Option: Business Energy Efficiency Rebate Programs

Description of what it is/does: Xcel Energy offers its Minnesota commercial

customers a variety of rebates for energy efficient appliances and alternative energy technologies. The incentive amounts for specified technologies can be found at the program website. In addition, Xcel offers design assistance and occasional financing for energy efficient buildings.

Xcel Energy also offers a Saver's Switch program for commercial customers to encourage curtailment of energy usage during peak periods. Customers have a device installed on their air conditioners and Xcel cycles the system on and off during periods of high energy demand. Customers who participate receive a bill credit during the summer months.

Who offers it: Xcel Energy (Gas and Electric)

Who is eligible to receive it/ criteria for receiving it: Commercial, Industrial, Nonprofit, Local Government, Construction, State Government

What technologies and practices are eligible to be funded by it: Refrigerators,

Equipment Insulation, Lighting, Lighting Controls/Sensors, Chillers, Furnaces, Boilers, Heat pumps, Central Air conditioners, Heat recovery, Steam-system upgrades, Compressed air, Programmable Thermostats, Energy Mgmt. Systems/Building Controls, Roofs, Motors, Motor-ASDs/VSDs, Processing and Manufacturing Equipment, Comprehensive Measures/Whole Building, Custom/Others pending approval, Led Exit Signs, Vending Machine Controls, Data Center Equipment, Optimization Studies, Recommissioning

What is the interest rate and term: N/A

What is the available amount per project:

Energy Design Assistance: free + construction incentives at $300/kW and $5/Dth
Compressed Air Studies: $2,500-$20,000, based on HP
No-loss air drains: $200/CFM
Compressors with integrated drives: $4,000–$4,500 (10–49 hp)
A/C and Heat Pumps: $75/ton plus $5/ton for greater efficiency
Chillers: $8-$15/ton plus $1.50-$2/ton per FLV + $0.75-$1.50/ton per IPLV for greater efficiency
Economizers: $20/ton
Hotel room controllers: $75/unit
Furnaces: $100-$250
Boilers: $500-$3,500/MMBTUH
Boiler Controls and Traps: 25%
Pipe Insulation: $2-$4/linear foot/inch of pipe
Low-Wattage 4-foot fluorescent T8 lamps: $1/lamp
Fluorescent T8/T5 lamps with electronic ballasts: $18–$28
High-bay fluorescent T8/T5 Lamps: $85–$175
Hardwired or Modular CFLs: $4–$35

Metal halide fixtures: $25–$120
Occupancy sensors and photocells: $25–$50
LED lights/signs $25–$50
Motors and Drives: $400–$8,000, varies by HP
Constant Speed Motor Controllers: $10/HP
Vending Machines: $50
Efficiency Studies, Recommissioning and Tune Ups: 75%
Electric Rate Savings Peak Control: $2.17-$5.30/kW of controllable load

Is there any limit/ceiling on its availability, or a deadline for it: When financing

ends in 2015 from Minnesota Statute 116C. 7791

Are there any additional benefits in terms of risk reduction and community

benefit: N/A

Gas and Electric: Residential and Energy Efficiency Rebate Program

Name of the Financing/Funding Option: (Gas and Electric) – Residential Energy Efficiency Rebate Programs

Description of what it is/does: Utility Rebate Program -In addition to home energy

audits, Xcel Energy offers rebates to its Minnesota residential customers for the purchase of energy efficient heating and cooling systems. Residential customers may also qualify for the Home Performance Rebate Program. In order to receive incentives participants must be both natural gas and electric Minnesota residential customers.

Xcel Energy also offers the residential Saver's Switch program. Residents receive a bill credit during the summer months in exchange for agreeing to have their air conditioning systems cycled on and off during peak energy demand periods.

Home Performance Rebate with ENERGY STAR requires a $35 audit before measures can be implemented and refunded. The Home Performance Rebate/Audit with ENERGY STAR Program provides $50-$150 higher incentives for furnaces, boilers, A/C, and water heaters than does the Heating and Cooling Rebates Program. More information, including specific equipment requirements, a list of registered contractors, and application materials can be found on the program website listed above.

Who offers it: Xcel Energy

Who is eligible to receive it/ criteria for receiving it: Minnesota Residential Customers

What technologies and practices are eligible to be funded by it:

Central A/C: $225-$475
Air-source Heat Pumps: $180-$330
Geothermal Heat Pumps: $150/ton
Natural Gas Furnaces: $100-$325
Boilers: $100 or $250 with Home Performance Rebates
Water Heaters: $120-$250(standard); $400-$450 (tankless)
Air Sealing/Weatherstripping: $60
Attic Insulation: $350
Wall Insulation: $400
CFLs: $40
Clothes Washer: $50
Dishwasher: $15
ECM Fan: $100
Refrigerator: $15
Refrigerator Recycling : $35
Occupancy Sensor: $60
Programmable Thermostat: $10

Savers Switch A/C Cycling: 15% off your electric energy and fuel cost charges from June through September

What is the interest rate and term: N/A

What is the available amount per project: Customers receive a reduced priced energy audit, and then implement at least five energy efficiency improvements: three mandatory and two optional. The rebate amount will then depend on the measures chosen.

Is there any limit/ceiling on its availability, or a deadline for it: The Home Performance Rebate Program with audit provides $50-$150 higher incentives for furnaces, boilers, A/C, and water heaters than does the Heating and Cooling Rebates Program. Insulation and Air Sealing/Weatherstripping: 20% of install cost up to rebate amount

Are there any additional benefits in terms of risk reduction and community benefit: N/A

Home Energy Audits

Name of the Financing/Funding Option: Home Energy Audits

Description of what it is/does:

Standard Audit with Infrared

- Everything from the Home Walkthrough and Standard Audit
- The infrared test, which gives a better idea of what is happening behind your drywall and areas that can't be seen.
- Scan of the walls and ceilings.
- View of temperature differences to see where insulation is present, missing or where the insulation is just not working effectively.
- The development of more customized solutions to address air leaks, the elimination of ice dams and reduction of overall conditioned air loss and energy consumption.

Standard Audit

- Everything from the Home Walkthrough
- The blower door diagnostic tool to determine how much air your home loses, each hour, through the various air leaks.
- This air needs to be reheated or recooled, increasing your energy bills.

Home Walthrough

- Comprehensive whole house inspection
- Thorough inspection of home's exterior, such as windows and doors, to identify problem areas
- Analysis of insulation levels throughout the home
- Examination of age, efficiency, and general condition of your mechanical systems
- Carbon monoxide test
- Basic analysis of your utility bills

Who offers it: Xcel Energy

Who is eligible to receive it/ criteria for receiving it: Minnesota natural gas and/or electric customers of Xcel Energy

What technologies and practices are eligible to be funded by it: N/A

What is the interest rate and term: N/A

What is the available amount per project:

Xcel Energy offers home energy audits to its residential customers at a substantial discount. The prices listed are up to 70% less than market value.

Home Walkthrough: $30 Standard Audit: $60 Standard Audit With Infrared: $100

Is there any limit/ceiling on its availability, or a deadline for it: N/A

Are there any additional benefits in terms of risk reduction and community benefit:

An expert auditor reviews of your attic, insulation, doors, windows, furnace or boiler, appliances and more and then identifies energy wasters, such as:

- Drafty windows
- Insufficient insulation
- Humidity problems
- Inefficient appliances
- Poor ventilation
- Inefficient heating and cooling systems

Once you know the problem areas, we have programs to help you make improvements. You get a more comfortable home, lower energy bills and a smaller carbon footprint.

Centerpoint Energy (Gas)

Name of the Financing/Funding Option: Commercial Energy Efficiency Rebate Program

Description of what it is/does: Utility Rebate Program - CenterPoint Energy offers

rebates on a variety of energy efficient equipment to its business customers in Minnesota. This includes boilers, furnaces, tune-ups, system controls, infrared heaters, food service equipment, water heaters as well as a custom rebate. CenterPoint Energy's rebate programs make it easier to install higher efficiency equipment for greater energy savings and improved performance. Operating cost over the life of these efficient products will save customers money in addition to the rebates which may be received through this program. The rebate must be applied for during the calendar year in which the equipment was installed. Locations receiving rebates on equipment must be heated with natural gas from CenterPoint Energy. Rebates should be received by December 15 of the current calendar year. See program web site and application forms for more information.

Who offers it: CenterPoint Energy

Who is eligible to receive it/ criteria for receiving it: Commercial/Industrial

Centerpoint Customers

What technologies and practices are eligible to be funded by it:

Boilers: varies, see rebate schedule
Boiler Tune-Ups: 25% of cost up to $200 - $300/boiler
Boiler Components:
-Commercial Boiler Turbulator: 35% of cost
-Fully Modulating Boiler Burner: $450/MMBtu
-Stack Damper: $250/MMBtu
-Boiler Reset Control: $150/control system
-Boiler Cut-out Control- $150/control system
Burners: $1,000 per 1MM Btu
Steam Trap Replacement: 35% of equipment cost
Booster Water Heaters: $500 per unit
Infrared Upright Broilers: $600 per unit
Infrared Charbroilers: $300 per unit
Combination Ovens: $1,000 per unit
Conveyor Ovens: $750 per unit
Dishwasher: $750 per unit
Fryers: $250 per unit
Pasta Cookers: $200 per unit
Rotating Rack/Rotisserie Ovens: $500 per unit
Infrared Salamander Broilers: $150 per unit
Steam Equipment: $200
Forced-Air Furnace: $150 - $400 per unit
Infrared Heaters: $250 per unit
Unit Heaters: $300 per unit

Water Heaters: $200 - $400, depending on system size
Custom Rebate: Up to $5,000 in engineering assistance
Equipment Not Listed: Case by case basis, up to $50,000 per system

Equipment Requirement:

Boilers: Efficiency Rating of 83% or higher; see rebate schedule
Burners: New or Retrofit; Fully modulating or 6-step modulation required
Steam Trap Replacement: Retrofit only
Boiler Tune-Ups: 2.5 MM Btu or less are eligible for $200/boiler and $1,000 facility cap; 2.5 MM Btu or more are eligible for $300/boiler and $1,500 facility cap
Furnace: AFUE 92% or higher
Unit Heaters: 83% thermal efficiency or higher
Infrared Heaters: New or Retrofit, Low intensity tube type
Water Heaters: 88% or greater condensing efficiency

What is the interest rate and term: N/A

What is the available amount per project:

Boilers, Burners: 25% of equipment cost
Steam Trap Replacement: Up to $10,000 per building
Boiler Tune-Ups: $1,000 - $1,500 cap per facility
Infrared Heaters: $1,000 per unit cap
Unit Heaters: 25% of equipment cost

Is there any limit/ceiling on its availability, or a deadline for it:

December 15, 2010

Maximum Incentive:

Boilers, Burners: 25% of equipment cost
Steam Trap Replacement: Up to $10,000 per building
Boiler Tune-Ups: $1,000 - $1,500 cap per facility
Infrared Heaters: $1,000 per unit cap
Unit Heaters: 25% of equipment cost

Are there any additional benefits in terms of risk reduction and community benefit: N/A

Centerpoint Energy (Gas) - Residential Energy Efficiency Rebate

Name of the Financing/Funding Option: Centerpoint Energy (Gas) - Residential Energy Efficiency Rebate Program

Description of what it is/does:

CenterPoint Energy offers residential high-efficiency heating system and water heater rebates to their Minnesota customers. These systems can greatly enhance savings and performance in residences, which install high efficiency equipment. All equipment requirements must be met in order to receive rebate. Monetary incentives are also available to dealers through this program. Every time a qualifying rebate listing a dealer is processed, that dealer will receive $15. Forms must be turned in by Dec 31 of the current calendar year. See program web site and application forms for other program details.

Who offers it: Centerpoint Energy

Who is eligible to receive it/ criteria for receiving it: Centerpoint Energy

Residential customers

What technologies and practices are eligible to be funded by it:

Forced Air Furnaces: $150-$400
Boiler: $300
Condensing Boiler: $500
Water Heater: $70-$100
Indirect Water Heater: $200
Programmable Thermostat Installation: $25
Air Sealing/Insulation: 50% of cost

Equipment Requirements:

Forced Air Furnaces: 92%-93.9% AFUE ($150), 94%-95.9% AFUE ($300), 96% AFUE and higher ($400)
Boiler: 83.5% AFUE and higher
Condensing Boiler: 91% AFUE or higher
Water Heater: 0.62 EF and higher ($70), 0.64 EF and higher ($85), 0.67 EF and higher ($100)
Indirect Water Heater: Installed with an 91% AFUE or higher condensing boiler
Qualifying equipment includes atmospheric, power or direct vent models. Tankless models do not qualify

What is the interest rate and term: N/A

What is the available amount per project:

Forced Air Furnaces: $150-$400
Boiler: $300

Condensing Boiler: $500
Water Heater: $70-$100
Indirect Water Heater: $200
Programmable Thermostat Installation: $25
Air Sealing/Insulation: 50% of cost – Maximum incentive $400

Is there any limit/ceiling on its availability, or a deadline for it: Program year is from 1/1/2010 through 12/31/2010. Applications must be submitted within 90 days of installation and be post-marked by Dec. 31 of that program year

Are there any additional benefits in terms of risk reduction and community benefit: N/A

Minnesota/MINNEAPOLIS Government Funds

The Minnesota Energy Efficiency Loan Programs

Name of the Financing/Funding Option: The Minnesota Energy Efficiency Loan Programs

Description of what it is/does: The Minnesota Energy Loan is a low-interest

financing tool for energy improvements and general home remodeling. The Neighborhood Energy Connection requires an energy auditor to examine your home, potentially at a reduced cost if you're an Xcel gas customer, under the condition that you implement one of the suggestions identified in their written report. The auditor will evaluate your energy consumption history, and diagnose areas for energy improvements, including attic, exterior walls, windows, basement, furnace, air conditioner and hot water heater.

Who offers it: Neighborhood Energy Connection/ The state of Minnesota

Who is eligible to receive it/ criteria for receiving it: Residences such as single-family homes, duplexes, and quads qualify. $96,600 is the maximum household income that would qualify for the loan.

What technologies and practices are eligible to be funded by it: The loan

program will finance new renewable energy systems, including equipment for geothermal heating/cooling; solar hot water heaters, photovoltaic/solar electric, and more

What is the interest rate and term: 5.750% Fixed Rate and repayment is figured at $1,000 per year

What is the available amount per project: While no minimum amount was

included, $35,000 is the maximum loan amount that will be issued.

Is there any limit/ceiling on its availability, or a deadline for it: N/A

Are there any additional benefits in terms of risk reduction and community benefit: All Minnesota Energy Loans are secured by a mortgage on the property, which could benefit renters.

CITATION: "Energy Improvement Financing." *Neighborhood Energy Connection*. Web. 06 Nov. 2010. <http://www.thenec.org/energy_financing/index.php?strWebAction=article_detail&intArticleID=222>.

Community Fix-UP fund Loan Program

Name of the Financing/Funding Option: Community Fix-UP fund Loan Program

Description of what it is/does: Allows improvements to the livability, accessibility, or energy efficiency of a home are eligible, such as a new furnace, air conditioning, electrical wiring, a new roof a garage, septic repairs, and many other repairs of remodeling.

Who offers it: Minnesota Housing Finance agency

Who is eligible to receive it/ criteria for receiving it:

- Household income at or below $96,600 (the income limit may be waived if the improvements are being made for the accessibility of a family member with a disability).
- Property must be owner-occupied.
- Single family homes, duplexes, triplexes or four-plexes are eligible.

What technologies and practices are eligible to be funded by it:

Most improvements to the accessibility or energy efficiency of a home, or general repairs are eligible, but homeowners may also finance renewable energy improvements. These include solar thermal, solar electric and wind turbines/generators.

What is the interest rate and term:

Maximum loan term of 10 or 20 years based on loan amount.

Fixed interest rate 5.99%

What is the available amount per project: Maximum loan 35,000

Is there any limit/ceiling on its availability, or a deadline for it: N/A

Are there any additional benefits in terms of risk reduction and community benefit:

Fix-up Fund borrowers who complete eligible energy saving home improvements with their loan proceeds may be eligible for a rebate for a portion of the cost of the eligible improvements that were financed with a Fix-up Fund loan, up to a maximum of $10,000. *There is a limit of one Energy Saver Rebate per household.*

Eligible Energy Saver Rebate Improvements:
35% Rebate:

- Replacement furnaces, boilers, and central air conditioners that meet criteria for Federal Tax Credit for Energy Efficiency
- Energy Star light fixtures
- Attic air sealing
- Wall and attic insulation in conjunction with attic air sealing
- Water heaters if “orphaned” due to furnace replacement

25% Rebate:

- Energy Star replacement windows

- Replacement exterior doors that meet criteria for Federal Tax Credit for Energy Efficiency
-

Citation:

"Fix-up Fund & Community Fix-up Fund Program." *Minnesota Housing Finance Agency*.

Web. 06 Nov. 2010.

<http://www.mnhousing.gov/partners/lenders/programs/MHFA_001236.aspx>.

Name of the Financing/Funding Option: Façade Improvement Matching Grant

Program

Description of what it is/does: The Great Streets Program of Minneapolis is

offering a façade improvement matching grant, designed to help create healthy commercial areas by providing incentives to improve the appearance of building facades and to stimulate private investment

Who offers it: The City of Minneapolis Great Streets Neighborhood Business District Program

Who is eligible to receive it/ criteria for receiving it: Building owners and

commercial tenants (with property owner's approval) can apply for the grant if they are located within an eligible business district and if the façade improvements are for commercial businesses or commercial buildings, i.e. retail or office use. For-profit and non-profit entities are eligible to apply, as long as the grant is used for a commercial building. Most commercial uses are retail and office; however, other uses may qualify, such as day care centers. Mixed-use buildings are eligible for the commercial portion for the building**.**

What technologies and practices are eligible to be funded by it:

PROGRAM NOT ELIGIBLE

What is the interest rate and term:

What is the available amount per project:

Is there any limit/ceiling on its availability, or a deadline for it:

Are there any additional benefits in terms of risk reduction and community benefit:

CITATION:"Façade Improvement Matching Grant Program." City of Minneapolis, Minnesota. Web. 06 Nov. 2010. <http://www.ci.minneapolis.mn.us/cped/Facade_Improv_Matching_Grant_Program.asp>.

Solar Sales Tax Exemption

Name of the Financing/Funding Option: Solar Sales Tax Exemption
http://www.state.mn.us/portal/mn/jsp/content.do?id=-536893811&subchannel=null&sc2=null&sc3=null&contentid=536885915&contenttype=EDITORIAL&programid=536917401&agency=Energy#Solar

Description of what it is/does: In Minnesota, solar-energy systems purchased on or after August 1, 2005, are exempt from the state's sales tax.

Who offers it: State of Minnesota

Who is eligible to receive it/ criteria for receiving it: Buyers must complete Minnesota Department of Revenue Form ST3 "Certificate of Exemption" in order to claim the exemption. Sellers are required to keep the form in their files for tax reference.

What technologies and practices are eligible to be funded by it: Solar energy systems are defined as "a set of devices whose primary purpose is to collect solar energy and convert and store it for useful purposes including heating and cooling buildings or other energy-using processes." Thus the exemption is very broad and could apply to solar electric (PV) systems, solar water-heating systems and solar space-heating systems. All components of these systems are exempt, including panels, wiring, pipes, pumps and racks.

What is the interest rate and term: Must be purchased after August of 2005.

What is the available amount per project: The cost of the appliance

Is there any limit/ceiling on its availability, or a deadline for it: This incentive has no expiration date.

Are there any additional benefits in terms of risk reduction and community benefit: N/A

Rental Energy Loan

Name of the Financing/Funding Option: Rental Energy Loan
http://www.mncee.org/programs_residential/rental_rehab_financing/rental_energy_loan_fund/index.php

Description of what it is/does: The Rental Energy Loan Fund provides financial assistance to owners of residential rental properties to increase the energy efficiency of their buildings. It is designed to assist owners in bringing the property into compliance with the Rental Energy Efficiency Standards.

Who offers it: The fund is run by the Center for Energy and Environment's Financial Resources, and is sponsored by the Minnesota Department of Commerce.

Who is eligible to receive it/ criteria for receiving it: The program is not restricted to low-income owners, and covers a wide range of efficiency improvements for a property. Borrowers must own the property or be purchasing it through a mortgage or contract for deed. The property must contain at least one rental dwelling unit and have been built prior to May 1, 1989.

What technologies and practices are eligible to be funded by it: N/A

What is the interest rate and term: The maximum term for this loan program is 5 years. The interest rate on all loans is 4.0% and there are no penalties for prepayment.

What is the available amount per project: The maximum loan under this program is $10,000

Is there any limit/ceiling on its availability, or a deadline for it: The loans will not cover improvements made prior to the date of loan application.

Are there any additional benefits in terms of risk reduction and community benefit: On-site building and analysis as well as prioritization, decision-making, and submission assistance are also provided.

Home Energy Loan Program

Name of the Financing/Funding Option: Home Energy Loan Program
http://www.mncee.org/programs_residential/home_improvement_financing/home_energy_loan_program/index.php

Description of what it is/does: The Home Energy Loan Program offers low interest loans to homeowners who want to make energy improvements to their properties.

Who offers it: A statewide program of the Minnesota Housing Finance Agency administered by the Center for Energy and Environment Financial Resources.

Who is eligible to receive it/ criteria for receiving it: The property should be single-family (1-4 units) residential, but up to 49% of the residence can be used for business. Eligible property must have been built prior to May 1, 1989. There is no maximum annual household income limit, but borrowers must own the property or be purchasing it through mortgage or contract for deed.

What technologies and practices are eligible to be funded by it: Eligible improvements include water heaters, furnaces, air conditioners, building insulation, storm windows, and storm doors. Custom improvements may be eligible as well as determined by the program administrator.

What is the interest rate and term: Interest rate: 5.99% and term of 5 years

What is the available amount per project: Maximum loan amount is $10,000

Is there any limit/ceiling on its availability, or a deadline for it: N/A

Are there any additional benefits in terms of risk reduction and community benefit: All loans will be secured by a mortgage

Property-Assessed Clean Energy (PACE)

Name of the Financing/Funding Option: **Property-Assessed Clean Energy (PACE)**

http://www1.eere.energy.gov/wip/pdfs/arra_guidelines_for_pilot_pace_programs.pdf

Description of what it is/does: PACE financing effectively allows property owners to borrow money to pay for energy improvements. The amount borrowed is typically repaid via a special assessment on the property over a period of years.

Who offers it: In April 2010, Minnesota enacted legislation (H.F. 2695) allowing cities (home-rule, charter or statutory), counties and towns to offer PACE financing programs that provide loans to local residents for energy conservation improvements, including certain renewable energy systems. Subsequent legislation (S.F. 3729) allows a local government to designate another authority -- the "implementing entity" -- to implement such a program. This could include a housing and redevelopment authority, economic development authority, port authority, or another entity permitted by law to exercise the powers of an authority. The authorizing laws sets a series of rules governing these local programs, but some details are left to the local government that establishes a program.

Who is eligible to receive it/ criteria for receiving it: Qualifying properties are defined as residential, multi-family residential, commercial, or industrial properties, which would benefit from energy conservation improvements based on the results of a formal energy audit or renewable energy feasibility study.

What technologies and practices are eligible to be funded by it: Renewable energy is defined to include solar thermal, photovoltaic (PV), wind, and geothermal energy systems that generate electrical or thermal energy. Eligible solar thermal systems generally includes both water and space heating systems except for residential systems (1) that provide less than half of the energy used for that purpose in the home or (2) which are used to heat a hot tub or pool. All renewable energy systems must be used for on-site energy needs. Energy generated by the system may not be sold, transmitted, or distributed at retail or be used to power an off-site facility. The law appears to limit on-site generating capacity to 10 MW (the limit defined in Minn Stat. 216B.1611 describing standardized interconnection procedures). Other qualified improvements include energy efficiency measures which are permanently affixed to the property and which result in a net reduction of energy consumption, and equipment which enables electric vehicle charging.

What is the interest rate and term: Under the state law, implementing entities must set loan maturities at the weighted average of the useful life of improvements made to the property, not to exceed 20 years. Interest rates are locally determined, but must be sufficient to cover program costs, including the issuance of bonds and any financing delinquencies. Loans amounts may not exceed 10% of the assessed value of the property and may include costs related to the required energy audit or feasibility study, equipment and labor costs, and performance verification. At least ten percent of the improvements financed by the program must be inspected and verified by the implementing entity. Loans must be secured with a lien against the property and must be coordinated with the Conservation Improvement Program (CIP) of the utility serving the property. Implementing entities may limit the number of properties for which a qualifying

owner may receive financing.

What is the available amount per project: dependent upon Minnesota legislatures.

Is there any limit/ceiling on its availability, or a deadline for it: PACE at the residential level is moving very slowly, so there are considerable obstacles.

Are there any additional benefits in terms of risk reduction and community benefit: Implementing entities are permitted to issue revenue bonds to initially fund a program. Proceeds from loan repayments, in the form of special assessments on participating properties, will be used to service bond principal and interest. The special assessment runs with the property in the event ownership of the property changes during the term of the loan.

St. Paul Port Authority Trillion BTU Program

Name of the Financing/Funding Option: St. Paul Port Authority Trillion BTU Program
http://www.positivelyminnesota.com/Calendar_of_Events/Development_Conference/Presentations/DEV-Financing_Energy_Improvements.pdf

*Look up 2010 Progress Report on the Recovery Funds in MN:

http://www.state.mn.us/mn/externalDocs/Commerce/Funding_Progress_Report_September_2010_092010040301_ARRAProgressReportSept2010.pdf

Description of what it is/does: Funded by the American Recovery and Reinvestment Act of 2009 (ARRA), the St. Paul Port Authority grant represents the largest single stimulus-funded contract awarded by OES with State Energy Program funds to date. The St. Paul Port Authority will leverage economic development funds and Conservation Improvement Plan (CIP) funds to create a $10 million dollar revolving loan fund for energy efficiency and cost effective renewable energy improvements for commercial and industrial buildings. The $5 million grant from OES, coupled with other sources of funding, will help fund the St. Paul Port Authority's Trillion Btu Program. This innovative and market-based approach provides another opportunity for businesses to reduce energy costs while creating economic stimulus and helping the State reach its energy objectives.

Who offers it: The Minnesota Department of Commerce's Office of Energy Security (OES)

Who is eligible to receive it/ criteria for receiving it: It's also the first ARRA-funded contract issued by OES to target the commercial and industrial sector.

What technologies and practices are eligible to be funded by it: N/A

What is the interest rate and term: N/A

What is the available amount per project: $10 million

Is there any limit/ceiling on its availability, or a deadline for it: N/A

Are there any additional benefits in terms of risk reduction and community benefit: The St. Paul Port Authority contract is the first in a series of grants that will target the commercial, industrial and manufacturing sectors. In December, the Office of Energy Security issued an RFP for its Energy Programs in Commercial and Industrial Buildings grant, which will provide $4.1 million to owners of commercial and industrial facilities, nonprofits and economic development agencies for energy efficiency improvements in commercial facilities.

Federal Incentives

Weatherization Assistance Program

2009 Recovery Act

Name of the Financing/Funding Option: Weatherization Assistance Program

Description of what it is/does: The Weatherization Assistance Program (WAP) enables low-income families to permanently reduce their energy bills by making their homes more energy efficient. Funds are used to improve the energy performance of dwellings of needy families using the most advanced technologies and testing protocols available in the housing industry. The U.S. Department of Energy (DOE) provides funding to states, U.S. overseas territories, and Indian tribal governments, which manage the day-to-day details of the program. These governments, in turn, fund a network of local community action agencies, nonprofit organizations, and local governments that provide these weatherization services in every state, the District of Columbia, U.S. territories, and among Native American tribes.

The energy conservation resulting from these efforts of state and local agencies helps our country reduce its dependence on foreign oil and decrease the cost of energy for families in need while improving the health and safety of their homes. During the past 33 years, WAP has provided weatherization services to more than 6.4 million low-income households. Families receiving weatherization services see their annual energy bills reduced by an average of about $437, depending on fuel prices. Because the energy improvements that make up weatherization services are long lived, the savings add up over time to substantial benefits for weatherization clients and their communities, and the nation as a whole.

Who offers it: US Department of Energy

Who is eligible to receive it/ criteria for receiving it: Any household at or below

200% of the poverty line

According to the US Department of Energy, approximately 38 million households are eligible for Weatherization services, with about 15 million of these good candidates.

What technologies and practices are eligible to be funded by it:

- Insulation
- Air Sealing
- Windows
- Heating
- Water Heaters
- Air Conditioning and Warm Climate Weatherization Measures
- Electrical Appliances and Weatherization Base Load Measures

What is the interest rate and term: N/A

What is the available amount per project: Average expenditure of $6,500 per home

Is there any limit/ceiling on its availability, or a deadline for it: Minnesota has been allocated $108, 837, 568 for the grant program. Minneapolis received $3,909,800 in the Energy Efficiency and Conservation Block Grant

Are there any additional benefits in terms of risk reduction and community benefit: N/A

Residential Renewable Energy Tax Credit

Name of the Financing/Funding Option: **Residential Renewable Energy Tax Credit**
http://www.energystar.gov/index.cfm?c=tax_credits.tx_index

Description of what it is/does: Established by the federal Energy Policy Act of 2005, the federal tax credit for residential energy property initially applied to solar-electric systems, solar water heating systems and fuel cells. The Energy Improvement and Extension Act of 2008 (H.R. 1424) extended the tax credit to small wind-energy systems and geothermal heat pumps, effective January 1, 2008. Other key revisions included an eight-year extension of the credit to December 31, 2016, the ability to take the credit against the alternative minimum tax, and the removal of the $2,000 credit limit for solar-electric systems beginning in 2009. The credit was further enhanced in February 2009 by The American Recovery and Reinvestment Act of 2009 (H.R. 1: Div. B, Sec. 1122, p. 46), which removed the maximum credit amount for all eligible technologies (except fuel cells) placed in service after 2008.

Who offers it: Federal Government

Who is eligible to receive it/ criteria for receiving it: If you purchase an energy-efficient product or renewable energy system for your home, you may be eligible for a federal tax credit.

What technologies and practices are eligible to be funded by it: The only appliances not included in the credit are: Ceiling fans, Clothes washers & dryers, Compact Fluorescent Light Bulbs (CFLs), Dehumidifiers, Dishwashers, Electric furnaces/boilers, Evaporative Coolers (swamp coolers), Lighting (Light Fixtures, CFLs, LEDs), Ovens / Ranges, Power Factor Correction Devices, Programmable thermostats, Refrigerators, Room air conditioners, TVs, and Toilets.

What is the interest rate and term: A taxpayer may claim a credit of 30% of qualified expenditures for a system that serves a dwelling unit located in the United States and used as a residence by the taxpayer. Expenditures include labor costs for onsite preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year. The excess credit can be carried forward until 2016, but it is unclear whether the unused tax credit can be carried forward after then.

What is the available amount per project: The maximum allowable credit, equipment requirements and other details vary by technology. For solar: There is no maximum credit for systems placed in service after 2008. The maximum credit is $2,000 for systems placed in service before January 1, 2009. Systems must be placed in service on or after January 1, 2006, and on or before December 31, 2016. The home served by the system does not have to be the taxpayer's principal residence.

Is there any limit/ceiling on its availability, or a deadline for it: Tax credits are available at 30% of the cost, up to 500 per .5 kW of power capacity, through 2016. Expenditures with respect to the equipment are treated as made when the installation is completed.

http://energystar.supportportal.com/ics/support/default.asp?deptID=23018&task=knowledge&questionID=24580

Are there any additional benefits in terms of risk reduction and community benefit: Note that the Solar Energy Industries Association (SEIA) has published a three-page document that provides answers to frequently asked questions regarding the federal tax credits for solar energy. Also Note: The American Recovery and Reinvestment Act of 2009 does not allow taxpayers eligible for the residential renewable energy tax credit to receive a U.S. Treasury Department grant instead of taking this credit.

Residential Energy Conservation Subsidy

Name of the Financing/Funding Option: **Residential Energy Conservation Subsidy** Exclusion
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US03F&re=1&ee=1

Description of what it is/does: According to Section 136 of the U.S. Code, energy conservation subsidies provided to customers by public utilities, either directly or indirectly, are non-taxable. This exclusion does not apply to electricity-generating systems registered as "qualifying facilities" under the Public Utility Regulatory Policies Act of 1978.

Who offers it: Federal Government

Who is eligible to receive it/ criteria for receiving it: Eligible dwelling units include houses, apartments, condominiums, mobile homes, boats and similar properties. If a building or structure contains both dwelling units and other units, any subsidy must be properly allocated.

What technologies and practices are eligible to be funded by it: The term "energy conservation measure" includes installations or modifications primarily designed to reduce consumption of electricity or natural gas, or to improve the management of energy demand.

What is the interest rate and term: N/A

What is the available amount per project: 100 percent of the subsidy.

Is there any limit/ceiling on its availability, or a deadline for it: When a taxpayer claims federal tax credits or deductions for the energy conservation property, the investment basis for the purpose of claiming the deduction or tax credit must be reduced by the value of the energy conservation subsidy (i.e., a taxpayer may not claim a tax credit for an expense that the taxpayer ultimately did not pay).

Are there any additional benefits in terms of risk reduction and community benefit: The definition of "energy conservation measure" implies that utility rebates for residential solar-thermal projects and solar-electric systems may be non-taxable. However, the IRS has not ruled definitively on this issue. Taxpayers considering using this provision for a renewable energy system should discuss the details of the project with a tax professional. *Other types of utility subsidies that may come in the form of credits or reduced rates might also be non-taxable, according to IRS Publication 525. This publication states: "If you are a customer of an electric utility company and you participate in the utility's energy conservation program, you may receive on your monthly electric bill either: a reduction in the purchase price of electricity furnished to you (rate reduction), or a nonrefundable credit against the purchase price of the electricity. The amount of the rate reduction or nonrefundable credit is not included in your income."

Low Income Home Energy Assistance Program (LIHEAP)

Name of the Financing/Funding Option: Low Income Home Energy Assistance Program (LIHEAP)

Description of what it is/does:

The mission of the Low Income Home Energy Assistance Program (LIHEAP) is to assist low income households, particularly those with the lowest incomes that pay a high proportion of household income for home energy, primarily in meeting their immediate home energy needs.

Block Grant: States, territories, and Indian tribes and tribal organizations that wish to assist low income households in meeting the costs of home energy may apply for a LIHEAP block grant. Congress established the formula for distributing funds to States based on each State's weather and low income population. Home energy is defined by statute as a source of heating or cooling in residential dwellings.

Leveraging Incentive Program: The law authorizes supplemental LIHEAP funding for grantees that acquired non-federal leveraged resources for their LIHEAP programs in the preceding fiscal year.

Residential Energy Assistance Challenge Program (REACH): The law authorizes supplemental LIHEAP funding for grantees to receive competitive grants for implementation through local community-based agencies of innovative plans to help LIHEAP eligible households reduce their energy vulnerability.

Contingency Funds: The President may release these funds to assist with the home energy needs arising from an emergency situation. They may be allocated to one or more grantees, or to all grantees, based on criteria appropriate to the nature of the emergency. In the past, the President generally has released these funds in response to emergency situations arising from extreme weather conditions or energy price increases. Generally, funds have been distributed based on the degree to which specific States are affected by the weather or energy price situation that led to the release of contingency funds.

Who offers it: US Department of Health and Human Services

Who is eligible to receive it/ criteria for receiving it:

The authorization provides that an eligible household's income must not exceed the greater of 150 percent of the poverty level or 60 percent of the State median income (In FY 2009, 75 percent of the State median income). Grantees may not set income eligibility standards below 110 percent of the poverty level, but they may give priority to those households with the highest home energy costs or needs in relation to income.

What technologies and practices are eligible to be funded by it:

- Bill payment assistance.
- Energy crisis assistance.
- Weatherization and energy-related home repairs.

What is the interest rate and term: N/A

What is the available amount per project: Not Disclosed

Is there any limit/ceiling on its availability, or a deadline for it: Deadline end of

fiscal year 2010

Are there any additional benefits in terms of risk reduction and community benefit: Created for low income communities.

FHA's Energy Efficient Mortgage program (EEM)

Name of the Financing/Funding Option:

FHA's Energy Efficient Mortgage program (EEM)

Description of what it is/does: FHA's Energy Efficient Mortgage program (EEM)

helps homebuyers or homeowners save money on utility bills by enabling them to finance the cost of adding energy efficiency features to new or existing housing as part of their FHA insured home purchase or refinancing mortgage.

Who offers it: U.S. Department of Housing and Urban Development

Who is eligible to receive it/ criteria for receiving it: All persons who meet the

income requirements for FHA's standard Section 203(b) insurance and can make the monthly mortgage payments are eligible to apply. The cost of the energy improvements and estimate of the energy savings must be determined by a home energy rating system (HERS) or an energy consultant. The cost of an energy inspection report and related fees may be included in the mortgage. Cooperative units are not eligible.

EEM can also be used with FHA's Section 203(h) program for mortgages made to victims of presidentially declared disasters. The mortgage must comply with both Section 203(h) requirements, as well as those for EEM. However, the program is limited to one unit detached houses.

What technologies and practices are eligible to be funded by it:

What is the interest rate and term: The mortgage loan amount for an FHA EEM can be increased by the cost of effective energy improvements. The maximum amount of the portion of the EEM for energy efficient improvements is the lesser of 5% of:

- the value of the property, or
- 115% of the median area price of a single family dwelling, or
- 150% of the conforming Freddie Mac limit

What is the available amount per project:

Maximum mortgage in Hennepin County (last updated 01/01/2009)

- One-family $365,000
- Two-family was $467,250
- Three-family $564,800

- Four family $701,900

Is there any limit/ceiling on its availability, or a deadline for it: There doesn't appear to be a deadline

Are there any additional benefits in terms of risk reduction and community

benefit: EEM is one of many FHA programs that insure mortgage loans--and thus encourage lenders to make mortgage credit available to borrowers who would not otherwise qualify for conventional loans on affordable terms (such as first time homebuyers) and to residents of disadvantaged neighborhoods (where mortgages may be hard to get). Borrowers who obtain FHA's popular Section 203(b) Mortgage Insurance for one to four family homes are eligible for approximately 96.5 percent financing, and are able to fold closing costs and the upfront mortgage insurance premium into the mortgage. The borrower must also pay an annual premium.

EEM can also be used with the FHA Section 203(k) rehabilitation program and generally follows that program's financing guidelines. For energy efficient housing rehabilitation activities that do not also require buying or refinancing the property, borrowers may also consider HUD's Title I Home Improvement Loan program.

Federal Stimulus American Recovery and Reinvestment Act's Multifamily Green Retrofit Program

http://portal.hud.gov/portal/page/portal/HUD/states/minnesota/news/HUDNo.2010-10-05a

203(k) rehabilitation program and generally follows that program's financing guidelines. For energy efficient housing rehabilitation activities that do not also require buying or refinancing the property, borrowers may also consider HUD's Title I Home Improvement Loan program.

Energy Efficiency Commercial Buildings Tax Deductions

Name of the Financing/Funding Option: **Energy Efficiency Commercial Buildings Tax Deductions**

http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US40F&re=1&ee=1

Description of what it is/does: The federal Energy Policy Act of 2005 established a tax deduction for energy-efficient commercial buildings applicable to qualifying systems and buildings placed in service from January 1, 2006, through December 31, 2007. This deduction was subsequently extended through 2008, and then again through 2013 by Section 303 of the federal Energy Improvement and Extension Act of 2008 (H.R. 1424, Division B), enacted in October 2008.

Who offers it: Federal Government

Who is eligible to receive it/ criteria for receiving it: The deductions are available primarily to building owners, although tenants may be eligible if they make construction expenditures. In the case of energy efficient systems installed on or in government property, tax deductions will be given to the person primarily responsible for the systems' design. Deductions are taken in the year when construction is completed.

What technologies and practices are eligible to be funded by it: A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum requirements set by ASHRAE Standard 90.1-2001. Energy savings must be calculated using qualified computer software approved by the IRS. *Deductions of $0.60 per square foot are available to owners of buildings in which individual lighting, building envelope, or heating and cooling systems meet target levels that would reasonably contribute to an overall building savings of 50% if additional systems were installed.

What is the interest rate and term: Applicable from 1/1/2006 to 12/31/2013

What is the available amount per project: Deductions of between (per square foot) $.60 - $1.80.

Is there any limit/ceiling on its availability, or a deadline for it: Deductions apply for the year in which construction of the appliances are completed.

Are there any additional benefits in terms of risk reduction and community benefit: The IRS released interim guidance (IRS Notice 2006-52) in June 2006 to establish a process to allow taxpayers to obtain a certification that the property satisfies the energy efficiency requirements contained in the statute. IRS Notice 2008-40 was issued in March of 2008 to further clarify the rules. NREL published a report (NREL/TP-550-40228) in February 2007, which provides guidelines for the modeling and inspection of energy savings required by the statute, and the US Department of Energy has compiled a list of qualified computer software for calculating commercial building energy and power cost savings.

Renewable Energy Production Incentive

Name of the Financing/Funding Option: Renewable Energy Production Incentive
http://apps1.eere.energy.gov/repi/

Description of what it is/does: Established by the federal Energy Policy Act of 1992, the federal Renewable Energy Production Incentive (REPI) provides incentive payments for electricity generated and sold by new qualifying renewable energy facilities.

Who offers it: Federal Government

Who is eligible to receive it/ criteria for receiving it: Qualifying systems are eligible for annual incentive payments of 1.5¢ per kilowatt-hour in 1993 dollars (indexed for inflation) for the first 10-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation. REPI was designed to complement the federal renewable energy production tax credit (PTC), which is available only to businesses that pay federal corporate taxes.

What technologies and practices are eligible to be funded by it: Qualifying systems must generate electricity using solar, wind, geothermal (with certain restrictions), biomass (excluding municipal solid waste), landfill gas, livestock methane, or ocean resources (including tidal, wave, current and thermal). The production payment applies only to the electricity sold to another entity. Eligible electric production facilities include not-for-profit electrical cooperatives, public utilities, state governments and political subdivisions thereof, commonwealths, territories and possessions of the United States, the District of Columbia, Indian tribal governments or political subdivisions thereof, and Native Corporations.

What is the interest rate and term: Payments may be made only for electricity generated from an eligible facility first used before October 1, 2016. Appropriations have been authorized for fiscal years 2006 through fiscal year 2026; however, program funding is determined each year as part of the U.S. Department of Energy budget process. If there are insufficient appropriations to make full payments for electricity production from all qualified systems for a federal fiscal year, 60% of the appropriated funds for the fiscal year will be assigned to facilities that use solar, wind, ocean, geothermal or closed-loop biomass technologies; and 40% of the appropriated funds for the fiscal year will be assigned to other eligible projects. Funds will be awarded on a pro rata basis, if necessary.

What is the available amount per project: Depending on the year, annual payments of $1.5 per kilowatt-hour in 1993 dollars.

Is there any limit/ceiling on its availability, or a deadline for it: The annual incentive is applicable for the first 10 years of operation.

Are there any additional benefits in terms of risk reduction and community benefit: Contact the program administrator to find out the current funding status of this program.

Façade Improvement Matching Grant Program

Name of the Financing/Funding Option: Façade Improvement Matching Grant Program

Description of what it is/does: The Great Streets Program of Minneapolis is offering a façade improvement matching grant, designed to help create healthy commercial areas by providing incentives to improve the appearance of building facades and to stimulate private investment

Who offers it: The City of Minneapolis Great Streets Neighborhood Business District Program

Who is eligible to receive it/ criteria for receiving it: Building owners and

commercial tenants (with property owner's approval) can apply for the grant if they are located within an eligible business district and if the façade improvements are for commercial businesses or commercial buildings, i.e. retail or office use. For-profit and non-profit entities are eligible to apply, as long as the grant is used for a commercial building. Most commercial uses are retail and office; however, other uses may qualify, such as day care centers. Mixed-use buildings are eligible for the commercial portion for the building**.**

What technologies and practices are eligible to be funded by it:

PROGRAM NOT ELIGIBLE

What is the interest rate and term:

What is the available amount per project:

Is there any limit/ceiling on its availability, or a deadline for it:

Are there any additional benefits in terms of risk reduction and community benefit:

For solar hot water systems, Minnesota sponsors a rebate program offering up to $2000 for residential systems and up to $25000 for commercial systems.

http://www.getsolar.com/cost_solar-energy-incentives-minnesota.php

Efficiency Vermont

Below is a summary for Efficiency Vermont, a case study for a way to provide technical advice, financial assistance and design guidance to help make Vermont homes, farms and businesses energy efficient. It is a good model for renewable energy.

"Savings in the Business New Construction and Business Existing Facilities markets for 2009 totaled 8,500 MWh and 37,500 MWh, respectively, delivering net economic benefits of $69.4 million. This significant level of savings was achieved despite an extremely challenging financial climate in which commercial access to capital for investment (even highly cost-effective investment) was severely restricted.

Efficiency Vermont savings for Residential New Construction and Existing Homes (which includes multifamily buildings) totaled 1,700 MWh and 3,000 MWh, respectively, in 2009, with reduced savings levels mirroring the national economic climate. However, savings rose over the course of the year, increasing by approximately 25% from the first quarter of 2009 to the final quarter.

In peak demand reduction, Efficiency Vermont produced significant savings: 2009 Summer peak kW 15,000 Winter peak kW 16,000 Summer Geographic Targeting peak kW 5,500

Winter Geographic Targeting peak kW 5,400 As in prior years, energy savings due to efficiency were responsible for supplying a significant share of Vermont's overall electricity requirements. Efficiency savings from measures installed in 2009 provided 1.8% of Vermont's statewide electricity requirements last year."

All directly quoted from website http://www.efficiencyvermont.com/stella/filelib/EfficiencyVermont20

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