



COMMUNITIES AND LOCAL ENERGY



Designing A Clean Energy Future: A Resource Manual

Developed for the Clean Energy Resource Teams

The Minnesota Project

University of Minnesota's Regional Sustainable Development Partnerships

Minnesota Department of Commerce

July 2003

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*Designing A Clean Energy
Future: A Resource Manual*
Developed for the Clean Energy Resource Teams

*MELISSA PAWLISCH
CARL NELSON
LOLA SCHOENRICH*

*The Minnesota Project
University of Minnesota's Regional Sustainable Development Partnerships
Minnesota Department of Commerce*

July 2003

ABOUT THIS REPORT

This report was a collaborative project of The Minnesota Project, the University of Minnesota's Regional Sustainable Development Partnerships, and the Minnesota Department of Commerce. **Melissa Paulisch** is a graduate of the Humphrey Institute of Public Affairs of the University of Minnesota. She worked on the report through a fellowship from the University of Minnesota's Regional Sustainable Development Partnerships and the Community Assistantship Project. **Carl Nelson** is a Program Manager and **Lola Schoenrich** is Senior Program Director at the Minnesota Project.

The Minnesota Project is a nonprofit organization dedicated to sustainable development and environmental protection in rural Minnesota. Since 1979, The Minnesota Project has worked to promote healthy rural communities through building broad-based coalitions, facilitating statewide, regional, and national networks, and connecting communities to resources and policy forums. Current program areas are renewable energy development, sustainable agriculture, water protection, and community sustainability.

The University of Minnesota's **Regional Sustainable Development Partnerships** bring together communities and University faculty and students to foster sustainable development in five rural regions. In collaboration with the University, citizens in these communities work through regional boards to develop innovative programs and projects that strengthen natural resources, agriculture, and tourism. Local energy and local foods are two areas of focus across regions. The Regional Partnerships program is a joint effort of University's Extension Service; the College of Agricultural, Food and Environmental Sciences; and the College of Natural Resources.

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In addition, a special thank you to all of the case study contacts who shared the stories of their communities and took special time to review them. These case studies give readers a real sense of the important work already underway in Minnesota.

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Regional Advisory Committee Members

Sigurd Anderson, Experiment in Rural Cooperation (Southeast Regional Sustainable Development Partnership)

David Benson, South West Regional Development Commission

Dick Broeker, Experiment in Rural Cooperation (Southeast Regional Sustainable Development Partnership)

Greg Cuomo, West Central Research and Outreach Center

Jon Hunter, Hennepin County – Metro Counties Energy Task Force

Linda Kingery, Northwest Regional Sustainable Development Partnership

Carl Michaud, Hennepin County – Metro Counties Energy Task Force

Mary Page, Statewide Coordinating Committee Chair, Regional Sustainable Development Partnerships

Cynthia Pansing, Statewide Coordinator, Regional Sustainable Development Partnerships

Mike Reese, West Central Research and Outreach Center

Sharon Rezac Andersen, Central Regional Sustainable Development Partnership

Dorothy Rosemeier, West Central Regional Sustainable Development Partnership

Monica Siems, Former Statewide Coordinator, Regional Sustainable Development Partnerships

Janet Streff, Minnesota Department of Commerce

Okey Ukaga, Northeast Regional Sustainable Development Partnership

Technical Committee Members

Rory Artig, Minnesota Department of Commerce

Jim Boerboom, Minnesota Department of Agriculture

Paul Burns, Minnesota Department of Agriculture

Keith Butcher, Center for Energy and Environment

Bob Cupit, Minnesota Department of Commerce

John Dunlop, American Wind Energy Association

Betsy Engleking, Great River Energy

J. Drake Hamilton, Minnesotans for an Energy-Efficient Economy

Paul Imbertson, University of Minnesota Department of Engineering

Matt Schuerger, Independent Consultant

Mike Taylor, Minnesota Department of Commerce

Doug Tiffany, University of Minnesota Department of Applied Economics

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This workbook was written for use by the Clean Energy Resource Teams and focuses on opportunities for communities to engage in energy planning regarding renewable and community energy projects. It is our hope that the workbook will be useful to a wide range of communities and a broad spectrum of audiences including local government officials, local utilities, businesses, farmers, community leaders, and individuals.

The focus of the workbook is to:

- Provide quick reference material that details potential energy alternatives and the nuts-and-bolts of implementation
- Provide detailed case studies that illustrate how similar projects have previously been done in Minnesota
- Provide bibliographical references for further resources and lists of contacts

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The following symbols are used in this book to help identify the ways in which the case studies illustrated may be of help to your community



Improves the environment



Works well with agriculture



Helps with reliability concerns



Recycles waste materials and waste heat



Offers community economic development



Improves energy independence, local control, and energy security



Promotes learning about energy

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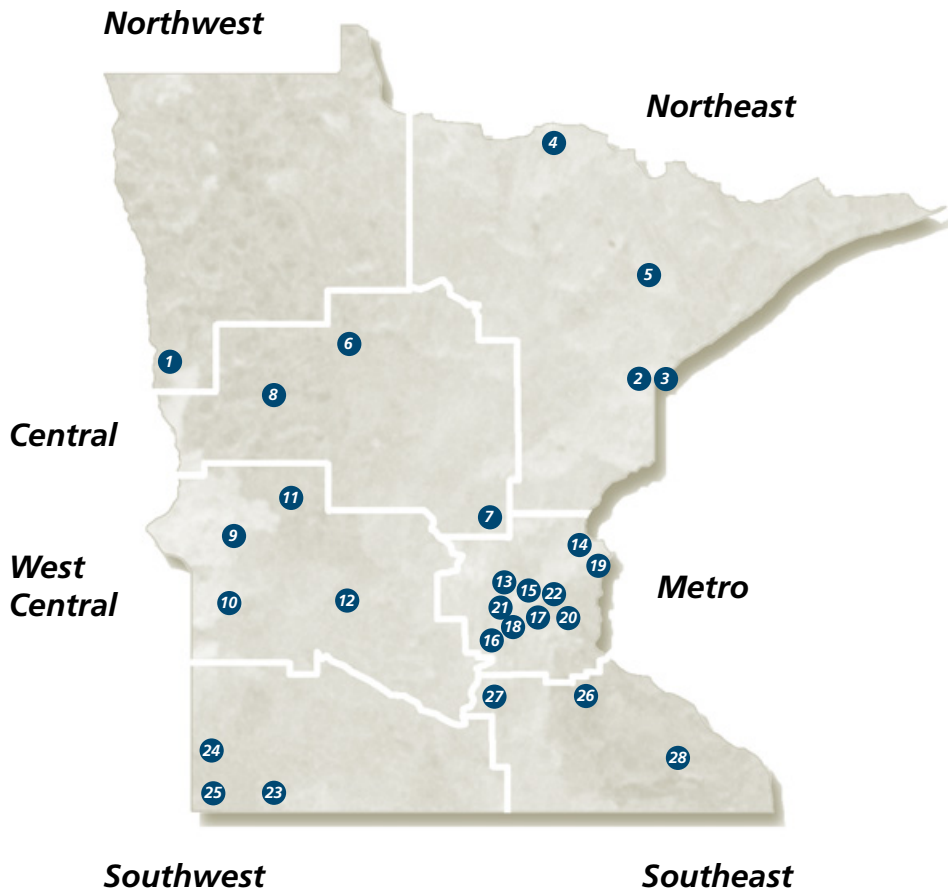
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CLEAN ENERGY RESOURCE TEAMS

HELPING MINNESOTA COMMUNITIES DETERMINE THEIR ENERGY FUTURE

A growing number of Minnesotans envision a future built upon a wide mix of renewable local energy sources – wind, biomass, solar and even hydrogen. The challenge is to bring technical resources to communities so that they can help to design this clean energy future. Many community and industry leaders interested in developing renewable energy alternatives do not have the technical background to evaluate the feasibility of potential energy projects. Community energy planning is too often piecemeal, with little linkage of strategic goals to outcomes. In addition, important stakeholders are often left out of the process.

To address these challenges, several organizations have joined together to launch an exciting and innovative project. These organizations are the Minnesota Department of Commerce, the Minnesota Project, the University of Minnesota's Regional Sustainable Development Partnerships, the Rural and Metro County Energy Task Forces, and the Resource Conservation and Development Councils. Named Clean Energy Resource Teams, or CERTS, the project seeks to engage regions and communities in planning and determining their energy futures. CERTS is patterned after the notion of regional resource management plans like county water plans.

The success of this project will rest upon the strength of collaboration between regional energy planning teams and technical resources. The regional teams will be comprised of community, industry, and government stakeholders. CERTS will match these teams with the technical expertise needed to accelerate development of renewable energy projects using local resources. The technical assistance will help the teams identify and prioritize renewable energy opportunities within their region. In this way, the regional teams will gain the knowledge and technical support needed to assess cost-effective energy options.

The outcome of the project will be a comprehensive and strategic renewable energy plan and vision for each region that reflects a mix of energy sources, such as biomass, solar, hydrogen, and wind. The plan will lay the groundwork for funding and implementing renewable energy projects that meet regional needs in a systematic and comprehensive way. CERTS is expected to begin in summer 2003.

PURPOSE OF THE WORKBOOK

This manual presents various energy technology options and discusses how communities have gone about shaping their energy future. The workbook provides users with quick reference material that details clean, local energy options as well as nuts-and-bolts for implementing community energy projects. It includes detailed case studies that describe how these projects have been implemented in the past and the level of success they have achieved. Lastly, the workbook provides lists of bibliographical references for those who wish to do more reading and research and lists of contacts for additional information.

CONTACT INFORMATION FOR CLEAN ENERGY RESOURCE TEAMS

For information about CERTS statewide coordination and technical resources, please contact:

Lola Schoenrich, Senior Program Director

Minnesota Project

651-645-6159, extension 4

lschoenrich@mnproject.org

For information about the regional CERTS resource teams and the Regional Sustainable Development Partnerships, please contact:

Cynthia Pansing, Statewide Coordinator

Regional Sustainable Development Partnerships Program

612-625-8759

pansi001@umn.edu

For more specific information about what you can do within your region, please contact:

CENTRAL

Sharon Rezac Andersen, Executive Director

Central Region Partnership

218-894-5192 or 1-877-997-7778

rezac003@umn.edu

NORTHEAST

Okey Ukaga, Executive Director

Northeast Minnesota Sustainable Development Partnership

218-879-0850 x107

ukaga001@umn.edu

NORTHWEST

Linda Kingery, Executive Director

Northwest Partnership

1-877-854-7737

lkingery@polarcomm.com

SOUTHEAST

Dick Broeker, Executive Director

Experiment in Rural Cooperation (Southeast Partnership)

651-345-4336

dbroeker@rconnect.com

SOUTHWEST

Annette Bair, Physical Development Director

Southwest Regional Development Commission

(507) 836-8547 ext. 101

phydev@swrdc.org

WEST CENTRAL

Dorothy Rosemeier, Executive Director

West Central Regional Sustainable Development Partnership

320-589-1711 or 1-866-589-1711

rosemeie@mrs.umn.edu

Introduction



Minnesota is well aligned to be a leader in energy systems that meet community energy needs, keep dollars in the local community, and have long-term environmental benefits.

COUNTIES AND MUNICIPALITIES have started to take a more active role in defining their energy future over the past several years. There are many reasons for this new local interest, but whatever the impetus, the direction is clear. Communities are looking for more locally controlled energy supplies and more renewable energy resources and are increasingly interested in moving away from centralized power stations running on imported fossil and nuclear fuels. Community energy is not a new phenomenon, and in fact, this trend represents both a renaissance back to early 20th century traditions and an advancement made possible by 21st century technologies.

WHAT WAS COMMUNITY ENERGY?

Before 1900 nearly all power was generated locally. Small-scale onsite energy generators provided electricity all across America. Farmers relied on windmills to pump their water. Mills depended upon rivers and streams to power their operations. Onsite generators powered industries and theaters.

As economies of scale made centralized power stations cheaper and more efficient, the nation shifted toward purchasing electricity from these central suppliers and away from community energy. Between 1900 and 1930, the proportion of onsite electricity generation declined from 60% to 20%¹.

WHAT IS COMMUNITY ENERGY?

Community energy today is based on electricity generation that is located in or near the building, facility, or community where it is used. Electricity generated near where it is used is often called distributed energy. Community energy could be fueled by renewable resources, like wind, biomass, hydropower, and solar, or by fossil fuels, like diesel and natural gas. Throughout this workbook, community energy is defined as electricity that is generated from local, renewable resources and is located onsite or near the users.

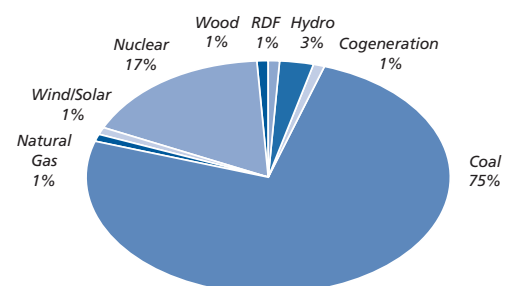
There have been many changes in electricity generation technology in recent years. Whereas throughout much of the 1900's centralized

power stations were by far the most efficient and cost effective, today distributed generation is becoming increasingly efficient and cost effective. Equally important, community energy can be fueled by a wide variety of renewable energy sources, providing long-term environmental benefits.

WHY RENEWABLE ENERGY?

The electric utility industry is the largest single source of air pollution in the United States because of coal burning. In Minnesota, 75% of the state's electricity is generated from coal and 17% from nuclear. The electric industry contributes 78% of the sulfur dioxide, 61% of the nitrogen oxide and more than half the mercury into Minnesota's lakes and streams, a very significant public health and economic issue. Air pollution from coal-fired power plants compromises our health, contributing to respiratory diseases such as asthma and causes acid rain.

Fuels used to generate electricity to serve Minnesota



Source: 2001 Energy Planning Report, MN Department of Commerce

Minnesota's only local energy resources are renewables.

Homegrown energy offers:

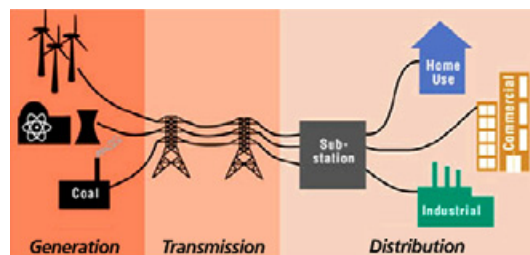
- *Opportunities for local economic development*
- *Greater community self-reliance*
- *Reduced reliance on volatile-priced foreign fuels*
- *A cleaner environment*

Global warming is another, growing problem. Burning fossil fuels is the main source of the increasing concentration of carbon dioxide in the atmosphere, the biggest factor in global warming. Minnesota scientists predict devastation of forest ecologies; disruption of agriculture by drought, flooding, pests, weeds, and reduced soil moisture; disruption of hunting and fishing habitat, including likely reductions in waterfowl and the loss of trout from Minnesota's streams.

Evidence is mounting that changes are already occurring. For instance, a recent study by the Department of Global Ecology of the Carnegie Institution of Washington in Stanford, California documented significant reductions in corn and soybean yield attributed to warming temperatures.² In addition to farming, forestry, hunting, and fishing, many of Minnesota's other industries, such as tourism and cold-weather performance testing, are totally dependent on a climate that is clearly rapidly changing.

Renewable energy from wind, biomass, solar and other local resources is clean, safe and abundant in Minnesota. Wind generated electricity has no emissions. Farm-grown biomass fuel sequesters carbon in the soil. Emission-free solar power can be ideal for remote locations. Anaerobic digestion generates electricity using manure from farms or waste from food processing and cleans up water and odor pollution at the same time. Many renewable community energy projects serve a dual purpose, generating electricity and improving the local environment.

The components of the electric grid



HOW IS THE ELECTRICAL ENERGY SYSTEM STRUCTURED TODAY?

Today our electric system has three components: generation, transmission and distribution.

Most of the generation occurs at large centralized power stations. In Minnesota, most of these centralized power stations rely on coal and nuclear fuel to make electricity. They burn fuel to heat water and create steam that turns a turbine and generates electricity. High-voltage electricity is transported to local substations by a complex, and in places aging, electric grid,

Why the Shift Back to Community, Distributed Energy?

TECHNOLOGY CHANGES AND IMPROVEMENTS

- *Improvements in fuel conversion make smaller generators more efficient.*
- *Manufactured technologies are cheaper than big power plants.*
- *The future development of fuel cells and microturbines will make onsite generation reliable and affordable.*
- *Smaller "combined cycle" and combined heat and power generators are highly efficient.*

NEW RELIABILITY NEEDS OF THE INFORMATION ECONOMY

- *Technology-based businesses cannot afford power outages.*
- *Computerized industries require greater power quality.*

RELIABILITY NEEDS OF COMMUNITIES

- *Municipal utilities with only one incoming power line face outages due to weather and equipment failure.*

LOCAL ENERGY OPPORTUNITIES

- *Distributed energy generation fueled by local resources stimulates community economic development.*

ENVIRONMENTAL AND HEALTH CONCERNS

- *Renewable community energy improves air and water quality, and helps mitigate global warming.*
- *Cleaner electricity reduces the negative health impacts of the current system.*

also known as the transmission system. At substations, transformers reduce the electric voltage for distribution to our homes and businesses completing the three-tiered chain.

GETTING STARTED

Start with Conservation and Energy

Efficiency The common misconception that conservation and energy efficiency means sacrifice, turning down the heat until you're cold and turning off all but one light, needs to be corrected. Turning off lights and keeping the thermostat at 65° instead of 70° are good energy saving practices, but reducing use of electricity is more about using better technologies than about changing behaviors. In the *2001 Energy Planning Report*³, the Minnesota Department of Commerce defines conservation as "primarily physical improvements that result in reduced energy consumption and that can be relied on, once they are installed, to continue to use less energy in the future."



Conservation and energy efficiency is the best place to start when crafting the 21st century energy future.

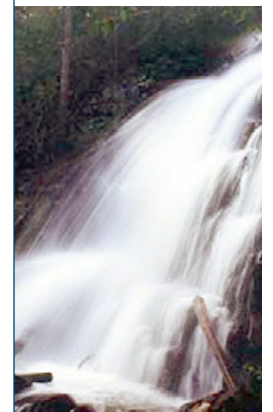
Conservation is the cheapest and often the easiest way to modify resource usage. Conservation reduces overall energy consumption, minimizing the potential for shortages and reducing the negative environmental impacts of fossil fuel or nuclear generation. Before looking at new generation of any kind, individuals, community leaders, business leaders, and government should evaluate what steps could be taken to conserve and improve energy efficiency. This includes technological changes such as using more energy efficient light bulbs and appliances, constructing buildings to take advantage of natural light and natural heating, or installing better insulation, all of which save money as well as energy.

Move Toward Local Renewable Resources and Community Energy Production

Even with significant conservation and efficiency improvements, there may still be interest in and need for new sources of energy for the community. Since Minnesota's only local energy resources are renewables, homegrown energy offers the potential for local economic development, greater self-reliance, and less reliance on foreign and volatile-priced fuels, and a cleaner environment.

Ethanol is a good example of the multiple benefits of using homegrown energy. Using ethanol increases energy security by utilizing a locally produced fuel that allows cars to burn "cleaner". In addition, the Minnesota model of small, farmer-based cooperatives that produce ethanol keeps profits in the community.

There are two key components to the community energy shift in Minnesota. The first is movement away from large, central station generating facilities to smaller, more flexible onsite or community generation. The second is the use of clean, local, renewable resources to generate electricity. Resources that make sense will spawn greater energy independence and mitigate, rather than exacerbate, environmental impacts. By moving toward these goals, Minnesotans are making choices today that will truly revolutionize our energy system in the future.



END NOTES

¹Morris, David, *Seeing the Light*, Institute for Local Self Reliance, 2001, www.newrules.org

²Lobell and Asner, "Climate and Management Contributions to Recent Trends in U.S. Agricultural Yield", *Science*, 299: 1032, 2003

³Minnesota Department of Commerce, *Minnesota Energy Planning Report 2001*. St. Paul, MN, January 2002, www.commerce.state.mn.us

PHOTOGRAPHS

page 1 – American Wind Energy Association; page 2 – Minnesota Energy Planning report, 2001, MN Department of Commerce; page 3 – National Renewable Energy Laboratory (hay bales/bulbs), Eastern Waterfall Guide (waterfall), Lisa Daniels/Windustry (wind turbines)