

Twin Cities Peak Oil Resource Guide

*Information and Ideas for
Community Sustainability*



The Twin Cities Peak Oil Working Group

June, 2007

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Introduction

Peak Oil is the proposition that the worldwide production of oil has already, or will soon reach its peak. After the peak, we will experience a long decline in oil supply. According to Peak Oil theory, this decline is unavoidable, as the earth's supply of petroleum is finite. The decline will occur regardless of how many wells are pumping and how many exploration crews are searching for new oil sources with new extraction mechanisms.

Worldwide population growth and ever-increasing oil demand, combined with dwindling oil production, will bring profound price pressures on crude oil and petroleum products. In the face of this unavoidable decline in the supply of oil and its related price increases, our society will experience dramatic and fundamental changes. The predictions of Peak Oil theory suggest that these changes may be relatively sudden, inevitable, substantial, and painful.

Few people deny that oil is a finite resource. The points of contention lie in the timeline for oil's exhaustion and in the predictions of potential economic and social impacts during its decline. Some predict that the decline in oil supplies will occur gradually, as rising prices for oil spur the development and use of alternative fuels (although none so cheap and convenient as those derived from petroleum). On the other hand, it is possible (some say probable) that the transition to the post-petroleum era will be a near-apocalyptic upheaval, with economic dislocations, industrial collapse, and widespread food shortages. Such an outlook is based on the premise that American industrial society, from farming to high-tech manufacturing to transportation, is heavily dependent on cheap, abundant liquid fossil fuels, and that the Peak Oil transition will occur too quickly for technological fixes to cushion the blow.

Peak Oil is a timely subject that deserves serious consideration. In Minnesota, the Twin Cities Peak Oil Working Group began meeting in 2006. We are an ad-hoc group of citizens, policy-makers, students, activists, and organizations who are exploring what the coming of Peak Oil might mean for our communities. This resource guide is our first product.

The guide is intended first to give readers a very basic understanding of Peak Oil theory and how the phenomenon might affect Minnesota. Then, the guide offers links to resources in the local areas where Peak Oil is expected to cause the greatest disruption, including transportation, food production, and housing. These sections will be most useful to individuals, communities, and policymakers. Business and organizational leaders may also find these sections valuable. Most of the resources listed are web links, so accessing this information will require no travel (we hope that you are using an ENERGY STAR® rated computer and buying Green Power to run it).

We intend for the guide to be a living document. As more resources and information become available, they will be added. We invite you to participate in revising and improving the document. Instructions for doing this are on the guide's acknowledgements page. Please use the resource guide to explore ways in which you, your neighborhood, and your community can reconsider oil-based activities.

We have chosen the model of "relocalization" to anchor our work. The term "relocalization" appears often in writings on Peak Oil—and refers to the process of recreating local economies, where key resources are available to support local populations. Relocalization can mean an improvement in quality of life: wonderful local energy and economic models exist that could be implemented here in Minnesota. Given our state's history of progressive

leadership and its strong intellectual capital, Minnesota should be first in implementing a bold vision for energy and community security.

Whether or not the direst predictions of the Peak Oil debate come true, the more our communities work to enact energy conservation, renewable energy production, local food and economic systems, non-motorized and other sustainable transportation networks, and human-scaled planning and development, the better off we'll all be—today, and in an energy-constrained future.

About Peak Oil: A Little Theory

The Peak Oil discussion involves history, geology, politics, and economics.

The Hubbert Peak Oil Theory maintains that the rate of petroleum production for any given area follows a symmetrical bell curve. The “peak” to which the title of the theory refers is precisely as it sounds: the top of a bell curve representing oil production. It thus marks the point in time in which half of the recoverable oil supply in a geographical area is consumed. The extraction of the remaining oil becomes technologically more difficult and more expensive. After the peak is reached, fewer barrels of oil will be produced each year and demand will exceed supply. At some point in the future, the energy equivalent of more than one barrel of oil will be needed to retrieve another barrel, such that further oil extraction will be pointless.

The term “peak oil” was coined by M. King Hubbert, Chief General Geology Consultant for the Shell Oil Company. In his 1956 paper, “Nuclear Energy and Fossil Fuels,” Hubbert predicted that the peak of oil production in the continental United States would be between 1965 and 1970.¹ Hubbert’s predictions came true when U.S. oil production peaked in 1970.

Consequently, the 1970s marked a growing U.S. dependence on imported oil. By 1973 the Organization of Petroleum Exporting Countries (OPEC) was producing over half of the world’s oil. Responding to the United State’s support of Israel in the Arab-Israeli War of 1973, OPEC cut off oil shipments to the U.S. and to other countries that had supported Israel in the conflict. The OPEC embargo led to the U.S. oil crisis of 1973, which was characterized by skyrocketing oil prices, fuel shortages, and long lines at gasoline filling stations. According to Dr. Vincent Cable, former Shell Chief Economist, upheavals in oil-producing areas have regularly been associated with economic recessions in developed countries.² The oil crisis of 1973 is one such example, while the more recent 1990 invasion of Kuwait is another. For oil-dependent countries, over-reliance on imported oil is not conducive to long term economic stability.

Today’s oil resource (as well as all fossil fuels, such as coal, lignite, natural gas, tar, and asphalt) formed over the last 500 million years. According to Dr. C.J. Campbell, oil began as algae, which spread throughout Earth’s “warm sunlit waters” where it proliferated and produced prodigious amounts of organic material. Dead algae descended to the ocean bottom and fell into static rifts, which had taken shape when the continents drifted from one another. The geologic processes that generated oil, like those that generated all fossil fuels, are still operative. Despite this, according to Hubbert, the amount of oil that is predicted to

¹ M. King Hubbert, “Nuclear Energy and the Fossil Fuels,” Publication No. 95, Shell Development Company, Houston, TX (1956).

² Vincent Cable, “The Economic Consequences of War,” February 2, 2003, writing in <http://observer.guardian.co.uk/print/0,,4596349-110863,00.html>.

form in the next 1,000 years is negligible in comparison to the amount that would be consumed even at present rates.

Human consumers have never before experienced the scarcity of a commodity as critical as oil without the prospect of a substitute.³ Between 1880 and 1930 the world's crude oil (petroleum) production increased 7% each year and doubled every ten years. The production of oil has increased exponentially since 1903. No finite resource can be sustained at this rate of consumption.

Predictions about the exact timing of the oil peak span across years and decades. While Hubbert accurately predicted the peak year of oil production for the continental United States, disagreements abound among geologists and analysts concerning the peak year for the world's oil supply. Hubbert himself predicted in 1979 that half of the world's oil supply would have been extracted in 2010. Energy company investment banker Matthew Simmons projected the peak to occur between 2007 and 2009.⁴ The Shell Oil Company foresaw the peak sometime after 2025.⁵ The Energy Information Administration (EIA) of the United States Department of Energy predicted the peak for 2021 at the earliest, and 2112 at the latest.⁶ M.C. Lynch, an energy economist, sees no visible peak in oil production.⁷

When experts report using optimistic numbers to calculate the year of the peak, they use values on the high end of the world's estimated oil supplies. John Edwards of the University of Colorado, Boulder, reportedly used "optimistic numbers" but nonetheless his figures predicted the first half of the age of oil would end in 2020.⁸

There are those who are yet more optimistic. Economist Douglas Bohi of the Charles River Associates reported that technology has offset the increasing cost of retrieving and finding resources. The EIA argues that technology is capable of doubling the yield from known fields.⁹ Geophysicist Rocky Detomo believes that there are still "elephant fields" (large oil fields that can fuel production for decades) to be discovered. "We have to bring all the technology we can bear to be successful," he told the British Broadcasting Company in 2006. At the Shell Exploration and Production Center in Houston, Detomo is responsible for developing new technologies to aid the search for oil wells. One example of such technology is the use of electromagnetic waves to seek oil through rock and silt that is "thousands of feet below the sea bed."¹⁰

Optimists point to a huge untapped opportunity in unconventional fuel resources, such as coal-to-liquid fuel conversions, or synthetic fuels ("synfuels"), such as the extraction of synthetic crude oil from shale, a sedimentary rock. Unconventional fuel extraction brings significant environmental concerns. Removing usable fuel from the abundant oil shales of Alberta, Canada, for example, might be unacceptable due to the impact on greenhouse gas emissions. Professor Alexander Farrell and graduate student Adam Brandt, of the Energy

³ C.J. Campbell, "The Dawn of the Second Half of the Age of Oil," *Soundings* No. 34, (2006): 56-66.

⁴ Matthew Simmons, speaking to the Association for the Study of Peak Oil, May 26, 2003.

⁵ G. Davis, "Meeting Future Energy Needs," *The Bridge*. National Academies Press. Summer 2003.

⁶ Energy Information Administration, 2000 presentation, http://www.eia.doe.gov/pub/oil_gas/petroleum/presentations/2000/long_term_supply/sld019.htm.

⁷ M.C. Lynch, "Petroleum Resources Pessimism Debunked in Hubbert Model and Hubbert Modelers' Assessment," *Oil and Gas Journal*, July 14, 2003.

⁸ Richard A. Kerr, "The Next Oil Crisis Looms Large – and Perhaps Close," *Science* 21 Vol. 281, no. 5380 (1998):1130.

⁹ Ibid.

¹⁰ BBC News, "Has Oil Production Finally Peaked?" August 31, 2005. <http://news.bbc.co.uk/2/hi/business/5305950.stm>.

and Resources Group at the University of California, Berkeley, write that "the oil transition is not a shift from abundance to scarcity: fossil fuel resources abound. Rather, the oil transition is shift [sic] from high quality resources to lower quality resources that have increased risks of environmental damage, as well other risks."¹¹

Optimists also argue that new technologies will not only delay the world's arrival of Hubbert's peak,¹² but will stretch the second half of his bell curve over time such that it is no longer symmetrical. However, as Campbell points out, much of this new technology is geared toward increasing production rates, which would draw the peak nearer.¹³ Furthermore, after the peak is reached, more expensive extraction methods could mean that the energy equivalent of more than one barrel of oil will be required to retrieve a like amount of oil.

As Minnesotans approach the altered landscape of a post-peak oil world, our lives will change dramatically. This, however, noted Campbell,¹⁴ is not a doomsday scenario. He surmised that countries and especially communities that adapt to the restrictions of the second half of the age of oil may be at a great advantage to those who do nothing. There will most likely be a period of transition from today's near total oil dependence, to reliance on conservation, restructured economic and social systems, and new technologies. In the face of a crisis like Peak Oil, an advance warning of one or two decades won't provide an easy transition. Given today's near-total lack of public discussion about Peak Oil, we should not expect an early warning from political or business leadership. However, our foresight and actions today will dictate in large part how we weather the transition period.

Peak oil will manifest itself in our day-to-day lives. The most obvious will be in transportation, due to soaring gasoline, kerosene, and diesel fuel prices. Minnesota's food supply will also be affected, as agriculture relies on fossil fuels to operate farming equipment, to produce petroleum-based fertilizers and pesticides, and to transport food to our markets. Because of the interconnectedness of our oil-based economy, Peak Oil will affect business and employment centers, education, healthcare, housing, water and waste management, public safety, and urban planning. No matter what the expected timeline for Peak Oil, it is prudent to analyze these areas now, and to implement personal choices and public policies that support more localized, self-reliant living today.

General Resources on Peak Oil:

www.energybulletin.net

A great Peak Oil primer plus extensive links and resources. Open submissions to the site are approved by an editorial board which claims no specific affiliation.

www.theoil Drum.com/

The Oil Drum offers in-depth and technical analyses of oil exploration, production, and consumption, critical reviews of alternatives to oil, and discussion of economic impacts of a tightening market for petroleum products.

¹¹ Alexander E. Farrell and Brandt, Adam R., "Risks of the oil transition." *Environmental Research Letters*, 2006. 1(1).

¹² Kerr.

¹³ Campbell.

¹⁴ Ibid.

www.peakoil.net

Association for the Study of Peak Oil & Gas (ASPO). An internationally-focused website maintained by Colin Campbell of ASPO Ireland. Includes links to U.S. and other ASPO chapters.

www.cera.com

Cambridge Energy Research Associates, Inc. (CERA), consults with international energy companies, governments, financial institutions, and technology providers. CERA analyzes energy markets, geopolitics, industry trends, and strategy. CERA's team of experts is headed by Daniel Yergin, Chairman and Pulitzer Prize-winning author of *The Prize: The Epic Quest for Oil, Money and Power*. CERA is Peak-Oil optimistic.

www.postcarbon.org

The Post Carbon Institute is a "think, action, and education tank" offering research, project tools, education and information to implement proactive strategies to adapt to an energy constrained world. It coordinates the Relocalization Network, created to provide individuals with the resources to coordinate effective community-level action.

www.communitysolution.org

The Community Solution is a nonprofit program dedicated to the development, growth and enhancement of small local communities. The website has a useful relocalization resource page.

www.wolfatthedoor.org.uk

Wolf at the Door offers the "Beginners Guide to Peak Oil," a site written by Paul Thomson from the U.K. An excellent layperson's interpretation of the problem with credible source back-up.

Readings:

- **The Citizen-Powered Energy Handbook: Community Solutions to a Global Crisis.** Greg Pahl, 2007.
- **Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy** Matthew R. Simmons, 2005.
- **The Empty Tank: Oil, Gas, Hot Air, and the Coming Global Financial Catastrophe** Jeremy Leggett, 2005.
- **The Long Emergency: Surviving the End of the Oil Age, Climate Change, and Other Converging Catastrophes of the Twenty-first Century** James Howard Kunstler, 2005.
- **Powerdown: Options and Actions for a Post-Carbon World** Richard Heinberg, 2004.
- **The End of Oil: On the Edge of a Perilous New World** Paul Roberts, 2005.
- **Blood and Oil: The Dangers and Consequences of America's Growing Petroleum Dependency** Michael T. Klare, 2004.
- **Beyond Oil: The View from Hubbert's Peak** Kenneth S. Deffeyes, 2004.
- **Crossing the Rubicon: The Decline of the American Empire at the End of the Age of Oil** Michael C. Ruppert, 2004.
- **High Noon for Natural Gas** Julian Darley, 2004.
- **Oil, Jihad, and Destiny** Ronald R. Cook, 2004.
- **The Coming Oil Crisis** Colin Campbell, 2004.
- **Crude : The Story of Oil** Sonia Shah, 2004.

- **A Century Of War: Anglo-American Oil Politics and the New World Order** F. William Engdahl, 2004.
- **Oil: Anatomy of an Industry** Matthew Yeomans, 2004.
- **Out of Gas: The end of the age of oil** David Goodstein, 2004.

Creating a Local Food System

Modern food production is heavily reliant on oil. In fact, it's fair to say that oil is consumed from field to table.

The fertilizers and pesticides used in commercial agriculture are natural gas and petroleum-based. Hydrocarbons help manufacture the gasoline- and diesel-powered farm equipment that is used for tilling, seeding, watering, and harvesting. After food has been picked, it is processed with oil-fueled machinery into value-added products, or shipped by diesel-powered trucks and ships across the world and across the country. We drive our cars to the store for groceries, which we pack into oil-based plastic bags, or to the fast food restaurant, where our meal is handed to us in an oil-derived box.

Minnesota's population is expected to grow by about one million by 2030.¹⁵ The peaks in oil and natural gas will make food production as it is practiced today impossible. In addition, global warming will change Minnesota's climate enough to require a re-thinking of what we grow and how we grow it.

According to author Dale Allen Pfeiffer, in his article "Eating Fossil Fuels," we've pretty much used up all large pieces of land suitable for agriculture on Earth, and we've essentially "built" our current food production around the use of dwindling hydrocarbons. Pfeiffer believes that Peak Oil will have drastic outcomes for farming and populations worldwide.¹⁶

Between 1950 and 1984, as the Green Revolution transformed agriculture around the globe, world grain production increased by 250%. That is a tremendous increase in the amount of food energy available for human consumption. This additional energy did not come from an increase in incipient sunlight, nor did it result from introducing agriculture to new vistas of land. The energy for the Green Revolution was provided by fossil fuels in the form of fertilizers (natural gas), pesticides (oil), and hydrocarbon fueled irrigation.

The Green Revolution increased the energy flow to agriculture by an average of 50 times the energy input of traditional agriculture. In the most extreme cases, energy consumption by agriculture has increased 100 fold or more.

In the U.S., 400 gallons of oil equivalents are expended annually to feed each American (as of 1994 data). Agricultural energy consumption is broken down as follows:

- 31% for the manufacture of inorganic fertilizer
- 19% for the operation of field machinery
- 16% for transportation
- 13% for irrigation
- 08% for raising livestock (not including feed)
- 05% for crop drying
- 05% for pesticide production
- 08% miscellaneous

¹⁵ Minnesota Department of Administration, Office of Geographic and Demographic Analysis, "Projections of the population by age and sex for the state, regions and metropolitan areas, 2000 to 2030." October 23, 2002.

¹⁶ www.fromthewilderness.com/free/ww3/100303_eating_oil.html.

Energy costs for packaging, refrigeration, transportation to retail outlets, and household cooking are not included in these figures.

In Minnesota, corn production uses the greatest amount of hydrocarbons (a fact that has more implications now that corn is being touted as a “green” fuel stock). In a report using 1995 data, researchers Barry Ryan and Douglas G. Tiffany from the Department of Applied Economics at the University of Minnesota found that farm-level amounts of energy to produce corn statewide (including corn used to feed animals) amounted to 63 million gallons of diesel fuel, 64 million gallons of LP gas, 235 million kWh of electricity, and 8 million gallons of gasoline.¹⁷

We also ship our food long distances, using more fuel. The Leopold Center for Sustainable Agriculture at Iowa State University found that, on average, fruits and vegetables traveled 1,500 miles to the Chicago Terminal Market, which is a key center of distribution to grocery stores in the Midwest.¹⁸

Minnesota’s short local growing season dictates that if we want fresh produce in the winter and spring, it must be shipped in from more temperate growing regions. However, it’s possible to reverse a significant portion of our dependence on far-flung industrial farms. We could instead choose efficient and more sustainable practices.

The combination of a growing population and a food system completely dependent on fossil fuels does not bode well for Minnesota food security. If we cannot produce enough food locally to feed our population without oil, then food shortages become a clear possibility.

In order to create a local food system, we can access knowledge that our Minnesota grandparents and great-grandparents and indigenous communities relied upon in the first half of the last century. (For more recent immigrants to the U.S., this knowledge may be more current). We can implement more traditional farming methods and organic techniques, rely on fewer oil inputs, and grow food closer to consumers. From home and community gardening, to the re-establishment of regional food farms, to more sustainable food retailing and distribution systems, increased local food production is well within our reach.

Gardening at Home and in the Community

Growing food does not have to be a high-input, industrial process confined to vast tracts of rural land. Individuals, community groups, and small entrepreneurs can grow bountiful gardens right in town for subsistence, as well as to sell for cash. As lower-density cities, Minneapolis and Saint Paul have excellent urban agriculture opportunities. From gardening for our families at home, to producing tomatoes and salad greens on our balconies, to using vacant lots, parkland, school and church yards, road frontages, and other arable land for community gardens, there are plenty of ways to relocalize food production—literally in our own back yards.

Sixty-five years ago, the home vegetable garden was typical in Minnesota. In other countries, home food gardening has been a key survival strategy, especially in communities where economic change has been swift and difficult. Writer Dmitry Orlov credited home

¹⁷ University of Minnesota Extension Service, www.extension.umn.edu/newsletters/ageconomist/components/ag237-693b.html.

¹⁸ Rich Pirog, *et al.* *Food, Fuel and Freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions* (Ames, Iowa: Leopold Center for Sustainable Agriculture. 2001).

gardening with maintaining the stability of the food supply in the former Soviet Union after its collapse.¹⁹ In Cuba, when Soviet support and oil imports vanished, home gardeners made use of every potential plot of urban land. Today, half of the fresh produce consumed by two million Havana residents is grown on abandoned city lots and leftover parcels.²⁰

The city of Saint Paul passed a municipal food policy in 1987.²¹ At the city council meeting prior to the policy's passage, city council members reportedly laughed at the recommendation that the city would favor edible landscaping in parks and on municipally-owned land.²² The laughter was unfortunate, because there's no reason that our parks and streets should not be lined with apple, plum, and pear trees; nor any reason that our school playgrounds and city parkways shouldn't be bursting with raspberries and grapes. The language that did pass is still quite progressive, though few of the items have been implemented. The paragraph titled "Resources for Food Production" includes the following directives:

- a. Provide neighborhood residents access to open space, water and light for purposes of raising food.
- b. Encourage city residents to raise a portion of their own food supply.
- c. Eliminate unnecessary legal barriers to city residents' raising plants and animals for food.
- d. To enhance individuals' ability to provide their own food supply, increase the availability of appropriate equipment and knowledge regarding processing and storage of home-grown foods to citizens throughout the city.
- e. Work with other appropriate public bodies to assure the continued availability of Metro area farmland for potential production of food consumed in the city.

This is a good model but clearly citizens need to remind city government to implement these goals.

The Twin Cities have a long history in the American community garden movement. Our oldest continuously operating community garden, the Dowling Community Garden in south Minneapolis, was started during the food rationing era of World War II. "Victory Gardens" were promoted during both World Wars as a way to supplement food production at a time when resources were being marshaled for war. For more on the community garden movement in Minnesota, see Laura Lawson's 2005 book *City Bountiful: A Century of Community Gardening in America* (University of California Press).

At a modern community garden, land is divided into parcels, where gardeners can grow whatever they wish. Gardeners share resources, such as water, tools, fencing, and compost areas, and sometimes they share plants, seeds, and the harvest itself. Gardening skills are

¹⁹ Dmitry Orlov, "Closing the 'Collapse Gap': the USSR was better prepared for peak oil than the US," 4 Dec 2006, Energy Bulletin: <http://energybulletin.net/23259.html>.

²⁰ Oxfam America, "Oxfam America Report Shows End to Cuba Food Crisis," 9 July 2001. From www.oxfamamerica.org.

²¹ <http://www.mnfoodassociation.org/twincitiesfoodcouncilhistory.htm>.

²² As told to Mary Morse by Ken Taylor, Minnesota Food Association, 1990.

passed on from gardener to gardener, making community gardens an excellent strategy for both food production and perpetuation of gardening knowledge.

Pounds of fresh fruit and vegetables can be grown at home, on boulevards or in parks, or in community gardens in Minnesota from April through October. Gardeners skilled with season-extending cold frames, or home greenhouses, can push the growing season into the coldest months of the year. With simple tools and a little knowledge, families can produce a significant portion of their own food needs.

Home and Community Gardening Resources:

www.gardenworksmn.org

Garden Works is a program of the Green Institute that provides a clearinghouse on community gardening and supports gardeners across the Twin Cities. Garden Works has links to composting, seed saving, and gardening and season extending techniques.

www.extension.umn.edu/topics.html?topic=5

The University of Minnesota Extension Service provides gardening bulletins, a question-and-answer area, and much more.

www.communitygarden.org

American Community Gardening Association—a national community garden resource organization.

www.cityfarmer.org

Urban Agriculture Notes by City Farmer, a Canadian urban gardening project with valuable resources for serious home food gardeners.

www.users.ncable.net.au/~urbanfoodgarden/Web/Design/GARDEN%20DESIGN/garden_design.htm

Home and full-yard gardening techniques for Australia (Generally useful in Minnesota, too.)

www.northerngardener.org/pages/index.asp

Minnesota State Horticultural Society. Gardening tips, *Northern Gardener* magazine, resources for cold-climate gardeners.

Edible Landscaping:

www.Edibleschoolyard.org

Model school garden program, featuring nutrition and cooking. Founded by iconic American chef Alice Waters.

www.Edis.ifas.ufl.edu/EP146

Edible Landscaping for Urban Sustainability, Eva Worden, University of Florida, Gainesville.

www.Oklahomafood.coop/edible.php

Growing a beautiful edible landscape in an urban neighborhood, Robert Waldrop, Oklahoma Food Coop, 2003

Raising Poultry at Home:

www.ansci.umn.edu/poultry/resources/urban_production.htm

University of Minnesota's "Poultry U" website with links to urban poultry information.

www.minnesotamonthly.com/media/Minnesota-Monthly/March-2007/Pecks-and-the-City/index.php?cp=3&si=2#artanc

"Pecks and the City: Fowl Play or Good Eggs? Minneapolis poultry owners assert their flocks' right to roost." Rachel Hutton. *Minnesota Monthly*, March, 2007.

www.extension.umn.edu/distribution/livestocksystems/DI0701.html

Home poultry processing instructions from the University of Minnesota.

Regional Farming and Farmers Markets

Millions of acres of former Twin Cities-area farmland have been developed for highways, housing developments, corporate campuses, and commercial centers. While this land may never return to agricultural use, it is important to begin prioritizing regional food production in future land-use decisions.

Throughout history, urban growth has depended on the efficiency of agriculture and the capacity of society to catalyze the production, distribution, and preservation of food. Most cities, while experiencing their first growth spurts, relied heavily on farming surrounding lands to meet food needs. However, with the expanse of globalization the nutritional connections between urban and rural populations have diminished. In order to "maximize economic efficiency,"²³ farmers have resorted to the use of fertilizers, pesticides, irrigation (one of the most energy-demanding elements of industrialized agriculture), and fossil-fueled machinery to successfully harvest the expanse of a single, or only a few cash crop(s).

Economic growth (as opposed to sustainability) has a magnetic appeal in our culture, and agriculture is not immune. According to Graham Haughton and Colin Hunter, authors of Sustainable Cities, sustainability can only be achieved if we break the growth mentality.²⁴ To function well in a post-Peak Oil environment, farms and farming systems need to be scaled to serve a local foodshed—the area within which the growing and transport of food remains economically and ecologically efficient. Think local and regional agriculture, not world-scale agriculture; farmers' markets, not food superstores.

Breaking the "growth mentality" does not necessarily lead to a drop in productivity. The Food and Agriculture Organization (FAO) of the United Nations found that in some cases smaller farms were more productive than larger farms. According to the FAO, Syrian farms with the highest productivity were approximately 0.5 hectares (1.23 acres), or 3 hectares (7.4 acres) in Mexico, less than 1 hectare (2.47 acres) in India, and less than 2 (4.94 acres) hectares in Nepal. In each case, farm output fell after it expanded beyond these values.²⁵

Consumers' concerns about health and sustainability have already sparked changes in our state's food system. Regional organic farms have sprouted up in Minnesota and surrounding states. Community Supported Agriculture (CSA) has grown as a niche system, where individual farmers supply pre-paid subscribers with a large variety of locally-grown produce, meat, and dairy products throughout the growing season. Retail food cooperatives,

²³ Andrew McKillop, ed., *The Final Energy Crisis* (Pluto Press, 2005), 69.

²⁴ Graham Haughton and Colin Hunter, *Sustainable Cities* (Routledge, 2003), 5.

²⁵ McKillop, 69.

which became popular in the 1970s, are thriving across Minnesota, from large, profitable full-service stores in the Twin Cities, to smaller, specialty co-ops. Food co-operatives have both created demand for and supported locally-grown food. There are several long-established food security organizations working to bring sustainable agriculture back to the fore in Minnesota.

The “slow food” movement that started in Italy and has spread around the world suggests that local food is not just best for environmental reasons, but for reasons of the palate. In a promotion for Carlo Petrini’s book *Slow Food*, Columbia University Press explains the origins and tenets of the slow food movement:

In 1986, Carlo Petrini decided to resist the steady march of fast food and all that it represents when he organized a protest against the building of a McDonald's near the Spanish Steps in Rome. Armed with bowls of penne, Petrini and his supporters spawned a phenomenon. Three years later Petrini founded the International Slow Food Movement, renouncing not only fast food but also the overall pace of the "fast life." Issuing a manifesto, the Movement called for the safeguarding of local economies, the preservation of indigenous gastronomic traditions, and the creation of a new kind of ecologically aware consumerism committed to sustainability.

Farmers markets across the country have also grown. According to federal statistics, the number of farmers markets in the country increased by 111% between 1994 and 2004.²⁶ Yet they make up less than 2% of the \$70 billion spent on produce in the United States.²⁷ In Minnesota, the Saint Paul Farmers Market has operated for 150 years, runs a downtown market plus 17 satellite sites, and features exclusively local, farmer-grown produce and value-added products. New independent markets modeled after the Saint Paul Farmers Market and featuring local growers are springing up in Twin Cities neighborhoods.

It will take a combination of understanding true farm efficiency, reserving land for local farms, training a new generation of organic farmers, and building additional distribution and retail channels to support local food security and access.

Regional Food and Farming Resources:

www.twincitiesfood.coop/coop101/

Twin Cities Natural Food Co-ops is an umbrella organization supporting member-owned food co-ops in the Twin Cities metro area and other Minnesota towns.

www.landstewardshipproject.org/

Land Stewardship Project promotes a regional food system, sustainable farm practices, and training for new farmers.

www.mnfoodassociation.org

Minnesota Food Association operates the Agricultural Training Center at Wilder Forest with the goal of relocalizing food systems. Programs include the May Farm CSA, the New Immigrant Agriculture Project, food business development, and work on projects related to strengthening local food systems.

²⁶ Michael S. Rosenwald. *Washington Post*, Nov. 6, 2006. www.washingtonpost.com, “A Growing Trend: Small, Local and Organic.”

²⁷ grist.org, “Eatin’ Good in the Neighborhood.”

www.stpaulfarmersmarket.com

Saint Paul Farmers Market—the state’s oldest, biggest, and most-locally grown.

www.iatp.org

Institute for Agriculture and Trade Policy, a Minneapolis-based organization promoting resilient family farms, rural communities and ecosystems around the world through research and education, science and technology, and advocacy.

Slow Food Resources:

www.Slowfood.com

International nonprofit organization that, “counteracts fast food and fast life, the disappearance of local food traditions and peoples’ dwindling interest in the food they eat, where it comes from, how it tastes and how our food choices affect the rest of the world.”

www.Slowfoodusa.org

U.S. nonprofit supporting and celebrating the food traditions of North America.

Local Food Resources:

www.Prideoftheprairie.org

A collaborative West-Central Minnesota effort to promote local food, farmers, and food entrepreneurs. Links to the Seasonal Guide to Minnesota Produce.

www.Localfoodnetwork.org

SE Minnesota organization that provides restaurants, buying clubs, cooperatives, grocers and institutions with one-stop ordering for foods from 40 regional producers.

www.nffi.net

Northland Food and Farming Initiative, supporting community food systems in NE Minnesota and NW Wisconsin. Kits, curriculum, slide show.

www.Sfa-mn.org

Sustainable Farming Association of Minnesota. Supports sustainable farming systems through innovative demonstration, education, and networking.

www.Localharvest.org

Find farmers markets, family farms, and other sources of sustainably grown food in the U.S.

www.Foodroutes.org

Local food advocates, including activist toolkits.

www.worldwatch.org/node/827

Worldwatch Paper #163: *Home Grown: The Case for Local Food in a Global Market*. 2002. Includes background and strategies for rebuilding the local foodshed.

www.100milediet.org

Resources for eating within a 100-mile foodshed.

www.locavores.com

A Bay-area group of individuals striving to eat foods grown or harvested within a 100-mile radius of San Francisco for one month. Very instructive and insightful.

www.Localfoods.umn.edu/challenge

Midwestern version of Locavores, above.

www.Sciencenews.org/articles/20030802/food.asp

Local Foods Could Make for Greener Grocers, Janet Raloff, Science News, 2003.
Analysis of transportation, environmental impacts of moving food from producers to consumers.

Food Preservation

The Minnesota growing season is very short. To enjoy the fruits of our farms and gardens throughout the year, it's necessary (and possible) to preserve the harvest. Minnesota gardeners use three main methods to preserve food: canning, freezing, and drying. Salting and smoking (e.g. fish) and fermenting (e.g. cabbage into sauerkraut) are less well-known but effective and delicious Minnesota traditions. The point of these preservation methods is to remove bacteria from the food, which extends its shelf life without spoilage.

Dehydration, or "drying," is one of the oldest methods of food preservation. Unlike canning and freezing, drying allows fruits and vegetables to retain the majority of their nutrients. Furthermore, drying and later reconstituting fruits and vegetables is a straightforward process, and requires less energy overall than canning and freezing. (For information on more energy-intensive food preservation methods, please see the link below to the University of Minnesota Extension Service's vast resources).

Solar food driers use energy from the sun to induce the process of convection in the dryer, which removes moisture from any fruits or vegetables, thereby retarding bacterial growth.

Solar food dehydrating and other preservation resources:

www.organicdownunder.com/solar_dryer.htm

Organic Gardening from Down Under's solar dehydrator.

www.solarfooddryer.com

Sun Works solar dehydrator.

www.pathtofreedom.com/pathproject/offthegrid/solarfooddryer.shtml

Path to Freedom's solar dehydrator.

www.extension.umn.edu/topics.html?topic=6&subtopic=35

The grandmother of all Minnesota food preservation sites. The University of Minnesota Extension Service offers instructions for drying, freezing, canning, smoking, pickling, and more.

Permaculture

Permaculture is both a practice and a philosophy. The term "Permaculture" arose in the mid 1970s with Australian ecologist, David Holmgren, and is a contraction of either "permanent agriculture" or "permanent culture." According to the *Permaculture Activist*:

Permaculture “describes a design system for creating human settlements that function in harmony with nature. Incorporating traditional knowledge, modern science, and the ecological patterns of the living world, permaculture design is applicable to farms, gardens, organizations, housing developments, towns and villages, or city neighborhoods.

According to ATTRA (link below), a “central theme in permaculture is the design of ecological landscapes that produce food. Emphasis is placed on multi-use plants, cultural practices such as sheet mulching and trellising, and the integration of animals to recycle nutrients and graze weeds.” Permaculture, therefore, is a complete cultural system, and with its emphasis on the complete cycle of food production—from planning to planting to soil fertility—might be an extremely valuable practice as communities grapple with the prospect of growing enough food, without oil and natural gas inputs, to sustain their populations.

The aim of permaculture is to create systems that are ecologically sound and economically viable, which provide for their own needs, do not exploit or pollute, and are therefore sustainable.

The 12 principles of permaculture, as phrased by David Holmgren, are:

1. Observe and interact.
2. Catch and store energy.
3. Obtain a yield.
4. Apply self-regulation and accept feedback.
5. Use and value renewable resources and services.
6. Produce no waste.
7. Design from patterns to details.
8. Integrate rather than segregate.
9. Use small and slow solutions.
10. Use and value diversity.
11. Use edges and value the marginal.
12. Creatively use and respond to change.

Permaculture workshops are presented from time to time in the Twin Cities area. See the ATTRA website below for more information.

Permaculture Resources:

www.permacultureactivist.net/index.html

The Permaculture Activist—a website and publication with resources designed to “liberate people everywhere to provide for their own and their communities' needs for food, energy, shelter, and a decent life without exploitation or pollution and from the smallest practical area of land.”

www.attra.ncat.org/attrapub/perma.html

ATTRA – National Sustainable Agricultural Information Service. Includes useful links to permaculture resources.

www.spiralseed.co.uk/permaculture/

Permaculture: “A Beginners Guide” by Graham Burnett.

The Natural Gas Challenge: Energy Conservation and Renewable Energy at Home

Natural gas is often seen as the fuel that might save us during a Peak Oil transition. Unfortunately, natural gas, like oil, is a finite resource. As in the Peak Oil discussion, there are differing timelines on when analysts predict that natural gas will become price prohibitive, and then exhausted. According to Centerpoint Energy, the U.S. has a natural gas resource base equal to about 63 years of consumption at current production levels.²⁸ Of course, with a rising population and growing reliance on natural gas for electricity production, the prediction of 63 years is overly optimistic. Natural gas wells in Mexico and Canada (countries friendly to the U.S. today) will be depleted at a similar pace. We can't really "manufacture" an abundant substitute, although advances are being made in biogas digesters, such as waste-to-energy plants that capture methane from tanks of waste collected from farm animals.

Natural gas burns relatively cleanly, emitting few pollutants and less CO₂ than coal or oil; it is easy to transport domestically, via a network of pipelines; and it is an efficient fuel, retaining most of its energy from extraction to point of end use. Natural gas is used to heat more than 50% of all homes in the U.S., and it generates 26% of U.S. electricity²⁹ (and soon a bit more, as the Xcel Energy Corporation's High Bridge plant in Saint Paul completes its retrofit from coal-burning to natural gas, in response to environmental concerns.³⁰) Used widely in manufacturing and oil refining, natural gas is also the key component in chemical nitrogenous fertilizer, one of the pillars of input-heavy world food production.

Natural gas is difficult to import from overseas. Voluminous in its gas form, it can be condensed to a liquid via super-chilling to -260 degrees Fahrenheit. The end product is called liquid natural gas (LNG), which can be shipped by tanker from wells around the world. Currently most U.S. natural gas imports come from Trinidad, Egypt, and Nigeria. There are only five LNG terminals at U.S. seaports to handle these imports. New LNG terminals—needed in order to fulfill U.S. energy needs—will require major capital investments, with expected prices between \$100 million and \$2 billion per facility.³¹ Beyond price, communities from Maine to California are skittish about allowing new LNG terminals to be constructed: they are vulnerable to major fires and explosions. Protests of new LNG facilities are becoming common (for a story on a 2006 protest against a proposed LNG terminal off the coast of Malibu, California, see http://cbs2.com/topstories/local_story_295171238.html).

Because of our cold winters and common reliance on natural gas-fueled furnaces, Minnesotans are vulnerable to problems with natural gas. Natural gas demand is greatest in our cold months, and supplies are directly affected by the weather. Our best response to expected shortages should be home energy conservation. As with Peak Oil, by reducing our consumption of natural gas now we can avert or lessen the price and shortage-induced problems that are undoubtedly on the horizon. Fortunately we have the knowledge and tools to conserve energy at home immediately.

²⁸ http://mn.centerpointenergy.com/for_your_home/energy_your_home/manage/pricing.asp.

²⁹ U.S. Energy Information Administration.

³⁰ http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_27620_34139_23912-20543-0_0_0-0,00.html.

³¹ U.S. Energy Information Administration.

Conservation

Conservation is affordable, easy to implement, and has fast and significant paybacks over time. It leads to buildings that are more durable, and that are healthier for the people who inhabit them. Conservation is the first step that any home or business owner should take before any investments are made in renewable energy.

There are guides to conducting a do-it-yourself home energy analysis, but it is very helpful to invite a trained home energy auditor to evaluate your home. Most Minnesota utilities offer this service at a deep discount. Auditors may employ blower doors to measure air infiltration, and many have infrared cameras at their disposal to diagnose and repair more challenging insulation and air sealing problems.

Once a house is properly insulated and its hidden cracks and air leaks have been sealed (usually with inexpensive caulk and spray foam), it can be re-checked for indoor air quality issues. If needed, a ventilation system can be installed to ensure adequate fresh air intake and a healthy indoor environment.

When purchasing new appliances, heating, ventilation, and air-conditioning (HVAC) systems, windows, hot water heaters, air conditioners, refrigerators, and washer-dryers, consumers should look for the federal ENERGY STAR® rating, which provides assurance that these products are energy efficient relative to others in their class. The ENERGY STAR is also applied to computer monitors, television sets, ceiling fans, and light bulbs.

Power strips—some with convenient timers—can be used to ensure that electronic equipment is disconnected from the electric grid when not in use. Minnesotans are adding electronic gadgets to our personal arsenals at a heady pace, and many of these products (including certain televisions and peripherals, cell phones, and portable music players) are plugged in for charging for several hours at a time. Often the charge adaptor stays in the electrical outlet and continues to draw power even after the device is disconnected. Unplug the adaptor when not in use for immediate energy savings.

Lighting can be made energy-efficient by using compact fluorescent bulbs, newer light-emitting diode (LED) products, by using motion-sensor switches and timers, and of course by making simple behavior changes such as turning off lights in uninhabited rooms.

Lifestyle has a big effect on energy consumption. Even the best designed home operates only as efficiently as its occupants allow. Install a programmable thermostat (or turn the dial manually) and heat your home only when it's occupied. Take advantage of your home's energy features: use storm windows in cold seasons, close window shades in the summertime, and open them up in the winter. Use ceiling fans to increase the comfort in bedrooms and family rooms without extra heating or air conditioning. Change furnace filters regularly. Clean refrigerator coils. Dispose of old refrigerators and freezers properly, and don't run an old beverage fridge in the basement or garage.

Most of the resources listed in this section are intentionally related to energy efficiency in existing homes. It's debatable whether much new home construction will occur with the advent of Peak Oil difficulties. Global warming-related population shifts may require new home construction for coastal flooding refugees. Perhaps there will be rural population growth, with urbanites heading out to take up much-needed organic farming careers. Others may find that high gasoline prices dictate living near our employers and community resources; leading to an exodus from the suburbs, and a boom in urban and small town living and existing home renovation.

Home Energy Conservation Resources:

www.thenec.org

The Neighborhood Energy Connection offers statewide home energy audits and advanced residential energy analyses, home energy loans, and ENERGY STAR® certifications and LEED inspections for new and existing homes.

www.state.mn.us/portal/mn/jsp/content.do?subchannel=-536881511&id=-536881350&agency=Commerce

The Minnesota Department of Commerce Energy Info Center is a treasure trove of home energy information, including fact sheets, do-it-yourself guides, links to utility programs, energy grants and rebates, and much more.

www.mngreenremodeling.com

The Minnesota Green Remodeling Program provides standards for sustainable home remodeling in Minnesota. Key concepts are energy efficiency, resource efficiency, indoor environmental quality, water conservation, and site management.

www.greencommunitiesonline.org/minnesota

Minnesota Green Communities is an initiative designed to foster the creation of affordable, healthier, and more energy-efficient homes throughout Minnesota.

www.mncee.org

The Center for Energy and Environment provides energy, environmental and housing rehabilitation services to utilities, private corporations, neighborhood organizations, municipalities and public agencies.

www.usgbc.org

The U.S. Green Building Council (USGBC), home of the Leadership in Energy and Environmental Design (LEED) certification program, is a building industry coalition working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.

www.energystar.gov

The U.S. Environmental Protection Agency/U.S. Department of Energy site lists energy-efficient home and office appliances, energy conservation information, and more.

www.waldseebiohaus.typepad.com/biohaus/design.html

The Waldsee BioHaus is the first building in Minnesota, and in the U.S., built to the German Passivhaus standard for energy efficiency. This site has information about the project and links to the Passivhaus Institut, which is pioneering hugely efficient existing building retrofit studies and practices in Germany.

www.mnenergychallenge.org

The Minnesota Energy Challenge encourages Minnesotans to review and reduce their personal carbon footprints.

Renewable Energy

Advances in technology are making renewable energy more accessible to individual consumers every day. Wind turbines, geothermal heating and cooling, and solar hot water

heaters and solar electric installations can be excellent choices for those who have completed their home energy conservation work, and who are ready to undertake home energy production. There are even simple solar ovens on the market today, which on sunny days can cook delicious hot meals without electricity.

As fossil fuels become more expensive, those who have invested in renewable energy systems will reap the fruits of their foresight. The primary argument used against installation of renewables today is that the payback period (the time that it takes from initial system purchase to the point where the system has saved enough money in fuel/utility costs to cover the initial investment) is too long. During the transition to a post-petroleum economy, prices of all fuels will fluctuate widely, and renewables may provide an excellent hedge against price increases.

Renewable Energy Resources:

www.mnrenewables.org

The Minnesota Renewable Energy Society promotes education, awareness, and advocacy for all forms of renewable energy technologies, with a particular emphasis on solar energy technologies.

www.the-mrea.org

The Midwest Renewable Energy Association promotes renewable energy, energy efficiency, and sustainable living through education and demonstration, including solar workshops and the hugely popular Renewable Energy and Sustainable Living Fair in Custer, Wisconsin, the third weekend in June.

www.windustry.org

Windustry promotes wind energy through outreach, educational materials, and technical assistance to rural landowners, local communities and utilities, and state, regional, and nonprofit collaborations.

www.ips-solar.com

IPS Solar & Wind is a Minneapolis-based design / build contractor specializing in solar energy systems that give home and business owners the power to produce their own heat and electricity.

www.bestpowersolar.net

Best Power International is a locally owned renewable energy solutions company, offering services to residential and commercial clients, including very small to very large photovoltaic and solar thermal applications.

www.conservtech.com

Conservation Technologies is a Duluth-based energy conservation company, specializing in solar hot water and solar electric design and installation.

<http://www.state.mn.us/portal/mn/jsp/content.do?subchannel=-536881511&id=-536881350&agency=Commerce>

The Minnesota Department of Commerce Energy Info Center contains information and links on all types of renewable energy.

www.cecofwi.com

The Citizens Energy Cooperative of Wisconsin makes solar site assessments and installations, primarily in Wisconsin, but some services may be available in Minnesota.

www.solarovens.org

The Solar Oven Society is a nonprofit organization that produces low-cost, high-performance, durable, aesthetically-pleasing solar ovens for use in developing countries, as well as for use in the U.S., to alleviate hunger and to provide a sustainable cooking method.

Sustainable Transportation

Americans consume almost three gallons of oil per day, per capita, a number made particularly high by our use of cars, trucks, and SUVs to travel relatively long distances. According to the U.S. Energy Information Administration, about two-thirds of all oil consumed in the U.S. is for transportation.³² Despite their usefulness and convenience, vehicles cause problems. Cars and trucks emit pollutants, including carbon dioxide (the principle greenhouse gas), they are noisy, and they injure and kill more than 40,000 occupants, bicyclists, and pedestrians in the U.S. each year.³³

The burden that we Minnesotans create both in terms of emissions and use of oil is particularly high. Minnesota ranks second nationally in levels of car ownership per licensed driver.³⁴ Maybe it's our relative prosperity, or our frigid winters, or just an inevitable result of Minnesota's sprawling suburban-style land use, but cars are the way we get around. According to Anthony Flint, author of *This Land: The Battle over Sprawl and the Future of America*, automobile pioneer Henry Ford understood the American freedom mentality, where "the lowliest immigrant and the richest industrialist craved the freedom to move around, to go places whenever they wanted to, unencumbered by rail lines or boat schedules." (p. 31)

Minnesotans spend thousands of dollars every year (\$7,800 per year on average, according to the American Automobile Association³⁵) to own their cars. And yet the true costs of vehicle ownership and operation—costs that even non-drivers shoulder—are mostly hidden. The Minnesota Pollution Control Agency (www.nextstep.state.mn.us/section.cfm?topic=28) notes these externalized costs, which include:

- Non-gas tax costs to build and maintain roads, bridges, parking structures, etc. (State and federal gas taxes pay for less than 1/3 the total costs to build and maintain roads. Local property taxes pay nearly 1/2 of these total costs.)³⁶
- Public and private costs of traffic congestion (estimated at \$1,000/year per Twin Cities commuter).³⁷
- U.S. military expenditures to assure oil supplies.
- Global warming: net damages and mitigation costs due to auto emissions.
- Private and public health costs due to traffic accidents, auto emissions, and noise.

The alternatives to traveling in privately owned cars and trucks include walking, bicycling, using public transit, sharing cars, or even just staying home. The Peak Oil challenge gives our community both a reason and an opportunity to redesign how we get around.

There is plenty of attention today on creating alternative fuels for cars, such as hydrogen, biofuels, and electricity. No one can predict whether fuels from switchgrass or algae will save our private vehicle habit, or if we'll plug electric cars into solar arrays installed on our garage roofs. These technologies may not be widely affordable. For that reason, this section

³² U.S. Energy Information Administration, http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html.

³³ U.S. Department of Transportation's National Center for Statistics and Analysis.

³⁴ U.S. DOT, Bureau of Transportation Statistics, Table 4-2: Licensed Drivers: 2001.

³⁵ "Your Driving Costs 2007," American Automobile Association, <http://www.aaaexchange.com/Assets/Files/20073261133460.YourDrivingCosts2007.pdf>.

³⁶ *Star Tribune*, 5/13/07, "Property taxes paying lion's share for state's roads, bridges."

³⁷ Texas Transportation Institute, 2005 data.

focuses on post-peak transportation strategies that already exist and that are possible to implement today.

An excellent overall introduction to sustainable transportation issues is available through the Minnesota Pollution Control Agency (MPCA):

<http://www.nextstep.state.mn.us/section.cfm?topic=28>

The Minnesota Pollution Control Agency's Next Step website with background, data, and links on transportation issues and solutions.

Public Transportation

Minnesotans have grappled for decades over the place of public transportation in our state. When the privately-owned metro-area streetcar lines were dismantled in the 1950s to be replaced by buses, the area's affordable and reliable public transit system began crumbling.

Today, there's new interest in public transportation. The area's first light rail line (Hiawatha) has surpassed its ridership projections from opening day. Suburban lobbyists are clamoring for rail to be built to their own communities. And baby boomers—accustomed to travel independence and on the cusp of becoming elderly—are beginning to wonder just how to remain mobile when their car keys are taken away and they're stuck in isolated, cul-de-sac neighborhoods.

European countries, already confronting high gasoline prices, have become world models for public transport. Author Timothy Beatly outlines the steps taken in the Swiss city of Zurich to promote public transportation in Green Urbanism: Learning from European Cities. (Island Press; Washington DC: 2000.)

Officials in Zurich accomplished high levels of transit ridership by designating lanes solely for trams. In addition, signal preemption for transit at intersections eliminates delays for trams and buses. This coupled with high frequency makes using the public transport system more time efficient than driving private vehicles. For example, trams and buses run every six to eight minutes in Zurich, which is more than double the frequency of Saint Paul's highest-frequency bus lines. Furthermore, most areas within the city are accessible within several hundred meters of a tram station or stop.

Most European cities furthermore do not suffer the social taboo of public transportation. Timothy Beatly described seeing some of the wealthiest, most recognizable persons in some cities riding light rail trains to work. Transit use in the Twin Cities is significantly stigmatized, and few business and community leaders routinely use the bus.

For more information on Twin Cities transit and visions for the future, see:

www.metrocouncil.org/planning/transportation/TPP/2004/summary.htm

The Metropolitan Council's 2030 Transportation Policy Plan for the Twin Cities metro region. The Metropolitan Council is a regional planning organization with members appointed by the governor.

www.metrotransit.org

Metro Transit is the transit program of the Metropolitan Council. The website includes a personalized transit planner, transit service updates, as well as a rideshare service (for carpooling) and a link to Van-GO, the region's commuter vanpool program.

www.tlcminnesota.org/index.html

Transit for Livable Communities (TLC) is a major force in Minnesota public transit advocacy. The TLC website lists several potential light rail, commuter rail, and bus rapid transit lines in their 2020 Master Plan, including numerous new rail lines.

[www.mncenter.org/minnesota_center_for_envi/files/GettingOnBoardOctober 2006.pdf](http://www.mncenter.org/minnesota_center_for_envi/files/GettingOnBoardOctober%202006.pdf)

An excellent resource on the community building potential of investment in rail transportation.

Human-Powered Transportation

Walking and cycling have a very large place in a sustainable, post-peak transportation scheme. They require no fossil fuels, are inexpensive (if not free) and can be used by most people, from young teens to older adults. The benefits of human-powered transportation are obvious, and yet both options are marginalized in Minnesota's culture in favor of driving. However, there are reasons to be optimistic about increasing biking and walking in our communities. According to a 2000 US Census survey, Minneapolis has one of the highest percentages of citizens who bicycle to work of any "large U.S. city." That figure is now at two percent but it is growing every year, as new trails and bike lanes are added throughout the city. Local businesses in Saint Paul are offering discounts to customers who arrive on bike or on foot. Businesses along Lake Street in Minneapolis offer discounts to customers who arrive by bus (and on foot). Details on this program are found at:

www.metrotransit.org/hopshop/index.asp

A variety of organizations and health care companies have studied the benefits of walking and biking in Minnesota. New bicycling programs and infrastructure are popping up everywhere, from the Safe Routes to Schools program, which pairs parents and schoolchildren to make their daily commute to neighborhood schools, to the expansion of dedicated bicycle lanes and routes in Minneapolis and Saint Paul, to new bike racks and showers in workplaces. Minnesota also benefits from the leadership Congressman Jim Oberstar, who has brought millions of dollars into Minnesota for new bike lanes, pedestrian paths, and education.

For more about bicycling and walking in the Twin Cities:

www.tlcminnesota.org/index.html

Transit for Livable Communities manages a major bike-walk infrastructure and education program for Minneapolis and surrounding communities.

www.center4neighborhoods.org

The Center for Neighborhoods features neighborhood profiles, zoning and planning information, resources on traffic calming strategies, and links to city and county transportation staff.

www.saferoutestoschools.org

The Marin County Bicycle Coalition, with history of their Safe Routes to Schools program and a link to the National Highway Traffic Safety Administration's complete guide to starting a Safe Routes program in your neighborhood.

www.dot.state.mn.us/saferoutes/index.html

Minnesota Department of Transportation's Safe Routes to School program website.

www.co.ramsey.mn.us/alrc/index.htm

Active Living Ramsey County creates and promotes environments that make it safe and convenient for people to be more physically active. Active Living Ramsey County works to bring about and sustain changes in design, transportation, and public/private policies to cultivate and support a way of live that integrates physical activity into daily lives.

www.midwaytmo.org

Midway TMO promotes bicycling, walking, transit, and other alternatives to driving alone in the Midway area of Saint Paul and Minneapolis. One of several transportation management organizations in the Twin Cities, the Midway TMO is an excellent resource for bike-walk ideas.

Promotion of Commuter Options

Five transportation management organizations (TMOs) work with employers and building property managers in the Twin Cities to promote alternative commuter options. Through programs like Metropass (discounted bus passes only available through employers) and state and federal tax credits, employees can save 40 percent or more on the price of transit passes. The Commuter Connection, located in downtown Minneapolis, also allows visitors to try out the bike rack available on the front of all Metro Transit buses.

Links to each of these TMOs are available at:

www.metrotransit.org/otherTransOpts/index.asp

Several municipalities in the Twin Cities have adopted model ordinances requiring new developments (over certain size threshold) to create a travel demand management (TDM) plan. The Minneapolis TDM and bicycle infrastructure ordinances and the Eden Prairie Developers Agreement, in particular, stand out.

- Minneapolis TDM ordinance (Minneapolis zoning code, 535.140).
- Eden Prairie Development Review Process Handbook, 2003.

Telecommuting, or Telework

Working from home is now more feasible than ever, thanks to modern workplace and home office technology. Employers should increase options for more telework programs for their workforces. Employers that create viable programs today will be prepared to manage the effects of gasoline price spikes on their employees.

www.mite.org

Midwest Institute for Telecommute Education (MITE) is a consultant group that provides expertise in strategic planning, manager/employee training and policy development to assist successful implementation of telecommuting work arrangements. MITE is the creation of more than 50 business and government leaders who contribute their time and expertise to develop the curriculum, seminars and implementation manual that are the foundation of all MITE products and services. MITE is a division of [RESOURCE, Inc.](#), a nonprofit human service organization.

Car-Sharing

Most car trips last just a few minutes. Drivers head to work, return home, run to the grocery store, pick up a book at the library, head back home, and put the car in the garage

for the night. Most cars sit parked for upwards of 22 hours every day. Private car ownership is an expensive and inefficient proposition.

With car-sharing, a large number of people have access to a fleet of vehicles. Individual drivers simply reserve a car online, use it during their reservation, and return the car to its permanent parking space after their trip is complete. An on-board computer tracks driver activity and generates a bill at the end of the month. Car-sharing provides consumers with a more reasonable cost for car use. The cost is in sync with actual driving instead of the cost of owning a car that is used only occasionally.

Car-sharing allows people to live their lives with freedom, mixing transit, bicycling and walking while saving a great deal of money. Car sharers rarely use the vehicles for commuting, since the clock is running while the car sits at work. Instead, they plan their errands for once or twice a week, when they have use of a car.

Car-sharing can be accomplished through established car-sharing organizations, or more informally among neighbors. Businesses, governments, and organizations can also participate in car-sharing, allowing their employees to use transit for their daily commute, and a shared car for local business or personal trips.

Car-sharing resources:

www.carsharing.net

Information on car-sharing from around the world.

www.hourcar.org

HOURCAR is the Twin Cities' largest car-sharing operation with 16 cars in Minneapolis and Saint Paul neighborhoods. A program of the nonprofit Neighborhood Energy Connection, HOURCAR focuses on fuel-efficient vehicles, including the Midwest's only plug-in hybrid electric vehicle.

www.zipcar.com

Zipcar is a Boston-based car-sharing corporation that provides car-sharing service to the University of Minnesota Twin Cities campus.

Intercity bus/train travel

Trains and buses provide a more fuel-efficient travel option than either driving or flying. The following websites offer information on rail and bus service from the Twin Cities.

www.amtrak.com

Amtrak's website includes schedules and a reservation system. The Empire Builder serves Saint Paul with destinations of Chicago, Seattle, or Portland. Rail connections can be made at destination cities.

www.megabus.com

Megabus offers deeply discounted intercity bus service between Minneapolis, Milwaukee, and Chicago.

www.greyhound.com

Greyhound bus company serves numerous Minnesota cities.

www.jeffersonlines.com

Jefferson bus company serves several Minnesota cities.

Air Travel

Finally, a discussion of post-peak oil transportation is not complete without mention of air travel. Unfortunately for those individuals and industries that depend upon frequent and inexpensive airplane trips, the price of aviation-grade kerosene (an oil product) is expected to rise as demand increases and supply dwindles. To our knowledge there are no current proven alternate fuels for airplanes.

Peak Oil and Public Policy

Peak Oil might be the most pressing political issue of this century. To avoid the direst consequences of the coming energy transition, we need intelligent and courageous political and social leadership. Minnesota lawmakers have been generally uninterested or unable to advance public policies that create significant structural changes in the state's energy infrastructure (the enactment of the Minnesota Renewable Energy Standard in 2007 notwithstanding). Even when broad solutions are presented, such as the increase in a gasoline tax, they are marketed with the need for more road repair, while their more pressing goal of increased transit funding is minimized.

While elected officials almost always discuss the financial costs of new policies and projects, they almost never consider energy costs. Government must begin to consider energy costs when making decisions about infrastructure, buildings, government operations, land use, and energy generation. And, elected officials must assume that these costs will be steeply higher in the years to come.

The key public policy goals to prepare for the Peak Oil challenge include to:

- Evaluate current and proposed city, county, and state policies, ordinances, rules and practices to reflect true demands for oil and natural gas.
- Modify these policies so that they favor less use, more efficient use, or substitutes for oil and natural gas.
- Set targets and track results for reduced demand and use of oil and natural gas in public facilities.
- Educate citizens, businesses, and institutions about Peak Oil; encourage creativity and ingenuity in reducing energy use while providing economic and community benefits.

Government has a critical role in preparing for Peak Oil. First, it can offer the carrot, and then it can apply the stick.

Offering the Carrot to Encourage Conservation

1. Invest public money in conservation.

The government affects energy outcomes when it invests in energy infrastructure. Consider, as one example, the hypothetical decision to invest taxpayer funds in one new liquid natural gas (LNG) port facility, at a cost of about \$1 billion dollars. The government has no long-term control over the price or availability of the natural gas resource (given that the largest remaining natural gas resources are found in Russia, Yemen, Iran, Qatar, Angola, and Algeria). Plus, pipelines need to be constructed from the port community to end-users. Security and safety measures must be provided throughout the lifetime of the LNG facility's operations. And the public may never reap a reasonable return in affordable, abundant natural gas on its initial investment.

On the other hand, a \$1 billion dollar investment in conservation could yield better results. Consider how far \$1 billion would go toward retrofitting homes and businesses with insulation and air sealing, geothermal heating and cooling systems, and solar thermal hot water heaters. How many homeowners would be willing to make their own significant investments in advanced conservation systems if they were encouraged by matching funds? In the Peak Oil scenario, there is less risk and more opportunity in managing energy demand than in funding new energy supplies.

2. Provide targeted public subsidies for alternative fuels and technologies.

Most tax-levying units of government make grants and purchase services from private businesses and organizations. Government subsidies can determine which elements of the market fail or take off. This is especially true with government subsidies in alternative fuel and energy sources.

The article "What Price Carbon?" from the March 2007 issue of *The Economist* illustrated three methods that government can use to reduce fossil fuel use: 1) subsidize alternatives, 2) impose standards on the products and processes of production, and 3) price greenhouse gases so as to reflect environmental damage (for example, by creating an artificial market for carbon credits that polluters could buy and sell). The article advocated the last two methods for reducing fossil fuel emissions. If the third method were practiced, then the first two forms of reduction would not be necessary. This is a classic free market argument: taxpayers don't subsidize new sustainable technologies when prices persuade businesses and individuals to make their own seed investments.

Unfortunately, in the Peak Oil scenario, the market may not send clear enough price signals for alternatives to be developed. The free market argument is also a false one. Public monies already flow freely to private companies to support innovation (see the wide variety of taxpayer grants available to private businesses at www.grants.gov), just as public monies flow to energy companies through tax breaks and infrastructure supports: (www.washingtonpost.com/wpdyn/content/article/2005/07/29/AR2005072901128.html).

The government must invest in proven methods to reduce energy use and to dramatically increase conservation of all fuel sources.

3. Engage in thoughtful planning.

Neighborhoods, cities, counties, and regions can institute zoning and planning guidelines that support energy-efficient living. Through thoughtful community design, policymakers tell private developers the kinds of housing, commercial, transportation, and institutional attributes they will accept. For example, consider Transit-Oriented Development.

Transit-Oriented Development, or TOD, was the primary form of development in the United States until after World War II, when owning a car became a norm. In TOD there were pockets of urbanization within a city, and each was built around a major public transit line. People in each urban community had access to public transit, education, business, clothing, and most basic services. TOD is enjoying a resurgence as cities across the U.S. begin rebuilding their transit infrastructure. The Twin Cities, while behind most urban areas of similar size, should follow suit.

TOD and Transportation Policy Resources:

<http://www.metrocouncil.org/planning/TOD/tod.htm>

The Metropolitan Council's Guide for Transit-Oriented Development highlights key ideas about TOD and shows how these ideas have been put to work within the Twin Cities metropolitan area. The Council's guide includes:

- A description of key TOD elements.

- A discussion how TOD might work in different urban and suburban settings.
- Profiles of 16 TOD projects in the Twin Cities.
- Links to other resources.

www.CTOD.org

The Center for Transit-Oriented Development (CTOD) is a national nonprofit dedicated to providing best practices, research and tools to support market-based transit-oriented development. CTOD encourages the development of high-performing TOD projects around transit stations and the building of transit systems that maximize the development potential.

www.thenec.org

The Neighborhood Energy Connection, parent organization to HOURCAR car-sharing, authored a guide for providing car-sharing services within new TOD projects.

http://www.mplstmo.org/pages/tdm_guidebook.htm

"Expanding Commuter Options in the Twin Cities" a report by local transportation policy expert David Van Hattum, offers "practical and cost-effective steps to reduce traffic congestion." This handbook is a useful introduction to the variety of ways leaders and policymakers can create public and private policies to support more energy-efficient transportation.

Readings:

Flint, Anthony. This Land: the Battle over Sprawl and the Future of America. Johns Hopkins University Press; Baltimore: 2006.

Beatly, Timothy. Green Urbanism: Learning from European Cities. Island Press; Washington DC: 2000.

Applying the Stick: Ways to Discourage Energy Inefficiency

Punitive strategies are generally unpopular, unless the reasons for the sanctions are widely understood. During World War II, unpopular food rationing was literally "sold" to consumers through a coordinated federal public relations campaign (www.u-s-history.com/pages/h1674.html). A similar nationwide campaign would help to sell U.S. energy consumers on the need for, and value of a nationwide energy conservation campaign.

Following are several "punitive" strategies that would result in more conservation-focused consumer choices:

1. **Increase Corporate Average Fuel Economy (CAFE) standards.** Legislatively increase the overall fuel efficiency of vehicles sold in the U.S. Reduce consumer choices and realize an immediate reduction in gasoline demand from new car buyers.
2. **Levy a gasoline tax and use funds raised for sustainable transportation programs allocated to communities where the taxes are raised.** Tax drivers heavily at the pump, and invest the resulting funds in community-based transit, bicycle and pedestrian infrastructure, car-sharing networks, telework programs, and car and van-pooling.
3. **Unbundle parking costs from housing and employment.** Make housing more affordable and employment more lucrative for non-car owners. Disconnect, or

“unbundle,” the costs of parking structures from new housing construction. Charge drive-alone workers the full costs of corporate parking construction and maintenance, rather than passing these costs on to the general workforce or to customers.

4. **Hold manufacturers to higher energy-efficiency standards** for oil and natural gas-fueled appliances, such as boilers, hot water heaters, ranges, clothes dryers, and fireplaces.

Given the threat of Peak Oil, political leaders and planners have an obligation to establish public policy goals, including:

- evaluation of city and county policies and their effect on oil and natural gas consumption
- setting targets for decreasing fossil fuel use
- educating citizens about the need to reduce dependence on oil and natural gas
- providing incentives to reduce consumption

Some communities are creating public policy manuals to prepare for the Peak Oil transition. The city of Portland, Oregon convened a 12-member Peak Oil Task Force, which was charged with “examining the potential economic and social consequences of Peak Oil in Portland and developing recommendations to mitigate the impacts of rising energy costs and declining supplies.” The Task Force held more than 40 meetings and involved more than 80 participants in their work. In January, 2007, they released a draft of their report, titled: “Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas,” found at www.portlandonline.com/osd/index.cfm?c=ecije.

Other communities (such as Willits, California) have created study and conservation teams. Tomkins County, New York, and Kinsale, Ireland have written preliminary Peak Oil plans. These plans, which are mostly introductory, delve into the stark possibilities of Peak Oil. The plans include sections on hunting for deer and raising livestock in the city, public safety requirements as key resources become scarce, and how to manage the necessity of local food production given the realities of a changing climate. In the face of such serious outcomes, the costs of the energy conservation strategies discussed throughout this guide seem possible.

Resources:

www.willitseconomiclocalization.org

The Willits, California Economic Localization (WELL) project, a comprehensive community effort to foster a sustainable local economy.

www.ibiblio.org/tcrp/doc/project

Tomkins County, New York Relocalization Plan

www.energybulletin.net/11464.html

Kinsale, Ireland Energy Descent Plan

www.beyondoilnyc.org

The Sierra Club, “Moving New York City toward Sustainable Energy Independence.” Recommendations to prepare New York for energy price volatility.