

# ENERGY Factsheet

2011-2012

China is currently the world's renewable energy leader leading in wind and solar-thermal installations and hydropower production. For example, China added 18.9GW (or 18,900 MW) of new wind capacity in 2010. This compares to the 5GW (or 5,000 MW) in added capacity the United States brought on in 2010.<sup>2</sup>

## Population Versus Energy Consumption

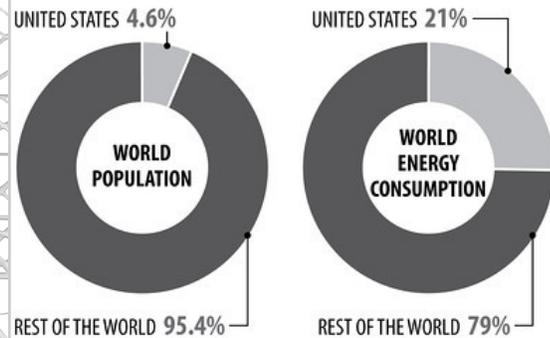


Figure 1. National Energy Education Development Project. (2011).

Of the world's total energy consumption in 2010, 81% came from fossil fuels, and 2.8% came from nuclear. The other 16% came from renewable sources which delivered approximately 20% of the global electricity supply.<sup>2</sup> The United States still leads the world in biomass power generation, producing 57% of the world's total.<sup>2</sup>

Most renewable energy goes to producing electricity in the United States. Up to 53% of the total U.S. renewable energy in 2009 went to electricity production.<sup>2</sup> In the United States, renewable energy accounted for 10.9% of primary energy production, as compared to the 11.3% produced by nuclear.<sup>2</sup>

33% of the United States' total greenhouse gas emissions and 40% of our CO<sub>2</sub> emissions come from generating the nation's electricity.<sup>4</sup>



In Minnesota  
3.1 million fewer  
megawatt-hours were  
generated from coal in  
2008, compared  
to 2005.

Approximately 40% of energy consumption in the U.S. is used to heat, cool, light and operate buildings. Because 70-85% of the buildings that will be in use in the year 2030 already exist today, significant energy savings and greenhouse gas emission reductions will occur through retrofitting of existing structures.<sup>1</sup>

## U.S. Electricity Net Generation, 2009

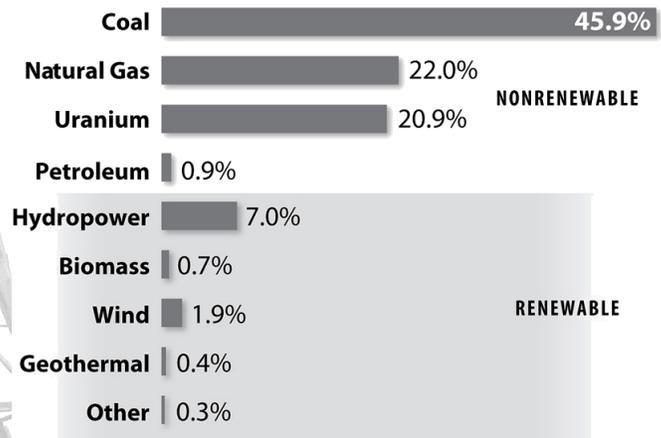


Figure 2. National Energy Education Development Project. (2011).

<sup>1</sup> Office of Energy Security. *Clean Energy Technology Roadmap*. (2009).

<sup>2</sup> U.S. Energy Information Administration. *Annual Energy Review 2009*. (August 2010).

<sup>3</sup> Renewable Energy Policy Network for the 21st Century. *2011 Global Status Report*. (July 2011).

*"Minnesota continues to be a leader in renewable energy, renewable fuels, energy efficiency and other energy-related efforts ..."*<sup>1</sup>

**DID YOU KNOW THAT?**

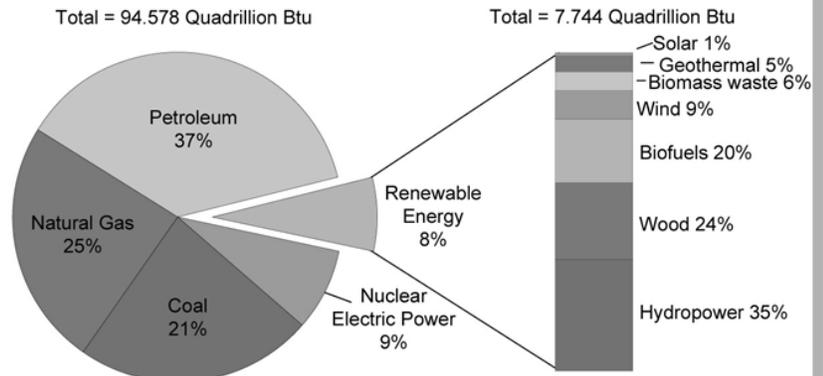
Wind-generated electricity increased by 28% in the U.S. between 2008 and 2009—more than any other renewable source of generation.



Minnesota has no fossil fuel resources, but has great potential to meet its energy needs through renewable technologies. Coal-fired power plants account for roughly three-fifths of Minnesota's electricity generation. Minnesota receives most of its coal supply by rail from Montana and Wyoming. Minnesota has two oil refineries in the Minneapolis-St. Paul area for processing crude oil that comes primarily from Canada.

The residential sector is Minnesota's largest natural gas consumer, accounting for over one-third of the State's consumption. Over two-thirds of Minnesota households use natural gas as their primary heating fuel. Natural gas is mostly supplied by pipelines from Canada and from North and South Dakota.<sup>1</sup>

**U.S. Energy Consumption by Energy Source, 2009**



Note: Sum of components may not equal 100% due to independent rounding.  
Source: U.S. Energy Information Administration, *Annual Energy Review 2009*, Table 1.3, Primary Energy Consumption by Energy Source, 1949-2009 (August 2010).

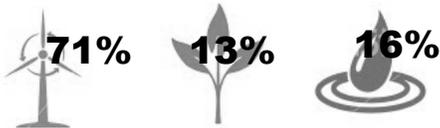
**Statewide, Greenhouse Gas (GHG) emissions have declined by 1.2% between 2005 and 2008.**

**60% of Minnesota's GHG emissions come from generating electricity and transportation.**

Minnesota has established a Renewable Energy Standard (RES), which is often referred to as "25-by-25" because it stipulates that all Minnesota electric utilities must have at least 25% of their total retail sales from renewable sources by 2025. The state outlined steppingstone requirements over the years, including a 1% goal in 2009. All 16 electric utilities met the standard 1% with, 71% of this portion came from wind, 16% from hydroelectric and 13% from biomass. In 2010, the goals increase to 7% for all utilities, except for Xcel Energy, which must meet a 15%

In addition to the RES, Minnesota has had a longer standing program for both gas and electric utilities called the Conservation Improvement Program (CIP). The CIP requires that a portion of a utility's revenue go towards energy efficiency and conservation programs. Examples include: furnace rebates, lighting rebates and efficient building design assistance.

Additionally, in 2007, the Next Generation Energy Act (NGEA) established that utilities must reach an energy conservation goal of 1.5%. Therefore, as of 2010, both electric and gas utilities must spend a specified portion of their revenue on energy conservation efforts, and, in doing so, conserve 1.5% of their energy use.<sup>6</sup>



threshold. While 2010 numbers have not been finalized, the Department of Commerce's Energy Security Office indicates that the utilities are at or very close to meeting the standards.<sup>7</sup>

Be sure to pay attention to *how* the data are conveyed. Energy data are compared using multiple units. Reports will use **CAPACITY**, **GENERATION**, or **CONSUMPTION** (sometimes all three) to compare various data. For example, a wind turbine could have the *capacity* to generate 2MW of electricity, but with Minnesota's wind speeds, this same turbine will typically *generate* about 760kW.

The amount of electricity *consumed* is usually measured in kilowatt-hours (kWh). One kWh represents the amount of energy needed by a 1,000-Watt device (e.g. iron, microwave) to operate for one hour.



<sup>4</sup> American Wind Energy Association (AWEA). *U.S. Wind Industry Second Quarter Market Report* (August 2011).

<sup>5</sup> AWEA. <http://www.awea.org/learnabout/publications/upload/4Q10-Minnesota.pdf>. (February 2011).

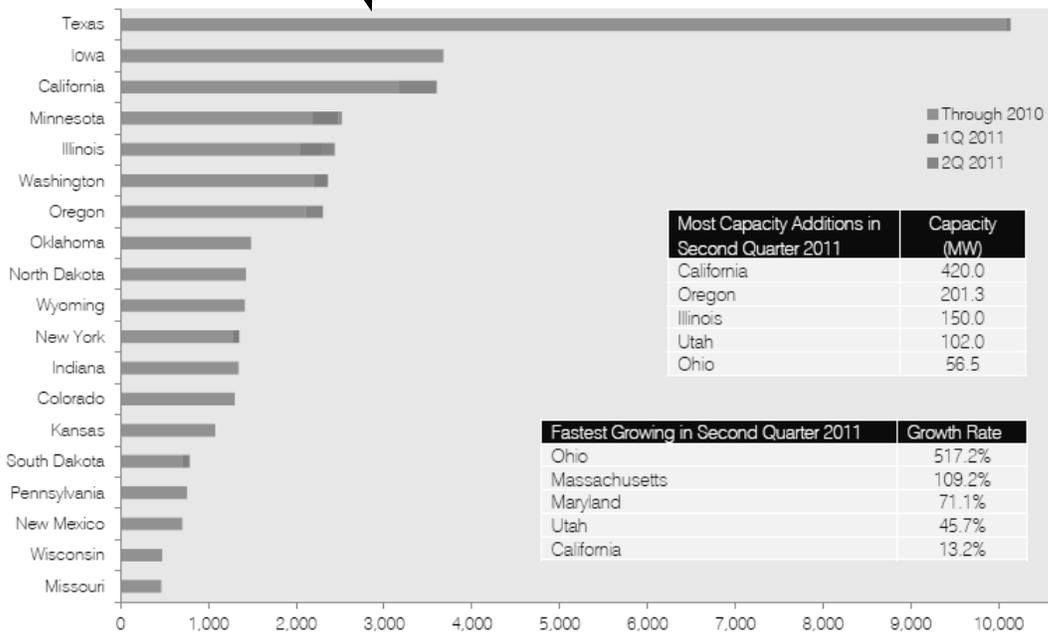
<sup>6</sup> PEW Center on Global Climate Change. <http://www.pewclimate.org/docUploads/climate101-overview.pdf>. (January 2011).

<sup>7</sup> Office of Energy Security. *Report to the Minnesota Legislature*. (January 7, 2011).

# SOLAR

Minnesota's weather conditions and latitude may uniquely position the state to evaluate how systems perform in variable weather and seasonal change conditions. These conditions are already being capitalized upon: cold climate testing in nine Minnesota cities (including

International Falls, Bemidji, Thief River Falls and Baudette) attracts auto engineers from around the globe. Due to available expertise and its climate, Minnesota may have the unique ability to influence product development by serving as a qualified research partner to evaluate performance and economics associated with solar.<sup>1</sup>



A 1-megawatt solar thermal installation, the largest in the Midwest, was recently installed on St. Paul's River Centre convention center. The system consists of 133 solar collectors that provide hot water and space heating for the convention center. This installation hopes to be credited for

a reduction of 900,000 pounds of carbon dioxide emissions per year!<sup>13</sup>

Figure 4. American Wind Energy Association (AWEA) Second Quarter 2011 Annual Report. 2011

According to the *Clean Energy Technology Roadmap*, a report from the Minnesota Office of Energy Security, distributed solar thermal and solar PV are the most logical applications of solar power in Minnesota. Due to the fact that Minnesota's buildings consume 41% of the state's total energy, installing these solar systems directly to buildings allows for the most efficient use of resources and, in turn, the greatest reduction in electricity and natural gas use.

# WIND

Minnesota ranks 4th nationally for most installed wind capacity and added the 5th most new capacity in 2010.<sup>5</sup>

Today, U.S. wind power capacity represents more than 20% of the world's installed wind power. Over 400 manufacturing facilities across the U.S. make components for wind turbines, and dedicated wind facilities that manufacture major components such as towers, blades and assembled nacelles can be found in every region.<sup>9</sup>

Although Minnesota's wind resource (as determined by measurements of wind speeds and consistencies at turbine height) is ranked 11th in the nation, Minnesota is currently ranked 3rd for its percentage of the state's total electricity derived from wind energy.<sup>5</sup>

## Minnesota Wind Projects completed in 2011<sup>3</sup>

Adams	19.8 MW	12 turbines
Bent Tree	201.3 MW	122 turbines
Danielson	19.8 MW	12 turbines
Lakefield	52.5 MW	35 turbines
Community Wind north (phase 1)	30 MW	12 turbines

<sup>8</sup> Office of Energy Security and MPCA. *Annual Legislative Proposal Report on Greenhouse Gas Emission Reductions* (January 2011).

<sup>9</sup> AWEA. [http://www.awea.org/learnabout/industry\\_stats/index.cfm](http://www.awea.org/learnabout/industry_stats/index.cfm). (2011).

<sup>10</sup> Minnesota Department of Commerce. *Biomass for Thermal Heat or Electricity* (powerpoint). (2007).

<sup>11</sup> Biobusiness Alliance. *Destination 2025-Minnesota's Renewable Energy Industry: A Vision for the Future*. (2009).

Smart grid technologies are at the cutting edge of furthering Minnesota's energy use. In operating under a smart grid system, both the utilities and consumers would have real-time data on the energy demands on the system. This information, along with transmission infrastructure improvements would allow the peak energy demands to be reduced, and in turn, our total energy generation needs.

Because Minnesota cannot currently generate all its energy needs, it must import 25% of its energy from nearby states. To do so, Minnesota must rely on its electric transmission grid. This grid is currently being upgraded to allow for greater voltage and speed in electricity delivery. Ideally, it will better accommodate renewable energy sources. Many utility providers and solar & wind

producers point to the state's transmission as their largest roadblock to incorporating renewable energy into the system. Minnesota is also maximizing energy storage technologies (i.e. advanced batteries).



### Smart Grid technologies:

Devices that allow for two-way informational flows between electric suppliers and consumers.

They allow the capability to monitor transmission flow, electric generation, customer preferences, and individual appliances or energy-using devices.

Current technologies are focused on reducing peak energy demand and enabling greater energy efficiency.<sup>8</sup>



Such technology will allow for a more consistent electric renewable supply. The Sodium-sulfur (NaS) battery is a potential solution and has shown high storage capacity, the ability to handle multiple charges/recharges and the opportunity for even larger scale applications. Xcel Energy is currently testing such batteries at Minnwind Energy, LLC wind farm near Luverne Minnesota.<sup>15</sup>

*"The types of energy used in the 21st century will be determined by the decisions and investments made in the next 20 years."<sup>14</sup>*

Apart from advances in Smart grid technologies, transmission and energy storage, Minnesota is looking to make cutting-edge advances in bioenergy. More specifically, optimizing the growth, storage, processing and application of end-use bioenergies.<sup>1</sup>

Minnesota's variety of forests and agriculture residue, make it especially suited to biomass

research and use. In a report to the Minnesota Department of Commerce, John Madole of Madole & Associates, recommended Minnesota pursue biogas

#### DID YOU KNOW?

To date, over **3,300** Minnesota school buses have been retrofitted to incorporate emissions reduction equipment.

and solid fuel combustible biomass industries. Biogas (typically methane) is produced by processing biomass through *anaerobic digestion*—a process by which microorganisms break down biomass in the absence of oxygen. Solid fuel combustible biomass is typically highly concentrated biomass in pellet form, to be used for heat or energy production in biomass burners. Minnesota currently has 3 pellet producers who sell largely to markets overseas.<sup>10</sup>

<sup>12</sup> U.S. Energy Information Administration (EIA). *Minnesota*. (October 2009).

<sup>13</sup> Solar Energy Technologies Program News. *Midwest's Largest Solar Thermal Project Goes Live*. (2011).

<sup>14</sup> PEW Charitable Trusts. *Who's Winning the Clean Energy Race? 2010 edition*. (2011).

<sup>15</sup> Clean Energy Resource Teams. *Designing a Clean Energy Future: A resource Manual*. (2003).



YES! is funded in part by Southwest Initiative Foundation, Southern Minnesota Initiative Foundation and the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources. YES! empowers youth to partner with their community to economic and environmental vitality through hands-on learning and team-based projects.

