



Emerging Energy Infrastructure Technologies: Opportunities and Implementation

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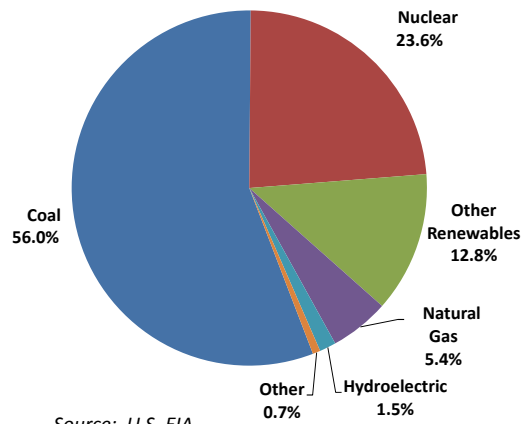
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Electricity in Minnesota

- 52.5 million GWh generated in 2009
- 64 million GWh sold in 2009
- Coal is imported from MT and WY
- Renewable goal: 25% by 2025

MN Electric Power Generation by Energy Source



Source: U.S. EIA

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States with Renewable Portfolio Standards

- Refer to NREL & ACE³ databases for more detailed information

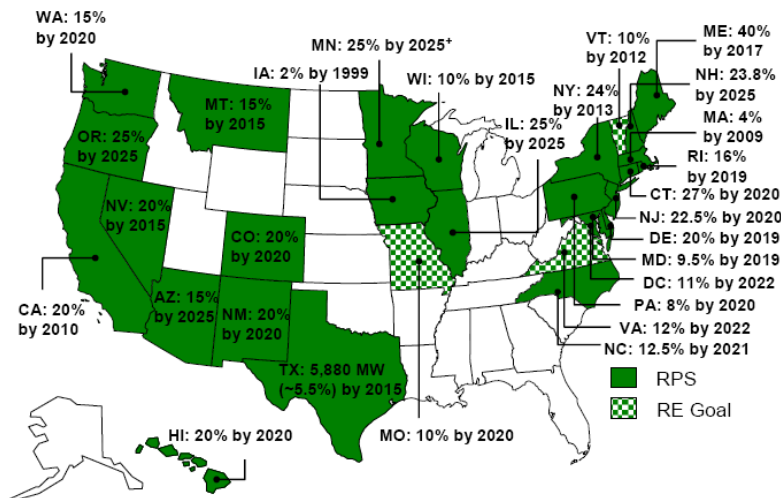


Image source: <http://www.nrel.gov/analysis/pdfs/41409.pdf>

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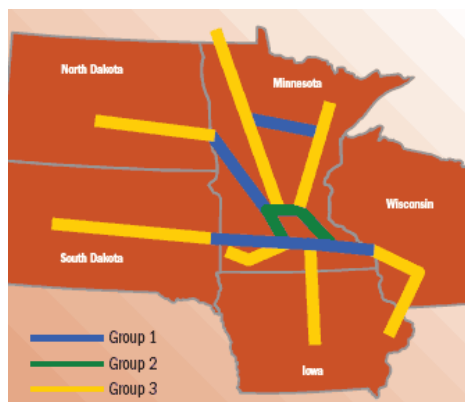
Minnesota Power

- Serves 144,000 customers in NE Minnesota
- Building two wind farms in ND, totaling 187 MW
- Reached purchase power agreement with Manitoba Hydro for 250 MW of hydro power beginning in 2020
 - Also allows MP to transmit wind power to Manitoba as a type of storage system

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CapX2020

- Joint project of 11 regional utilities to build 1,600 miles of new transmission lines
- First phase: 5 projects, 700 miles of lines
- Supports expansion of wind and other renewables



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Distributed Generation

- Energy produced at the community level or on-site
- Shifts control from supplier to consumer
- Reduces transmission loss
- Improves grid resilience
- Glad MN is holding 4 workshops!



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Local Resources

- What are your local resources? Efficiency, wind, geothermal, hydro, solar, biomass (including wastes)
- Find out what your state is spending on energy that would otherwise be spent locally if it were producing its own energy – keep dollars local!
- Look at community's energy use, costs & resources
- Money saved by implementing green technology can be reinvested in the community and grow businesses, represents real savings in energy and pollution
- Opportunities: greening of schools, work with co-ops, municipal utilities, and colleges/universities

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State Resource Assessment



- Link to state-by-state success stories (NASEO):
http://naseo.org/programs/sep/recovery/SEP_Success_Stories-2011-02.pdf

Local Economic Benefit

- Locally-produced energy supports the local economy
- Creates local jobs
- Revenue stays in the community
- Creates economic multiplier effect

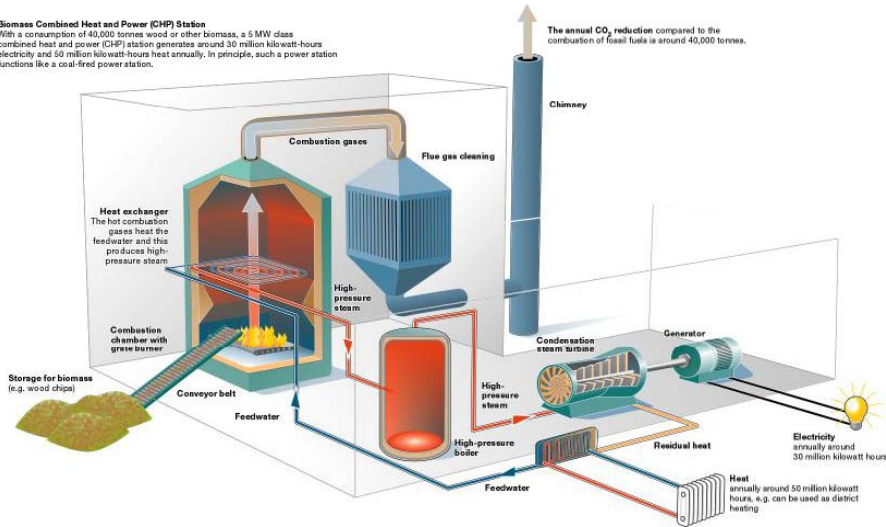


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Combined Heat and Power (CHP)

Biomass Combined Heat and Power (CHP) Station

With a consumption of 40,000 tonnes wood or other biomass, a 5 MW class combined heat and power (CHP) station generates around 30 million kilowatt-hours electricity and 50 million kilowatt-hours heat annually. In principle, such a power station functions like a coal-fired power station.



Source: Germany's Agency for Renewable Energies

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District Energy St. Paul

- Centralized heating and cooling system
- Distributed through water piping
- Supplies much of downtown St. Paul
- Energy is partially supplied through CHP system, fueled by wood waste
- Building solar thermal system to increase capacity

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Role of Thermal Energy

- Constitutes 37% of national energy use
- Often left out of policy
- Policy often focused on electricity and fuels
- Thermal is key to optimal energy use



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Solar Energy Programs

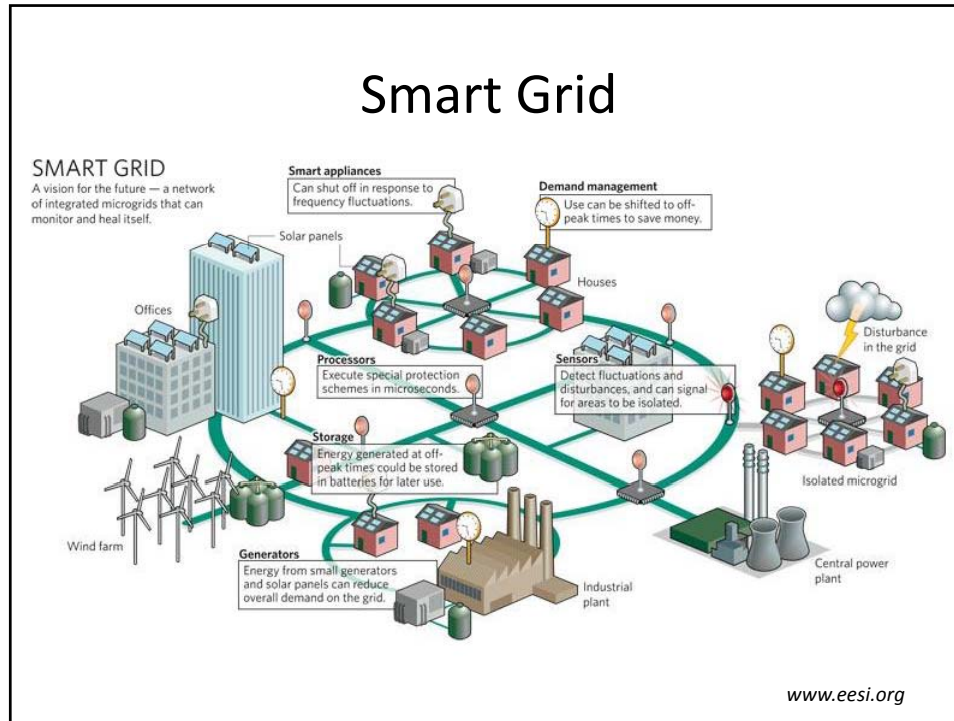
Success Stories

- San Jose, California obtained a power purchase agreement to have a 1.3 mW **solar energy system installed on a municipal facility**, with an estimated savings of more than \$500,000 over the next 20 years.
- Gainesville, Florida, which implemented the first **European-style Solar Feed-In Tariff** in the U.S., which has increased the amount of solar energy produced from 328 kW (in 2009) to almost 7 mW today.
- Strategies from Pendleton, Oregon, for using **tax credits** to make solar installation affordable for businesses and homeowners, and find out how the city got two solar energy systems installed that were paid for by a third party.

Benefits

- Provide communities with power from secure, domestic sources
- Produce clean energy that helps meet greenhouse gas reduction targets and climate change goals set at the state and local levels
- Develop new economic opportunities and create new local jobs
- Improve regional economic competitiveness.

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Transportation Electrification

- The Leaf and Volt are hitting the road, but adequate charging infrastructure key to market penetration
- 3,150 non-residential electric charging stations in U.S.
 - Greater than number of E85 fueling stations
 - What about flex-fuel plug-in hybrids?
- Options to make EVs practical for owners without a garage?
- How must utilities prepare for EVs?
- Not just passenger vehicles
 - Electrified parking spaces for long-haul trucks
 - Shore-based power for docked ships



Energy Storage Systems

- Advanced storage technologies have the potential to unlock a cleaner and more efficient electrical delivery system
- Needed at both utility and community/small scale
- Pumped storage, compressed air, fly wheels
- Fuel cells can be used to store energy created by renewable energy sources that can then be released into the grid at the most opportune time
- EVs become mobile storage systems in a smart grid
- Research & Development is critical




Renewable Energy Jobs


Type of Renewable Energy	U.S. Job Estimates	Relation to Industry
Wind	75,000	Direct/Indirect
Solar	93,500	Direct/Indirect*
Hydropower	200,000-300,000	Direct
Geothermal	18,300	Direct/Indirect
Biomass	14,000	Unknown
Biodiesel	51,893	Unknown
Ethanol	70,402; 69,564; 260,711	Direct; Indirect; Induced
Total	853,370-953,370	

*Estimate comes from a direct survey of solar employers, who reported the number of workers who spend 50% or more of their time in solar.





Current Legislation



- **Long term consistent policy** is essential to drive innovation and market development (eg, Germany, China, CO, TX, PA)
- **S.1000 -- Energy Savings and Industrial Competitiveness Act of 2011** (reported out by Senate Energy Committee)
 - Introduced in May by Senators Jeanne Shaheen [NH], Rob Portman [OH] & Christopher Coons [DE]
 - Includes building energy codes, appliance standards, worker training and capacity building, building efficiency finance, electric motor rebate program, industrial efficiency and competitiveness, federal agency energy efficiency, etc.
- **FY 2012 Appropriations** – eg, Energy & Water, Agric., DoD
- **Clean Energy Standard discussion** (Bingaman-Murkowski)
- **FERC Order 1000 encourages regional planning**
- **Thermal Renewable Energy and Efficiency Act** (Franken-McCollum)

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Policies that Work

- **Long term, transferable incentives work best.**
 - South Carolina's *Energy Freedom and Rural Development Act* (2008): incentives focused on diversifying feedstocks for biofuel facilities and research
 - Oregon's *Business Energy Tax Credit (BETC)*: Biorefinery projects and equipment used to produce biofuels are eligible for a tax credit (against taxes due) for 35-50 percent of the project costs
 - For more information: http://eesi.org/021610_state_biofuel_paper
 - State Clean Energy Funds
- **1603 Program: Payments for Specified Energy Property in Lieu of Tax Credits (expires end of 2011) & PTC/ITC**
 - allows taxpayers eligible for the federal business energy investment tax credit (ITC) or production tax credit (PTC) to take this credit or to receive a grant from the U.S. Treasury.
 - PTC and ITC expire at the end of 2012 for large wind; end of 2013 for geothermal, biomass, and hydro/marine; end of 2016 for solar, CHP, small wind, and geothermal heat pumps.
- **Government Procurement Policies / Market Aggregation / Co-Ops**

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Takeaways

- Envisioning our energy future – what do you want it to be?
- Hold design charrettes
- Renewable energy hybrid opportunities
- What are our resources?
- What will be the infrastructure needs for those resources?
- Make sure you are not fostering perverse incentives
- Create win-wins: use agriculture, forestry, and waste to meet multiple objectives:
 - Environmental and better energy security, public health, local economic development, competitiveness, innovation

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