Keys to delivering solar power at competitive prices
NASEO – September 13, 2016

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Minnesota State Energy Office

Accelerate market acceptance of energy efficiency & renewables

- State Energy Program
- Conservation Improvement Program
- Low-Income Weatherization Assistance Program
- Made in Minnesota Solar Energy Incentive Program
- Competitive & special funding
“I’d put my money on the sun and solar energy. What a source of power!”

~ Thomas Edison, 1931
One day solar “may provide more power than all the world’s coal, oil, and uranium.”

- U.S. News & World Report, 1956
Enlisting the Sun
Powering the U.S. Military
with Solar Energy
Americans Want More Emphasis on Solar, Wind, Natural Gas

by Dennis Jacobe, Chief Economist
IHS CERAWEek

The big energy debate that solar power has finally won

The cost of solar panels has dropped from $150/watt in 1970 to 60 cents/watt today.

COMMENTARY

Terry Tamminen | @terrytamminen
Tuesday, 21 Apr 2015 | 11:00 AM ET

CNBC
MN case study: Keys for delivering solar power at competitive prices

1. Policies to promote growth
2. Consumer options
3. Empowered marketplace
1. Policies to promote growth
Solar Policies = Solar Growth

2015 Year-End Cumulative Solar PV Capacity (MW dc)

- California, 11,987
- North Carolina, 2,087
- Arizona, 2,020
- New Jersey, 1,631
- Nevada, 1,041
- Massachusetts, 1,037
- New York, 638
- Hawaii, 557
- Colorado, 542
- Texas, 537
- Others, 3,519

Source: SEIA/GTM Research U.S. Solar Market Insight
USA = 29 GW of Capacity Installed

Yearly U.S. Solar Installations

2016 PV = 85% increase over 2015

Source: SEIA/GTM Research U.S. Solar Market Insight Q4 2015
greentechmedia.com/research/ussmi
Used with permission by: Solar Energy Industries Association
40+ state now have Net Metering - reaching for grid parity in 20

Source: Shayle Kann, GTM Research U.S. Solar Market Insight Conference
Keynote: The Future of Solar
<table>
<thead>
<tr>
<th>State</th>
<th>2011-15 Utility-Scale MW</th>
<th>2016-2020 Utility-Scale MW</th>
<th>Utility-Scale % Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Washington</td>
<td>0.0</td>
<td>142.4</td>
<td>-</td>
</tr>
<tr>
<td>2 Iowa</td>
<td>0.0</td>
<td>68.0</td>
<td>-</td>
</tr>
<tr>
<td>3 Louisiana</td>
<td>0.0</td>
<td>33.7</td>
<td>-</td>
</tr>
<tr>
<td>4 New Hampshire</td>
<td>0.0</td>
<td>12.5</td>
<td>-</td>
</tr>
<tr>
<td>5 Virginia</td>
<td>2.1</td>
<td>750.4</td>
<td>36414%</td>
</tr>
<tr>
<td>6 Minnesota</td>
<td>2.3</td>
<td>682.6</td>
<td>29578%</td>
</tr>
<tr>
<td>7 Michigan</td>
<td>1.3</td>
<td>333.5</td>
<td>26372%</td>
</tr>
<tr>
<td>8 South Carolina</td>
<td>3.7</td>
<td>525.2</td>
<td>14095%</td>
</tr>
<tr>
<td>9 Florida</td>
<td>20.9</td>
<td>1,173.0</td>
<td>5511%</td>
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<tr>
<td>10 Oregon</td>
<td>26.3</td>
<td>1,041.8</td>
<td>3861%</td>
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</table>
MN Solar Policies = Solar Growth

• 1.5% Solar Electricity Standard + 10% Goal
• Community solar mandate
  • Moves consumers to support voluntary programs
• Support for generators
  • Net Metering cap of 1,000 KW
  • Value of Solar
• Move from capacity to performance-based incentives
  • Made in Minnesota
  • Solar*Rewards
Minnesota Capacity Estimate 2020

Minnesota's Possible Future Solar Capacity

Current capacity: 38 Megawatts$_{DC}$ as of March 2016

- Total resource mix from solar:
  - 2015 = 0.01%
  - 2020 = 1%
  - 2030 = -10%
2. Options Exist for Solar Entry
Solar Options

- Rooftop Solar
- Community Solar
- Green Pricing

Photo Credit: Applied Energy Innovations
State run
Made in Minnesota

- $15 million annually
- 10 years
- Investor owned utilities
- Performance Based
- < 40 kW
- 50%/50% residential and commercial projects
- $250K Solar Thermal Rebate Program

Xcel Energy
Solar*Rewards

- $5 Million annually
- 5 years
- < 20KW
- $150 Million total
- $.08/kWH for 10 year
Expanding solar options: Community Solar

Credit on electricity bill

Power Purchase Agreement

Customer Acquisition and Management

Icons from www.flaticon.com

energy.gov/sunshot

Used with permission: USDOE-Sunshot
MN Community Solar Gardens

- 2 Investor Owned
- 16 Cooperatives
- 1 Municipal
Xcel Community Solar

- MN Statute 216B
- Projects <1MW
- 5 subscribers minimum
- Subscribers receive on-bill credit
- Subscribers must live in a contiguous county
Wright Hennepin Cooperative

• First community solar program in Minnesota:
  • Opened with 40 kW system September 2013
  • Has expanded to 340 kW
• Subscribers own the system:
  • Rate locked for 20 years
  • 15.5 cents/kWh
  • Pre-pay or meet in the middle
• Utility commitment:
  • Utility promotes eligibility for federal ITC
  • Utility maintains system

Community Solar Considerations

- Program Administration
- Subscription model
- Commercial *and* Residential?
- System size
- Transferability
- REC ownership
- Securities
Green Pricing

- Optional utility service that allows customers
- Support greater level of utility company investment in renewable energy technologies.
- Customers pay usually less than 1 cent/kWh more
- May include solar, wind, bio
- RECs remain with customer
Barriers still exist for solar

- High upfront costs
- Long-contract requirements
- Rental housing
- Shaded rooftops
- Confusing subscription requirements
- "bad" actors
- Low credit score
- Lack of information
- Access to financing
- High "soft costs"
- Interconnection wait times
- Structural issues
- Anti-solar HOA rules
- State or local officials
- Structural issues
3. State Energy Offices play a vital role in empowering the marketplace
DOE focused on lowering Soft Costs

SunShot Initiative

SunShot Goal:
6¢/kWh without subsidy
A 75% cost reduction by 2020

energy.gov/sunshot

Slide credit: DOE SunShot initiative, National Community Solar Partnership Southeast Region presentation summer 2016
Provide Technical Assistance

- Structural engineering
- Model permits
- Solar help-line
Support business & government
Support business & government

Minnesota Business First
Stop

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
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<tbody>
<tr>
<td>2000</td>
<td>348</td>
</tr>
<tr>
<td>2014</td>
<td>772</td>
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</table>

122% increase in clean energy businesses since 2000
Partner to grow consumer awareness

Community Solar in Minnesota

Community solar gardens are centrally located solar systems that produce electricity for a community of individual subscribers.

What’s on this map?
- Solar energy customers can subscribe to community solar gardens offered by private developers.
- Members of other utilities can subscribe to a community solar garden if a program is offered.
- Minnesota Department of Commerce solar garden installations

How it works?
1. Contact your electric utility to learn more or visit CleanEnergyProjectBuilder.org to find a community solar garden near you.
Invest in staff expertise

– MiM program coordinator
– MiM solar business advisor
– SEP solar policy specialist
– SEP DG engineer
– Clean technologies coordinator
– Administrative support
– Financial rates analyst
– Legal
– Upper management
Utilize outside expertise

- National Association of State Energy Officials
- U.S. Department of Energy - Sunshot
- National Community Solar Partnership
- National Renewable Energy Lab STAT Program
- Interstate Renewable Energy Council
- Trade & research organizations
- + many more....
On the horizon...

PVEV

Solar + Storage
In Summary…

3 keys for delivering solar power at competitive prices

• 1. Policies to promote growth
• 2. Consumer options
• 3. Empowered marketplace
Thank you~

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~Thank you~