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Building Minnesota's Solar Future:
The Option of a "Solar Carve-Out" in the Renewable Energy Standard

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Planning for a diversity of renewable resources is important to achieving the long-term transition to a sustainable energy future. Solar energy will be a key part of the renewable energy mix. The current state program – a solar rebate ending in 2009 – has been helpful to jump starting solar in Minnesota, but its imminent expiration is not conducive to the development of a long-term sustainable solar industry. A "solar carve-out" in the existing Renewable Energy Standard could provide for the orderly and market-driven development of a solar industry in Minnesota. This issue brief provides background on how a solar carve-out would work, the benefits and some of the issues in crafting one.[1]

Background

Minnesota has long been a national leader in renewable energy policy, particularly with regard to wind energy development. Minnesota's strong commitment to wind energy dates back to the early 1990s, and came before the global surge in wind development that has lead to a cost-competitive industry. This commitment culminated in 2007 with the passage of Senate File 4, the Renewable Energy Standard (RES) bill. The bill simultaneously strengthened the previous renewable energy objectives with a specific mandate, and increased the target of those objectives to earn Minnesota the designation of having the "strongest Renewable Portfolio Standard in the country."[2] Although the electricity to meet this mandate will not come entirely from wind, it is anticipated that the vast majority of development to meet the RES will be wind. This will push wind energy to near the limits of what studies have shown the grid can accommodate from this intermittent source, resulting in possible transaction costs from transmission upgrades. [3]

If Minnesota is to develop renewable sources beyond 25 percent, development of additional, cost-effective sources of renewable energy over the next 15-20 years will be necessary. Although not currently cost-competitive with utility-scale wind sources, solar technology is improving rapidly and has much potential in the long-term for expanding renewables beyond the limits of wind energy. This is due to several favorable characteristics of solar:

- The solar production often closely matches with utility demand and can more easily be easily absorbed into the grid; and
- Solar is appropriate for urban areas and almost always developed at the point of consumption with little to no impact on the transmission system.

One myth that has slowed solar policy discussion is that Minnesota isn't sunny enough to make solar practical. However, other states' solar activities are not solely correlated with the solar resource. Instead, three equally important components determine the viability of state markets – solar resource, retail prices, and state policies.

Minnesota's solar resource is very good – nearly as good as Miami – and solar resources change more gradually and linearly across distances, unlike wind energy, which is more site specific across the state, and varies with the cube of the wind speed. Solar should also be compared to the retail price of electricity, not any particular technology, since it is offsetting direct retail consumption. These two factors, resource and prices, combine to equalize less sunny, but more expensive states in the northeast, with those in the west. Minnesota finds itself in the middle of both issues.

The third component is policy. In crafting solar-specific policies, southwestern states are clearly moving to emphasize their solar resource strengths, price increases, and environmental concerns, while northeastern states are responding more to the latter two. New Jersey has a lower solar resource than much of the country, including Minnesota, and yet has the second largest solar market in the U.S. Similarly, Germany has roughly the same solar resource as Alaska (the lowest in the country), and yet in 2006 Germany installed nearly seven times more solar electric capacity than the entire U.S.[4]

While other states have included solar as a component of their renewable mandates, Minnesota as of yet does not have a clearly defined long-term solar strategy. A state rebate program for solar electricity ($2/watt) funded through Xcel Energy's Renewable Development Fund will run out of funding in 2009 if not before, continuing a cycle of funding uncertainty over the last two years. This is clearly not conducive to solar development in the state.

What is a Solar Carve-Out?

A solar carve-out is an addition to a renewable energy standard (RES) that specifies that a portion of that RES needs to be met with a particular technology – in this case solar. Minnesota law already has a "carve-out" for wind – it states that Xcel Energy must meet at least 25% of their 30% requirement with wind.[5] A solar carve out would simply specify what proportion of the RES needs to be met with solar. It could also specify what kinds of solar can be included --- other states have included solar thermal for example, or that a certain proportion of the solar come from distributed generation sources, rather than large utility-scale installations.

The rationale for a carve-out is that a particular technology needs an extra "boost" over other technologies to ensure timely and rationale development of that technology. Solar may not be cost-competitive with wind now, but it is rapidly approaching cost-effectiveness (Figure 5). It is imperative that Minnesota start to develop a solar industry and a base of qualified installers prior to the point where solar is cost-effective on its own if the state is to see maximum development of this technology.

The carve-out is a market-based mechanism, in that once a given level is determined – the target percentage - the utility and the market can determine the most cost-effective method to achieve that target. This can include a rebate program, or the utility can incent solar by paying a premium price for solar. The utility can then adjust these incentives as solar becomes more widely adopted and more cost-effective.

Other policies to promote solar

- ***Performance incentives or feed-in tariffs.*** Both these policies set a standard price for purchasing back electricity generated from customer-sited solar. This price is set high enough to incent development of the technology based on an estimated rate of return, but declines over time as installation goals are met. In Germany, a feed-in tariff of around 75 cents/kWh has resulted in massive investment in solar, while in Ontario (Canada), a feed-in tariff of 42 cents/kWh has generated a large number of installation activity. California currently offers performance incentives of 25-35 cents/kWh, but is investigating feed-in tariffs. These rates vary considerably depending on if onsite consumption is offset (lowers the incentive rate) or the solar resource is higher or lower (Germany is much lower).

- ***Tax credits.*** A one-time tax credit can be recovered against the total capital cost of solar. Currently a federal 30% tax credit (with a $2000 cap) exists for solar, and some states have an additional tax credit.

- ***Cash rebates or grants.*** Minnesota currently has a $2/watt state rebate from a finite fund, which is projected to expire in 2009 or before. Some states also have systems benefits charges (a special charge to all utility bills) that fund solar rebates. Wisconsin has a grant program to fund solar, as does Massachusetts. California operates the largest rebate program in the country, funded by ratepayers. The rebate is currently at about $2.50/watt for residential projects, and scheduled to slowly phase out over 10 years.

- ***Green pricing programs.*** Two utilities in Wisconsin, and others across the country, offer feed-in tariff rates to solar installations in the community, which provide part of the generation for voluntary green pricing programs –thousands of participants pay a marginally small increased rate increment to diversify the green pricing programs away from wind-only instruments.

It should be noted that the first three of the above incentives can be used under a solar carve-out policy – it would be up to the utility to decide which was the most effective and cost-effective method of achieving the targets set by the carve-out.

Other states with Solar Carve-Outs

Nearly half of the states in the U.S. with an RES have a solar carve-out. In total, 11 states plus the District of Columbia have some kind of solar carve-out. Although California does not have a solar carve-out, it is projected to install the most solar of any state in the U.S. (3000 MW) through a ratepayer-funded direct rebate program called the California Solar Initiative. Oregon is another state without a solar carve-out that has significant solar incentives funded through a systems benefit charge on all utility bills. Figure 1 lists the states with solar carve-outs.

Figure 1: States with Solar Carve-Outs in Their Renewable Energy Standards

State	Size of carve-out (year required)	Unique characteristics
Arizona	191 MW (2010)	Renewable customer-sited distributed generation sources must provide 30% of total RES requirement; one half of this from residential. Solar thermal is eligible.
Colorado	56 MW (2010)	Solar must be 4% of RES, or 0.002% of electric load in 2010; on-site solar must provide 50% of total solar requirement
Delaware	307 MW (2019)	Customer-sited solar receives a 300% credit for the purposes of meeting the RES
District of Columbia	63 MW (2022)	
Maryland	1883 MW (2022)	Solar Renewable Energy Credits for small systems (less than 10 kW) must be paid all up-front, which helps owners to finance the system
Nevada	100 MW (2010)	Customer-owned solar receives a 240% credit. Solar thermal is eligible.
New Hampshire	51 MW (2025)	
New Jersey	240 MW (2010)	Separate tracking system (apart from the PJM tracking system) created for tracking distributed generation Renewable Energy Credits
New Mexico	790 MW (2020)	Solar receives a 300% credit for the RES
New York	99 MW (2010)	Customer-sited generation must meet 2% of the RES; this includes solar, wind and anaerobic digestion, limited to the size of the customer's load; solar is a portion of this total customer generation
North Carolina	314 MW (2018)	Includes the following solar thermal technologies: solar water heating, solar absorption cooling, solar dehumidification, solar thermally driven refrigeration, and solar industrial process heat.
Pennsylvania	993 MW (2020)	

Sources: IREC, SEPA, Green Institute and various state source documents

Generally, the carve-outs are expressed in terms of a percent of total retail electric load, which is a portion of the total renewable requirements. Figure 2 demonstrates how the solar carve-out works in New Jersey. The solar percentage starts out at a relatively modest level in the early years, slowly rising to just over 2 percent of total retail load by 2020.

Figure 2: New Jersey's Solar Carve-Out

Year	Total Renewables (%)	Solar (%)
2007	5.5	0.08
2008	6.5	0.16
2009	7.4	0.22
2010	8.3	0.31
2011	9.2	0.39
2012	10.1	0.45
2013	11.1	0.62
2014	12.1	0.77
2015	13.1	0.93
2016	14.1	1.19
2017	16.2	1.33
2018	18.2	1.57
2019	20.4	1.84
2020	22.5	2.12
2021	22.5	2.12
2022	22.5	2.12
2023	22.5	2.12
2024	22.5	2.12
2025	22.5	2.12

Issues to consider in crafting a Solar Carve-Out

1. ***Including Solar Thermal***. Several other states have utilized a solar carve-out to promote solar thermal technologies, which includes solar hot water heating and solar space heating and cooling. While technically this technology does not generate electricity, solar thermal is a viable renewable technology that frequently is overlooked by the focus on renewable electricity. In Minnesota, there are several solar thermal manufacturing plants that could potentially benefit from this policy as well. A conversion can be made between Btus generated by solar thermal and kilowatt-hours or megawatt-hours, which is the unit used for compliance with the RES.[6] Some considerations in designing a carve-out to include solar thermal include:
    - *What technologies to include.* Generally, solar pool heating is considered a commercial technology, and should not be included. Solar hot water heating, space heating and cooling could be considered for inclusion.
    - *Accounting for the net energy produced.* The policy should reward for energy produced, not just for the number of solar panels installed. Solar thermal is different from solar electric in that the energy is not utilized unless there is a use for the heat. Thus solar space heating does not generally produce as much useful heat in the summer. Likewise the energy used by fans and pumps should be considered, so that a system is rewarded for net energy produced.

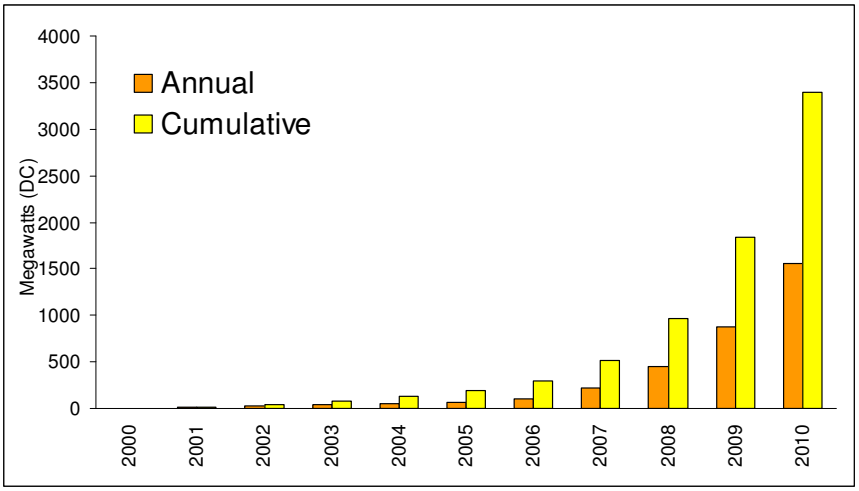
   As some of these factors can be difficult to accurately include in statute, it probably makes sense to delegate a state agency, such as the Office of Energy Security, to develop specific rules for how solar thermal can be applied to meet the RES.

2. ***Customer-owned vs. utility or third-party ownership***. Minnesota has strong policy to support community ownership, including the C-BED law (Community-Based Energy Development), which is mostly oriented towards wind. Many other states have developed a preference in their solar carve-outs for customer-owned solar (for example, a requirement that half of all the solar carve-out must be met with customer-owned solar).

3. ***Renewable Energy Credits.*** Minnesota's RES is designed so that the renewable attributes of electricity generation are separate from the energy attributes, or Renewable Energy Credits (RECS), and tracked through a separate system. This allows energy to be produced anywhere in the Midwest Independent System Operator (MISO) territory, and RECS to be counted towards the Minnesota RES. This presents several challenges to ensuring that the policy goals of a solar carve-out are met. A challenge of integrating solar with the RECS system is that the transaction costs can be quite large for small solar systems, which may produce only several megawatt-hours of electricity in a year (there is one REC credit per megawatt-hour). Thus mechanisms for aggregating small generators should be considered to keep transaction costs low.

A solar carve-out offers the opportunity to develop a more diversified renewable energy portfolio in Minnesota. Figures 3, 4 and 5 present additional data on solar electric trends in the U.S. This data demonstrates that costs for solar are coming down with increased volume of installations. Minnesota can take a leadership role in solar, support its existing solar industry, and help to develop new industry through the implementation of a solar carve-out.

Figure 3: Total U.S. Grid-tied Photovoltaic Installed Capacity (megawatts)



Source: Larry Sherwood, IREC; Projections: Prometheus Institute

Figure 4: U.S. Grid-tied Photovoltaic Installations in 2005 and 2006 by State (kilowatts)

	2005	2006	% Change	% Market
CA	52,015	70,573	36%	70%
NJ	5,526	17,858	223%	18%
NY	1,418	2,709	91%	3%
NV	494	2,619	434%	3%
AZ*	1,549	2,088	35%	2%
MA	640	1,452	127%	1%
CO*	179	933	521%	<1%
TX	593	714	20%	<1%
CT	174	541	211%	<1%
OR	353	529	50%	<1%
All Others*	699	1,450	107%	1%
TOTAL	63,640	101.466	59.4%	59.4%

Source: IREC
* Includes some estimates

Figure 5: Cost Trends for Solar Photovoltaic (cents/kWh)

	Average Grid Costs 2005	PV 2005	PV 2010	PV 2015
Residential	6-17	22-32	13-18	8-10
Commercial	5-15	16-22	9-12	6-8
Utility	4-8	13-22	10-15	5-7

Source: U.S. DOE Solar America Initiative PV Goals

ENDNOTES:

[1] Special thanks to Mike Taylor, Research Director at the Solar Electric Power Association, for providing data and thoughtful comments on drafts of this document.
[2] According to the U.S. Department of Energy, as quoted in "Electric Power Daily," February 21, 2007, pg. 2. Minnesota's RES requires a renewable energy mix from Xcel Energy of 30% by 2020, and from all other utilities of 25% by 2025; this will result in an estimated 27.5% of total renewables by 2025.
[3] "Wind Integration Study - Final Report," EnerNex Corporation and WindLogics, September 28, 2004.
[4] Marketbuzz™ 2007: Annual World Solar Photovoltaic Report, March 19, 2007.
[5] The exact language in the statute is: "Of the 30 percent in 2020, at least 25 percent must be generated by wind energy conversion systems and the remaining five percent by other eligible energy technology." MN Statutes Section 216B.1691.
[6] There are 3412 Btus (British Thermal Units) per kilowatt-hour.