Issues in Gas-Renewables Coordination: How Changes in Natural Gas Markets Potentially Impact Renewable Development

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Overview

- Renewable Portfolio Standards ("RPS") require increasing share of generation market to be dedicated to qualifying renewable resources (defined by each state, not a federal issue at this point).
- For many states, an RPS alone has not been (may not be) enough to stimulate the desired/required renewable energy ("RE").
- To date, early RE adopters have tended to move the market and support RPS goals (i.e., "behind the meter applications," capacity increases at legacy assets, new projects leveraged by ARRA funding/support).
- Now, the hard work begins… second phase of RE development, particularly in some areas/states, will require considerable financial (long-term) support not only for RE capacity, but all supporting capacity (gas power, gas transmission, power transmission, power distribution).

Overview (continued)

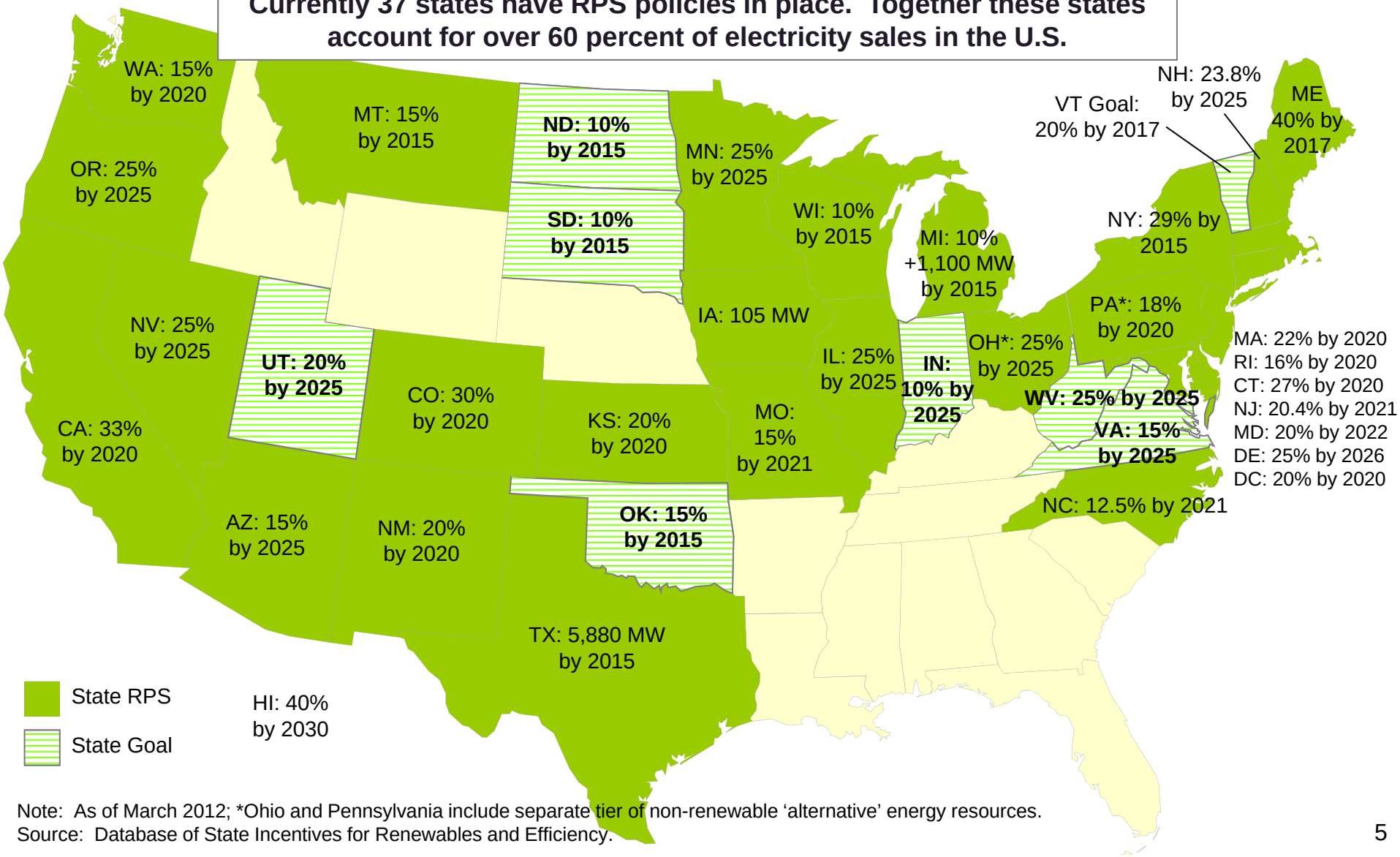
- **Renewable energy business is starting to recognize many of the hard lessons learned by merchant generators over a decade ago (i.e., contracts matter, spot market prices can fall).**
- **Second-phase RE development challenges include:**
  - **A. Natural gas generation back-up (capacity, efficiency).**
  - **B. Power transmission development and investment.**
  - **C. Cost and implications of over-incenting investment.**
  - **D. Natural gas prices, RECs, SRECs, and other RE credit prices.**

(A) + (B) + (C) + (D) = HIGHER COSTS

Renewable Portfolio Standards

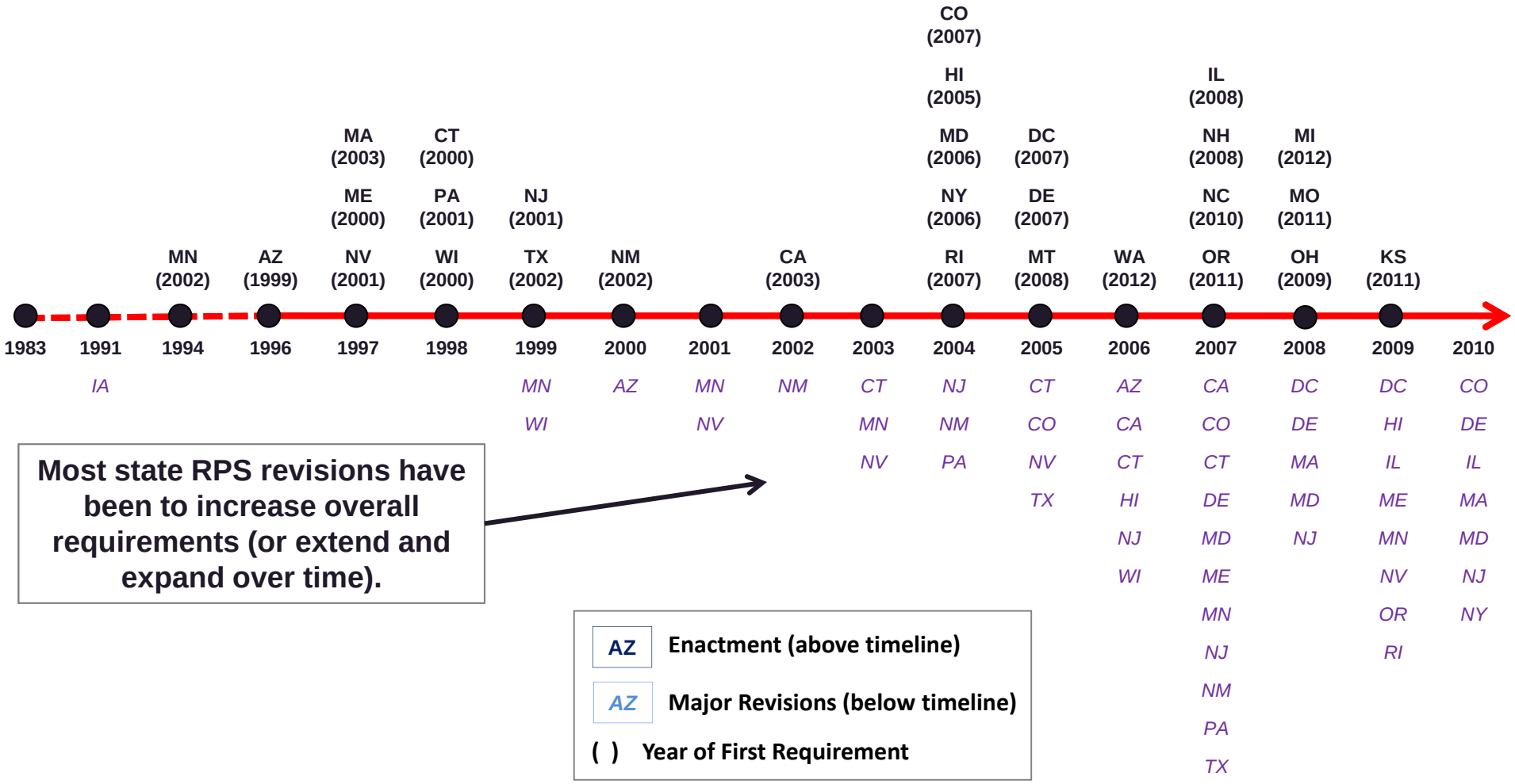
RPS States

Currently 37 states have RPS policies in place. Together these states account for over 60 percent of electricity sales in the U.S.



Note: As of March 2012; *Ohio and Pennsylvania include separate tier of non-renewable 'alternative' energy resources.
Source: Database of State Incentives for Renewables and Efficiency.

RPS State Adoption and Revisions



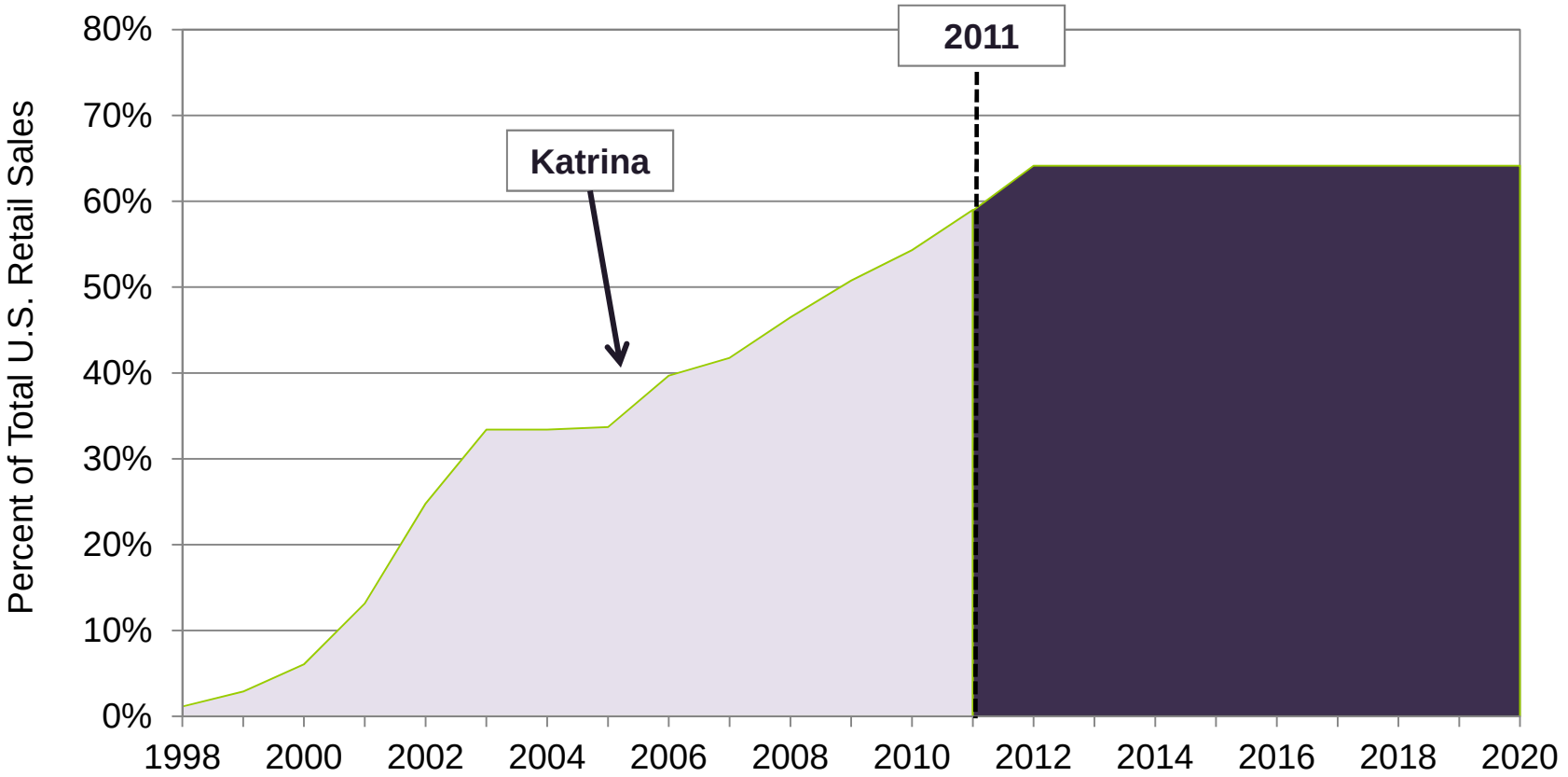
Most state RPS revisions have been to increase overall requirements (or extend and expand over time).

AZ	Enactment (above timeline)
AZ	Major Revisions (below timeline)
( )	Year of First Requirement

Source: Ryan Wiser, State of the States: Update on RPS Policies (2010).

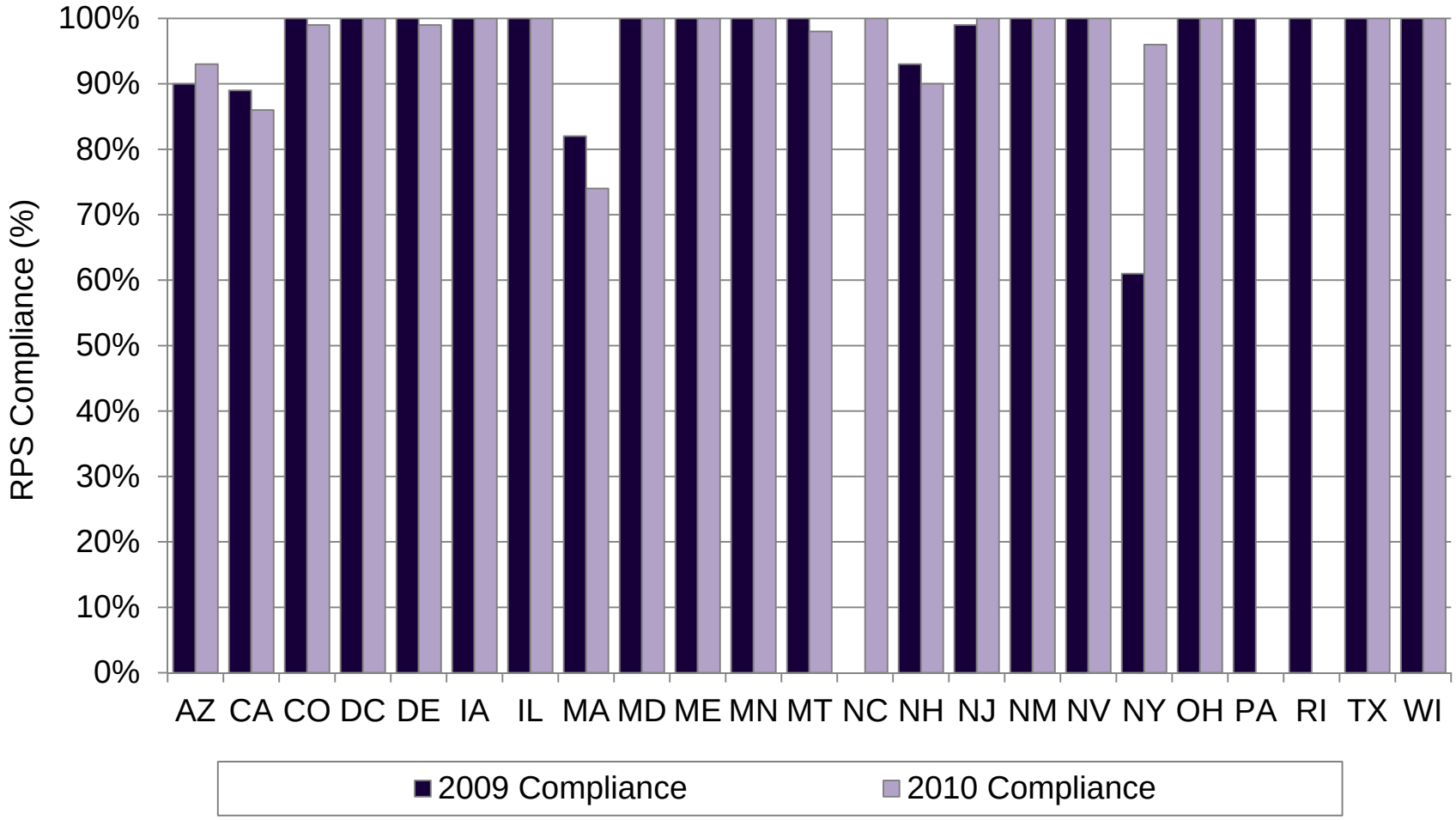
RPS Phase-in – Share of Total U.S. Retail Sales with RPS Requirements

State RPS requirements have been increasing significantly since 2005 and the post-Hurricane Katrina volatility in energy prices.



Source: Energy Information Administration, U.S. Department of Energy.

RPS Goals Performance To Date

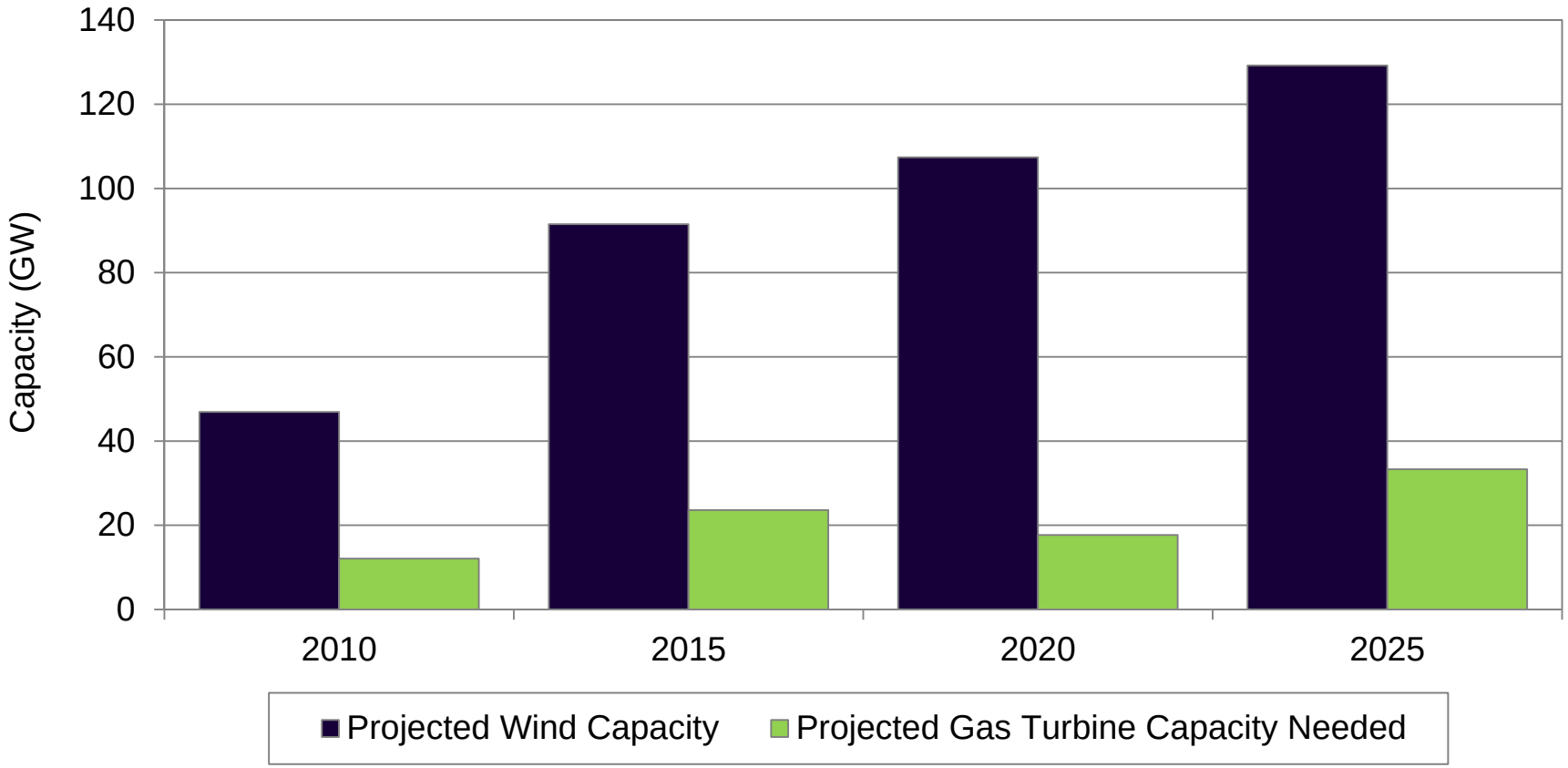


Note: Chart only displays states for which data is known; As of March 2012.
Source: Database of State Incentives for Renewables and Efficiency.

The Cost of Natural Gas Generation Support

Gas Generation Issues – Capacity and Efficiency

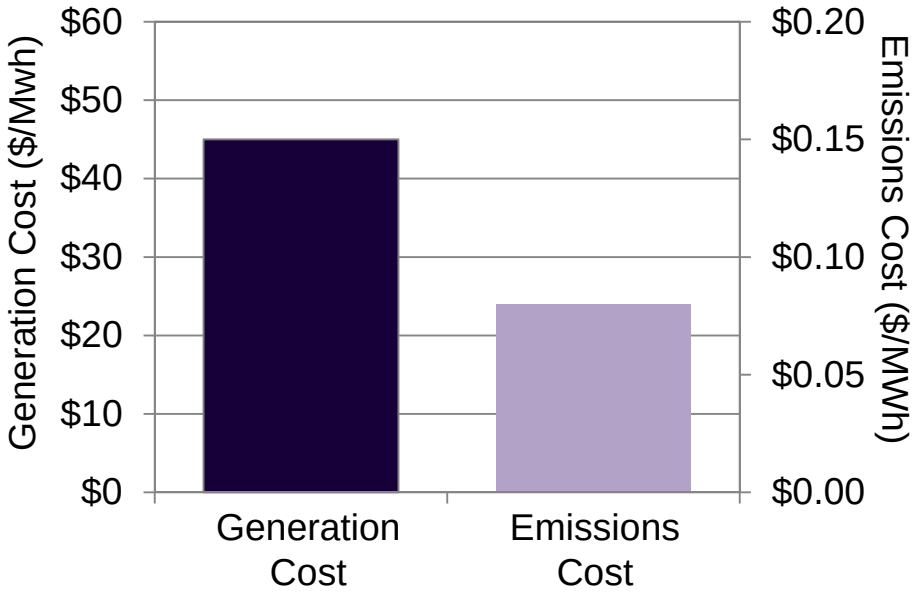
Projected wind capacity increases from just under 50 GW in 2010 to almost 130 GW in 2025; as does the gas turbine capacity needed for firming wind generation. Gas-fired capacity needed to support intermittent wind will grow from about 12 GW in 2010 to more than 33 GW in 2025.



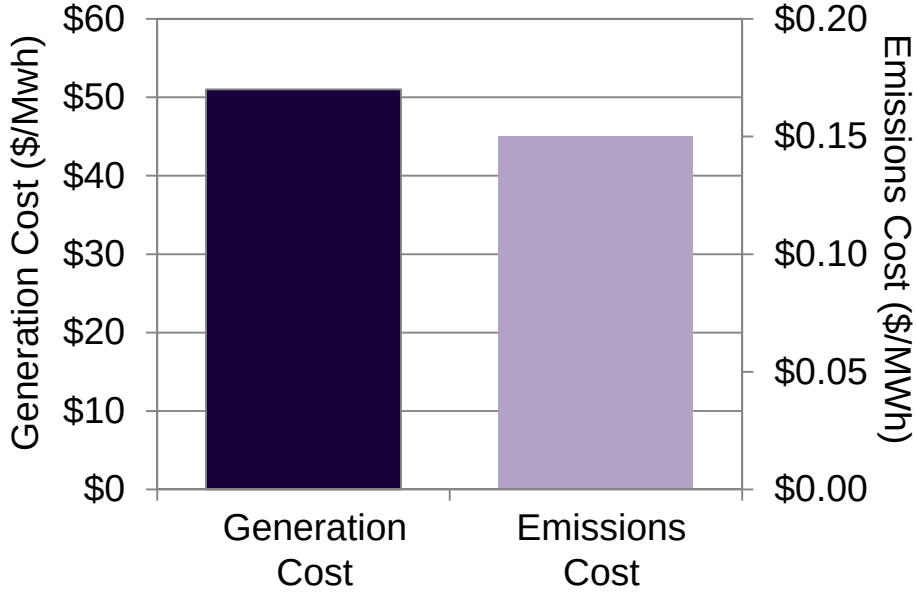
Note: Assumes the required gas turbine capacity for firming wind generation is 25.8 percent of the installed wind capacity and the average annual utilization of gas turbines for firming purposes is 15.6 percent.
Source: ICF International.

Gas Generation Issues – Capacity and Efficiency

Natural Gas Generation at a 6,500 Btu/kWh Heat Rate



Natural Gas Generation at a 8,500 Btu/kWh Heat Rate

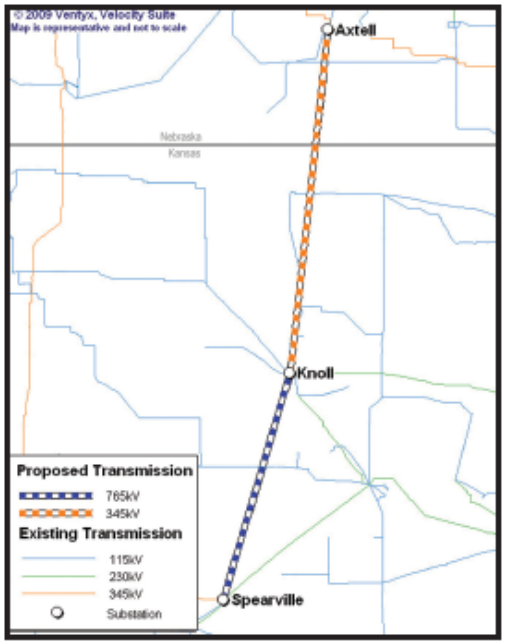


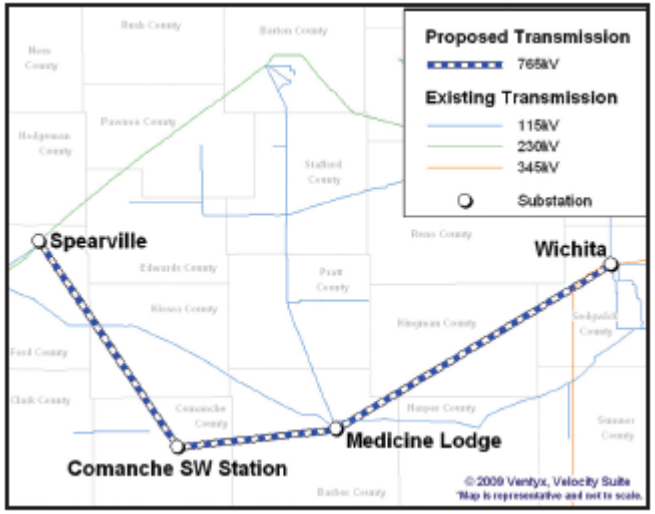
Note: Assumes a capacity factor of 68 percent; a fuel cost of $3.00/Mcf; and a NOx price of $1,500 ton.

Power Transmission Location & Development

Midwestern Power Transmission Development: Onshore Wind Support

- **The Kansas Electric Transmission Authority ("KETA") Project** includes over 210 miles of new high-voltage transmission lines, in addition to substation and associated facilities.
- The KETA Project will extend from the Spearville Substation near Spearville, KS to a substation near Axtell, NE.
- The entire project, as currently proposed by SPP, will cost approximately $350 Million and should come online in May 2012.



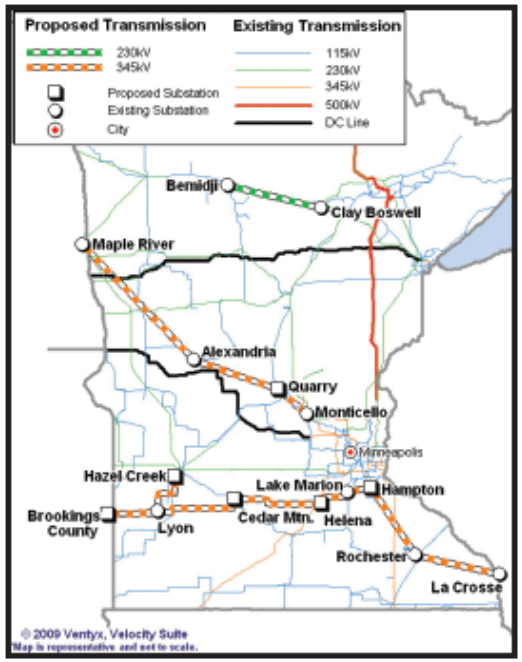


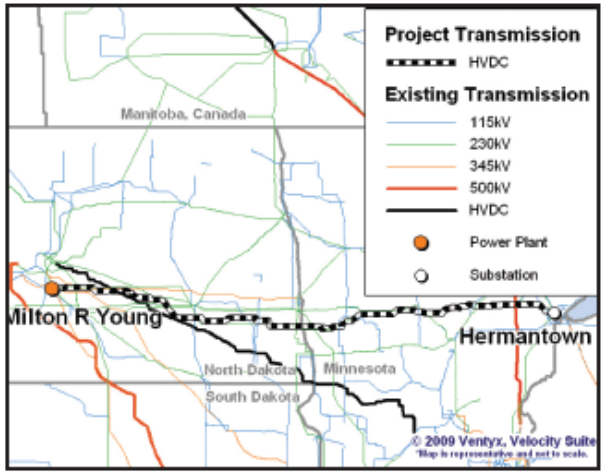
- **The Kansas V-Plan** will aid in the delivery of wind generation from the western half of the SPP footprint to the east.
- The project consists of a 180 mile 765 kV transmission line, which may be operated initially at 345 kV, from Sunflower Electric Cooperative's existing Spearville 345 kV switchyard to a point near the existing Westar Energy Wichita 345 kV switchyard
- The project will cost approximately $476 million (based on 765 kV construction) and is expected to be in service in 2012.

Source: Edison Electric Institute.

Midwestern Power Transmission Development: Onshore Wind Support

- **CapX2020** is a joint initiative of 11 transmission-owning utilities in the Upper Midwest to expand the electric transmission grid to ensure continued reliable service to 2020 and beyond.
- Of these new transmission lines, the 240-mile Hampton-Brookings County 345 kV line provides access to the wind generation resources in Southwest Minnesota and eastern South Dakota.
- The line is expected to increase the delivery of generation from this region by 700 MW. The other lines are driven primarily by reliability needs, but will also facilitate future wind development by providing the necessary infrastructure underpinnings.
- Of the total project cost of $1.4 to $1.7 billion approximately $650 million is associated with the wind supporting Hampton-Brookings line. The projected in-service date is between 2013 and 2015.





Source: Edison Electric Institute.

- **Minnesota Power** will purchase a HVDC transmission line from Square Butte Electric Cooperative for approximately $80 million.
- The 465 mile HVDC line with a total capacity of 500 MW, currently transports coal-generated energy from the Milton R. Young generating station in Center, North Dakota to a Minnesota Power substation in Hermantown, Minnesota. As part of the deal, Minnesota Power will gradually phase out the power it purchases from the Young station and replace it with wind generated electricity.

Atlantic Wind Project (OSW Transmission "Backbone")

Incentives (Over-Incenting?)

Over-Incentives: NJ Commercial Solar Energy Rebate Program

Figure 2-4. Schematic of Project Cash Flow Analysis

	Year 1	Year 2	Year 3	Year 4
A	- Installed Costs			
B	+ Electric Savings	+ Electric Savings	+ Electric Savings	+ Electric Savings
C	+ Rebate			
D	+ SREC Sales	+ SREC Sales	+ SREC Sales	+ SREC Sales
E	- O&M Costs	- O&M Costs	- O&M Costs	- O&M Costs
F	= Pre-Tax Cashflow (D-E)	= Pre-Tax Cashflow (D-E)	= Pre-Tax Cashflow (D-E)	= Pre-Tax Cashflow (D-E)
G	Pre-Tax Cash-flow (F)	Pre-Tax Cash-flow (F)	Pre-Tax Cash-flow (F)	Pre-Tax Cash-flow (F)
H	-MACRS	-MACRS	-MACRS	-MACRS
I	=Taxable Income (F-H)	=Taxable Income (F-H)	=Taxable Income (F-H)	=Taxable Income (F-H)
J	Taxable Income (I)	Taxable Income (I)	Taxable Income (I)	Taxable Income (I)
K	x Tax Rate	x Tax Rate	x Tax Rate	x Tax Rate
L	= Gross Tax (I x K)	= Gross Tax (I x K)	= Gross Tax (I x K)	= Gross Tax (I x K)
M	- Federal Tax Credit			
N	= Net Taxes (L-M)	= Net Taxes (L-M)	= Net Taxes (L-M)	= Net Taxes (L-M)
O	= Net Cashflow (A+B+C+F+N)	= Net Cashflow (A+B+C+F+N)	= Net Cashflow (A+B+C+F+N)	= Net Cashflow (A+B+C+F+N)

Atlantic Wind Incentives: FERC

- FERC Commissioners unanimously granted an overall return on equity (ROE) of 12.59 percent, which includes 250 basis points in incentive ROE adders. (Atlantic Wind had requested 300 basis points.)
- FERC also granted Atlantic Wind's requests for several other incentives, such as:
  - inclusion of 100 percent of construction work in progress (CWIP) in rate base;
  - the opportunity to recover 100 percent of prudently incurred costs if the project is abandoned for reasons outside the company's control; and
  - a hypothetical capital structure based on 60 percent equity and 40 percent debt.
- The incentives do not take effect until the project is approved under the transmission planning process managed by PJM, the region's independent grid operator.

Over-Incentives: FERC Incentive ROEs

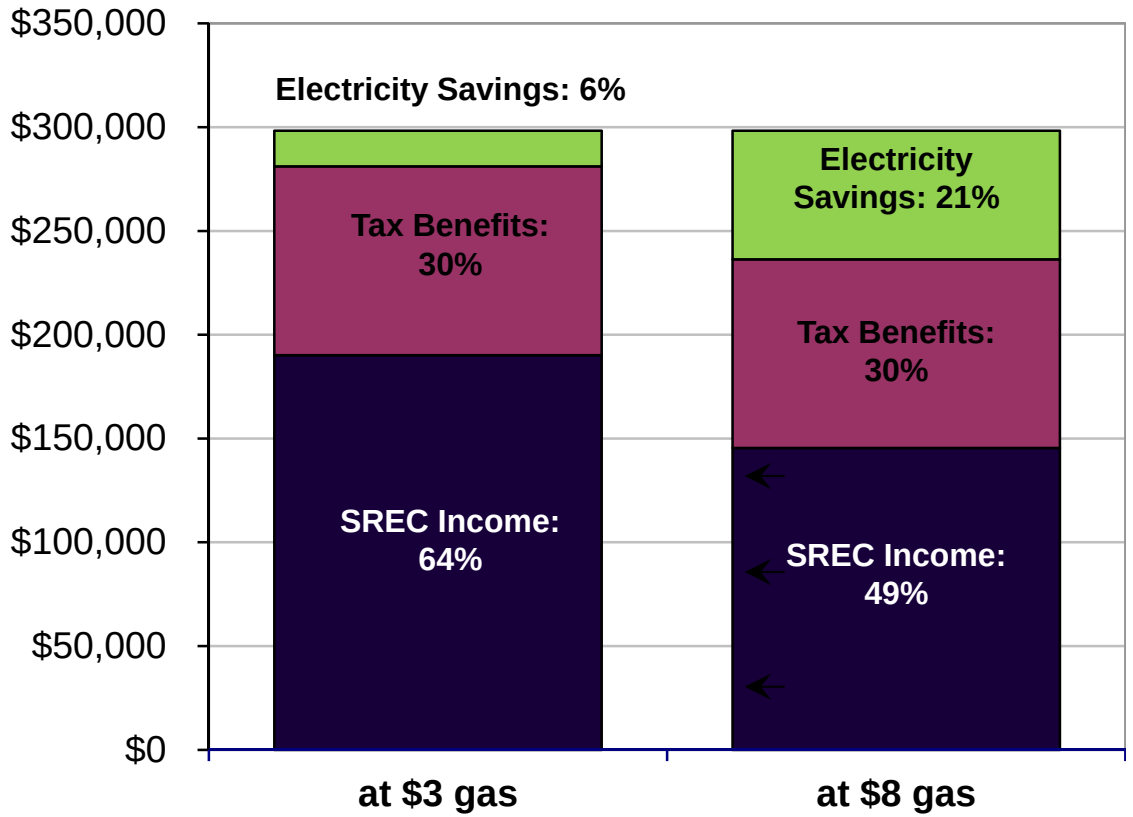
Project	Region	Size	ROE Adders[1]	CWIP in Rate Base	Abandoned Plant Cost Recovery	Pre-Commercial Cost Recovery	Hypothetical Capital Structure (Equity/Debt)
Dessert Southwest Power	Southern CA	118 mile, 500-kV	150 b.p.	100%	Yes	n.a.	50% / 50%
Ameren Services - Illinois Rivers Project	Missouri - Illinois - Indiana	331 mile 345-kV	12.38% [2]	100%	Yes	n.a.	56% / 44%
Ameren Services - Big Muddy River Project	Missouri - Illinois	185 mile 345-kV	12.38% [2]	100%	Yes	n.a.	56% / 44%
Atlantic Wind Connection	Atlantic Coast / PJM	250 mile of four 320 kV	13.58% (incl. 250 b.p.)	100%	100%	n.a.	60% / 40%
Central Transmission LLC	Illinois	30-50 miles of 345-kV	50 b.p.	n.a.	Yes	n.a.	n.a.
Great River Energy	MN	240-mile, 345 kV; 250-mile, 345 kV; and 68-mile, 230 kV.	n.a.	100%	100%	n.a.	20% / 80%
Otter Tail Power Co	MN	250-mile, 345 kV; 250-mile, 345 kV; and 68-mile, 230 kV.	n.a.	100%	100%	n.a.	n.a.
Southern California Edison	Southern CA	New and upgraded substations; 35-mile double-circuit 220 kV.	150 b.p.	100%	100%	n.a.	n.a.
Green Energy Express	Southern CA	70-mile, double circuit 500 kV; new 500 kV/230 kV substation; and a fast-acting phase shifter.	150 b.p.	100%	100%	100%	n.a.
Baltimore Gas & Electric	Mid-Atlantic	230-mile, 500 kV	150 b.p.	n.a.	100%	n.a.	n.a.
Green Power Express	Midwest	3,000 mile 765 kV	110 b.p.	100%	100%	100%	n.a.
Pioneer Transmission	PJM-MISO	240-mile 765 kV	200 b.p.	100%	100%	100%	n.a.
ITC Great Plains	KS-NE	210 mile, 345 kV/765 kV; and 180 mile 765 kV	150 b.p.	100%	100%	100%	n.a.

Note: [1]In most cases a specific ROE will be determined when the project makes future filings under FPA section 205 (updating revenue requirement to reflect the fact that the facilities have been placed in service). [2]Ameren did not seek a stand-alone incentive ROE adder.

Natural Gas Prices and Renewable Credit Prices

Solar Project: Required SRECs at Differing Natural Gas Prices

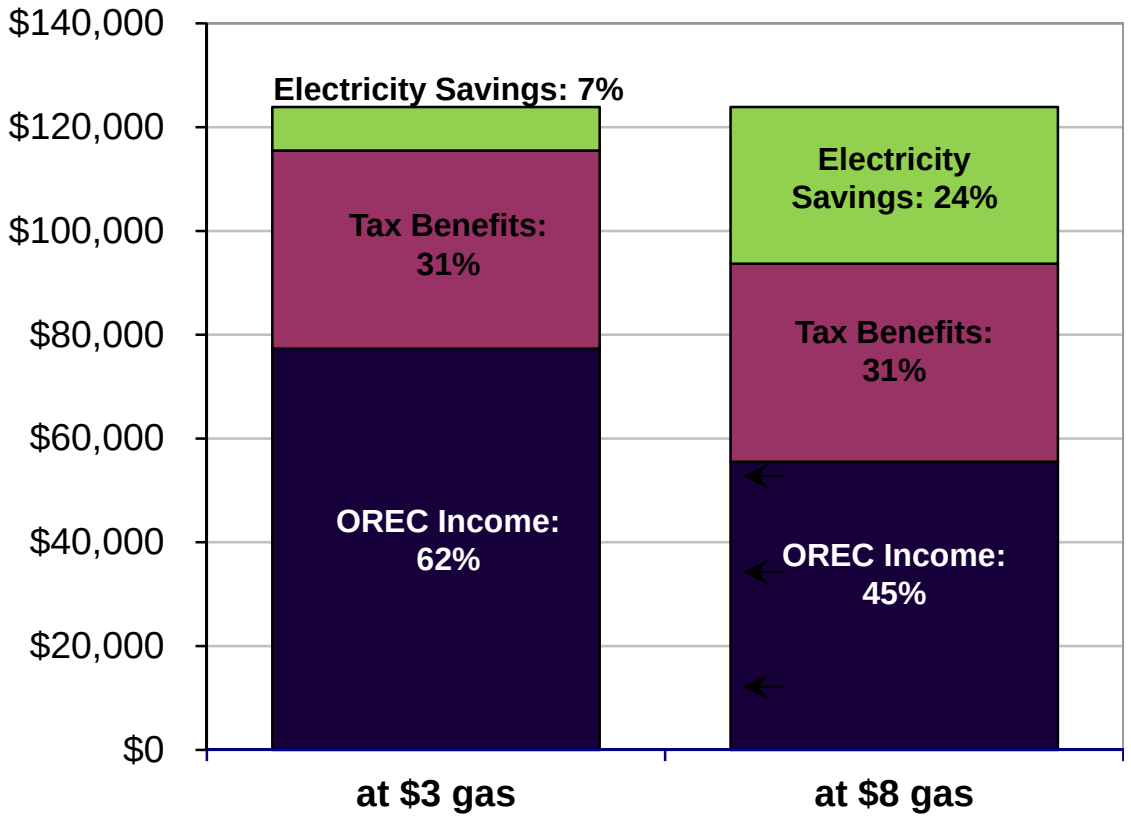
- Electricity Savings: Total savings to the PV owner from not having to purchase electricity
- SREC Income: Total amount of income generated from sale of renewable energy credits.
- Tax Benefits: Total value of accelerated depreciation and investment tax credit.



Note: The percentages are based on a 50 MW system with an installation cost of $6,500/kW and a targeted IRR of 12%.
The funding amounts were discounted using a rate of 10 percent over 20 years.

Offshore Wind: Required ORECs at Differing Natural Gas Prices

- Electricity Savings: Total savings to the PV owner from not having to purchase electricity
- OREC Income: Total amount of income generated from sale of renewable energy credits.
- Tax Benefits: Total value of accelerated depreciation and investment tax credit.



Note: The percentages are based on a 25 MW system with an installation cost of $5,600/kW and a targeted IRR of 12%. The funding amounts were discounted using a rate of 10 percent over 20 years.

Conclusions

Conclusions

- There are a number of "complimentarities" between natural gas and renewable energy power generation.
- These "complimentarities," however, will likely come at a very high cost.
- Big investment requirements will be needed to secure (a) the increasing renewable capacity requirements in most states' RPS and (b) the supporting infrastructure (pipes, wires and plants).
- Raises significant questions about the cost-effectiveness of this RE path given the current natural gas supply-price outlook.
- RPS is premised on HIGH priced natural gas scenario (not crude oil) that does not appear to be warranted anymore. If gas price is low, the benefits of an RPS evaporate (if not evolve into a significant net cost).
- Time to re-think these RPS percentages? Timetables?

Questions, Comments and Discussion

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