MSEIA Initial Testimony
New Jersey Energy Master Plan

Clean and Renewable Power Stakeholder Meeting
The College of New Jersey
Ewing Township, NJ

Lyle K. Rawlings, P.E.
President

Summary of Initial Testimony (1 of 3)

1. Introduction of MSEIA

21 years of advocacy for solar energy and a clean energy future, starting with EDECA utility restructuring legislation in 1997. 3 principles for policy: accelerate growth of solar, do so at the lowest cost to ratepayers while delivering the greatest public good, ensure a diverse market with opportunity for local NJ companies to grow and create Jersey jobs.

2. Magnitude of the Clean Energy law renewable requirements

A total re-orientation in the generation and use of something as fundamental to society as energy is a task of unprecedented scale and complexity, matched only by the urgency of dealing with climate change and pollution. The change will have costs attached, too.

A great deal of effort, creative thinking, and advanced expertise is required in order to get there at the least possible cost. MSEIA has substantial expertise in these matters, and it has energy and determination. MSEIA offers to deploy these assets to the state's benefit.

3. Solar Energy Cost Effectiveness

In 2012 MSEIA commissioned a study on the value delivered by solar energy in New Jersey and Pennsylvania by Clean Power Research, perhaps the most respected firm in the country on this topic. It found that the value premium for solar energy averaged 17 cents/KWH, well in excess of the premium payment necessary to drive solar development **(see Slide 3).** The cost of solar continues to decrease rapidly.

Also of note, a recent USDOE (LBL) study found that in NYISO, 44%-50% wind & solar by 2030 would lower average wholesale prices by 39% **(see slide 4).**

Summary of Initial Testimony (2 of 3)

4. Short-Term Challenges

a. Close the SREC market in an orderly fashion ASAP and begin a new, lower-cost solar incentive program.

b. Find solutions to the rapid onset of closure or restriction of the connection of solar to distribution circuits **(see slides 5 and 6).**

5. Long-Term Challenges

a. Through comprehensive study, determine the lowest-cost pathways to a 100% renewable future.

b. Adopt the most appropriate drivers for solar, wind, and storage, and aim those drivers at opportunities to create additional public good & "do double duty"

c. Address infrastructure issues for incorporating large amounts of intermittent renewables into the electric system **(see slides 7 and 8).**

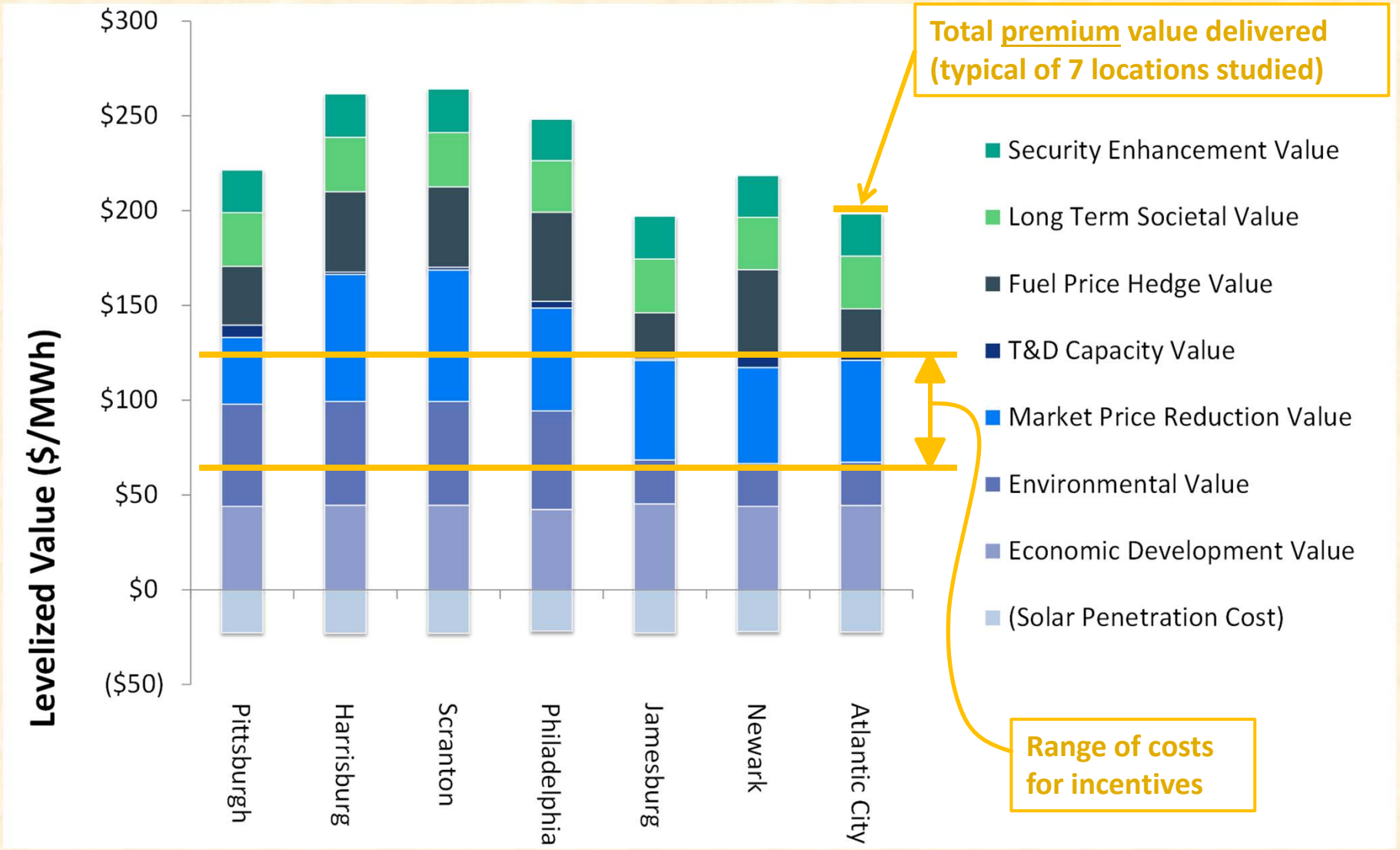
d. Change the utility business model to better enable renewables, while at the same time keeping utilities healthy enough to tackle the aforesaid infrastructure issues.

6. The Minnesota Pathways Study

Just completed but not yet published, this comprehensive study by Clean Power Research, sponsored by USDOE and MN Dept. of Commerce used multi-disciplinary modeling and stakeholder input to find the lowest-cot pathways to a 100% renewable future. Some of those pathways were surprising, as was the key finding that 100% solar and wind could provide 365/24/7 power at a cost of 5.1 cents/KWH **(see slide 9).**

Pathways to a High-Renewable Future

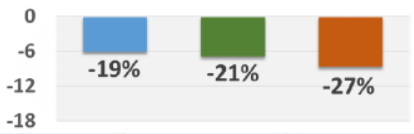
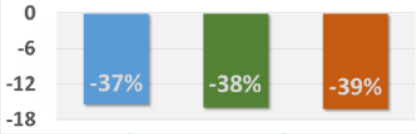
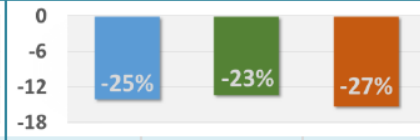
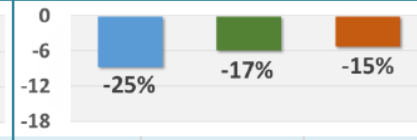
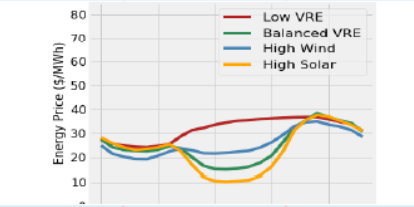
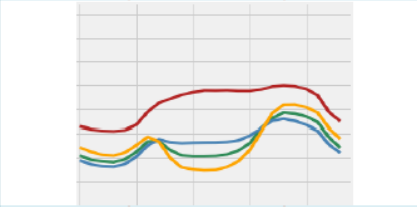
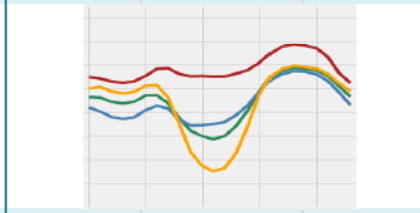
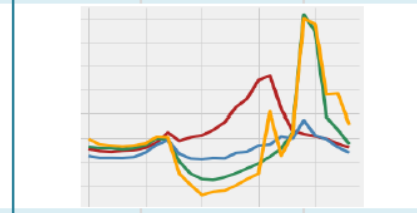
Solar energy is a high-value renewable resource that will play a key role in securing a renewably-fueled future.



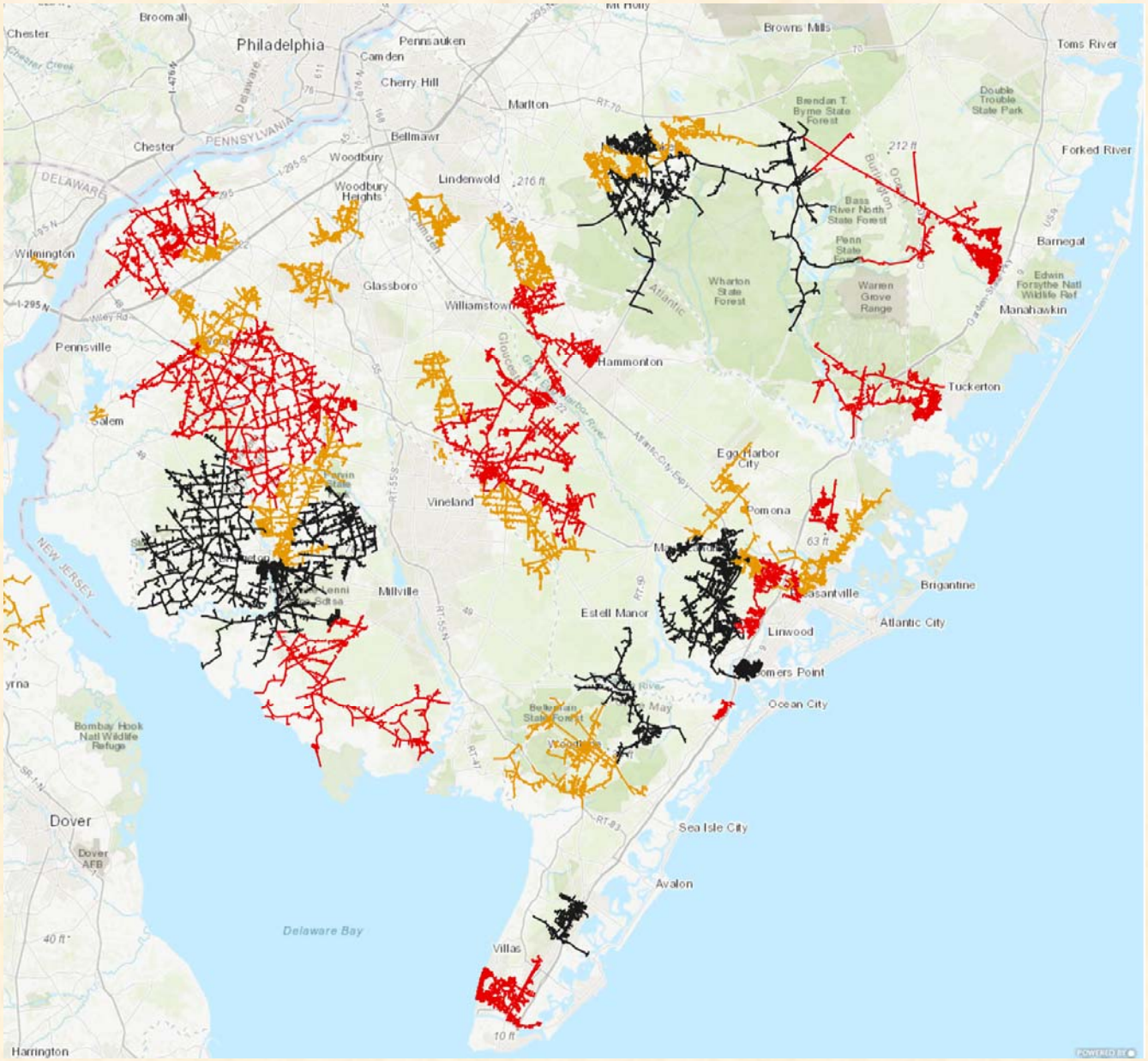
The services delivered by solar power in New Jersey are worth more than the incentive payments that are necessary to deliver them (Source: The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania. Clean Power Research, Perez, Norris, & Hoff, Nov. 2012. Commissioned by MSEIA)

Wholesale Price Effects of 40-50% Wind & Solar

(Wind: 30% wind & 10+% solar | Balanced: 20% wind & 20% solar | Solar: 30% solar & 10+% wind)

Impacts in 2030 relative to baseline with 2016 wind & solar shares	Southwest Power Pool 2016: 18% wind & 0% solar			NYISO (New York) 2016: 3% wind & 1% solar			CAISO (California) 2016: 7% wind & 14% solar			ERCOT (Texas) 2016: 16% wind & 1% solar		
	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar
Lower Average Prices [$/MWh]												
More Hours <$5/MWh In baseline: 0% of all hours	6%	8%	13%	2%	7%	11%	6%	7%	11%	6%	11%	19%
Changes in Diurnal Price Profile red baseline shows 2016 wind & solar shares												
More Price Variability	1.8x	2.1x	2.5x	2.1x	2.3x	2.5x	3.0x	2.9x	3.4x	1x	4.7x	6.6x
Higher AS Prices Regulation Down	5x	6x	9x	2x	2x	3x	3x	3x	3x	2x	3x	4x
Change in Timing of Top Net-Load Hours	Shift from 4pm to 7pm			Shift from 3pm to 5-7pm			No further shift 7pm			Shift from 3pm to 6-8pm		

Utilities Closing Circuits to Further Solar Development



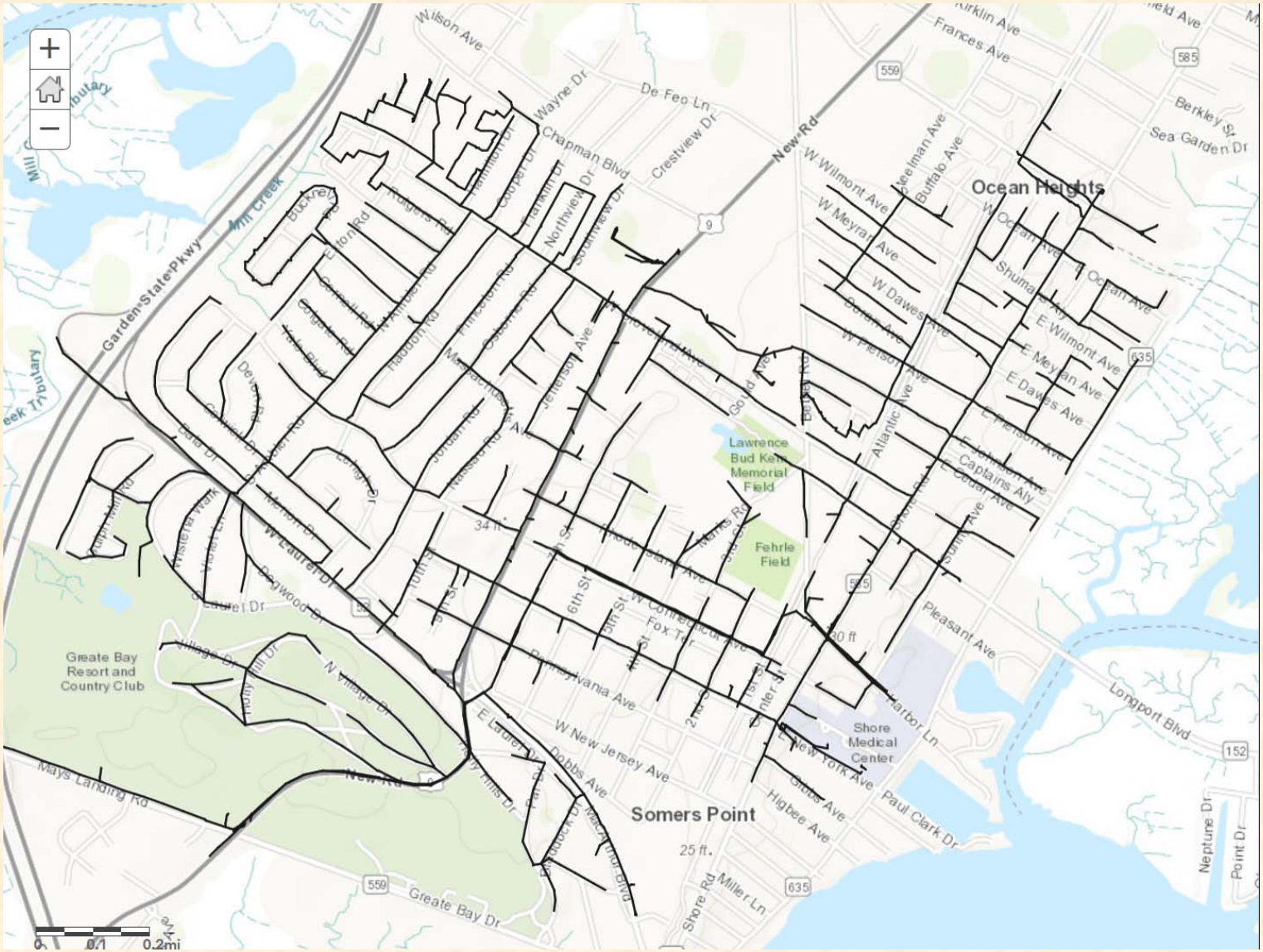
Restricted circuits map, Atlantic City Electric Co.

A large proportion of circuits in ACE territory are restricted or closed to *any* further development of solar power.

Denial of interconnection is becoming more common in the rest of the state too.

Antiquated standards for circuit closure, disallowance of available enabling technology, and disallowance of reverse flow through substations are problems that need to be addressed.

Utilities Closing Circuits to Further Solar Development



Restricted circuits map Closeup of Somers Point

Entire towns are being closed to further solar development.

Pathways to a High-Renewable Future

9 INFRASTRUCTURE NEEDS FOR A RENEWABLE FUTURE (1 of 2)

1. **Generation mix** – The right mix of solar, wind, and biomass will be synergistic, providing an improved match between renewable generation and load.

2. **Geographic mixing/HV transmission** – The more numerous and the more widely dispersed the solar and wind generation sources are, the more their individual intermittencies cancel each other out. They are then able to match load better. This means building long-distance transmission assets such as HVDC transmission lines. Eventually, this will include the need for an "electron superhighway" from Denver to New York, crossing two time zones.

3. **Load shaping/demand management** – large amounts of solar power will create low pricing in the middle of the day, the opposite of the case now. These changes along with renewable intermittency will create the need for much greater investment in load shaping (grid-responsive pricing and incentives) and demand side management.

4. **Curtailment of renewable generators –** Solar and wind cannot be curtailed without economic loss, but as their cost drops and the amount they generate grows larger than the load at times, they will need to be curtailed.

5. **Stationary electric energy storage** – To the extent that the first four measures are not enough to match up generation and load, electric energy storage will be needed.

Pathways to a High-Renewable Future

9 INFRASTRUCTURE NEEDS FOR A RENEWABLE FUTURE (2 of 2)

6. **Vehicle-to-grid (V2G) storage –** With electric vehicle technology advancing rapidly and EV adoption in the market accelerating, the cumulative electric energy storage capacity in EV's will soon far surpass stationary electric storage. Accessing this huge reservoir of storage to stabilize the distribution and transmission systems will require EV charging infrastructure with two-way power flow, and sophisticated communication and control.

7. **Reinforcing local circuits and substations –** high-penetration renewables will require enough reverse flow in local circuits and substations that the above measures will not be sufficient. Many local circuits and subs will need to be modified and/or enlarged to handle the flow and prevent flicker.

8. **More complex control of the grid & transactions** – All of the above measures require controlling and balancing of sources and loads in a more complex fashion than yesterday's grid, while transactions are far more numerous and complex.

9. **State-of-the-art, fast-ramp, efficient natural gas plants as a bridge** - It is important **not** to build more new fossil plants than is necessary, but what *is* built or modified should be compatible with a growing share of renewables.

Pathways to a High-Renewable Future

The Minnesota Solar Pathways Study

- Conducted for DOE Sunshot program and Minnesota Dept. of Commerce by Clean Power Research, led by Dr. Marc Perez. Utilities, NGO's, businesses, renewable energy groups, and other stakeholders were involved.
- One of the most sophisticated and complete studies ever done on pathways to a 100% renewable future.
- Study focused on 100% solar & wind power, and considered 95% solar & wind + 5% gas.
- Complex modeling of technical and economic factors was aimed at finding the least cost combination of technologies and infrastructure changes.
- The final study report has not yet been published. The following slides are excerpts from an IEEE presentation, and a draft journal paper, showing some of the results (with permission).
- Key finding: the most optimal solution, including 95% solar & wind + 20% curtailment + storage + 5% gas, can match load 365/24/7 for a 3.6 cent/KWH premium in 2050. The cost with 100% solar and wind was a still-low 5.1 cents/KWH
- Jersey results would be higher in cost for several reasons.