



The Materiality of Distributed Solar
Preparing for a market-driven approach
to electricity delivery

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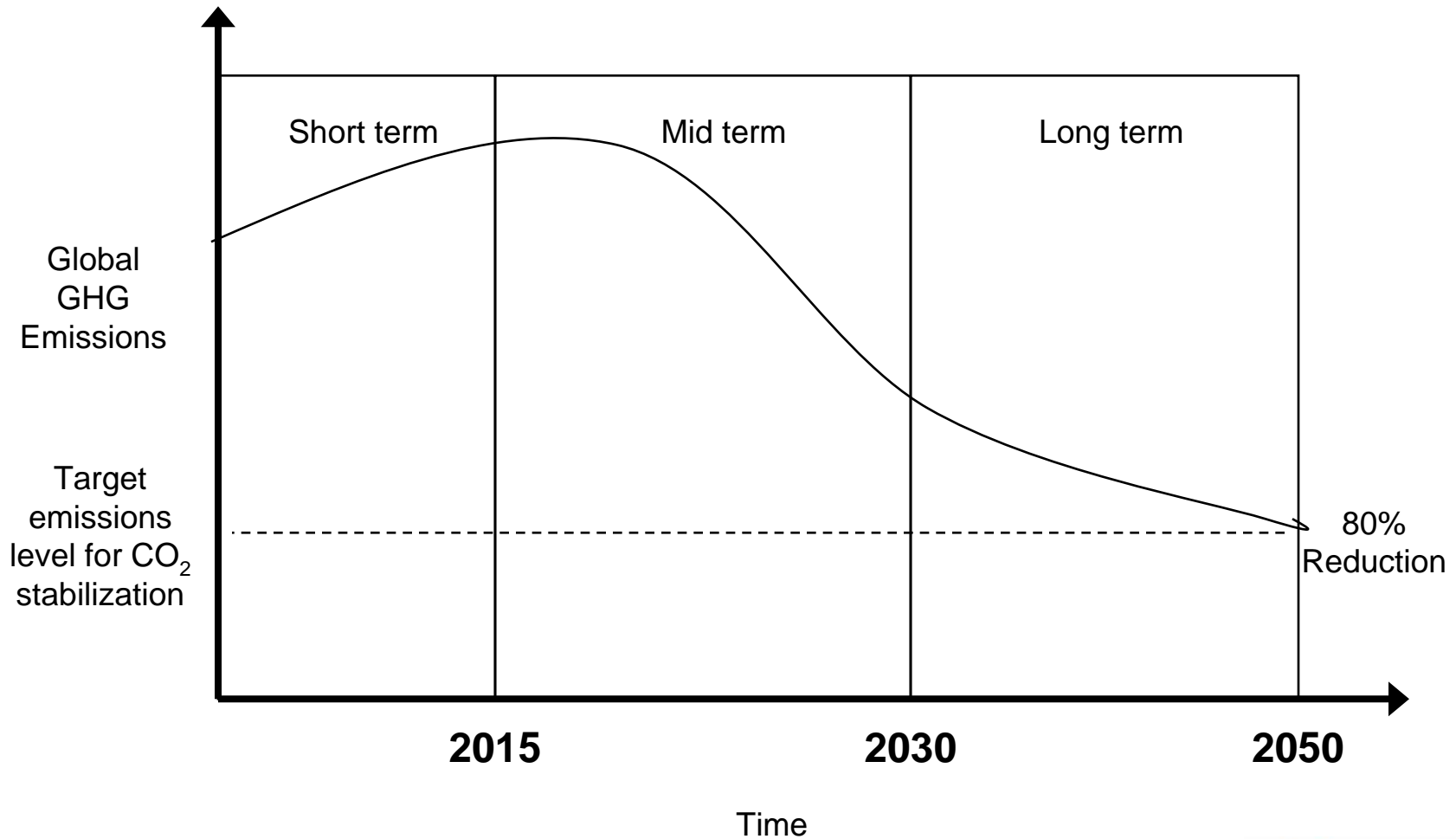
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Solar Generation and Materiality

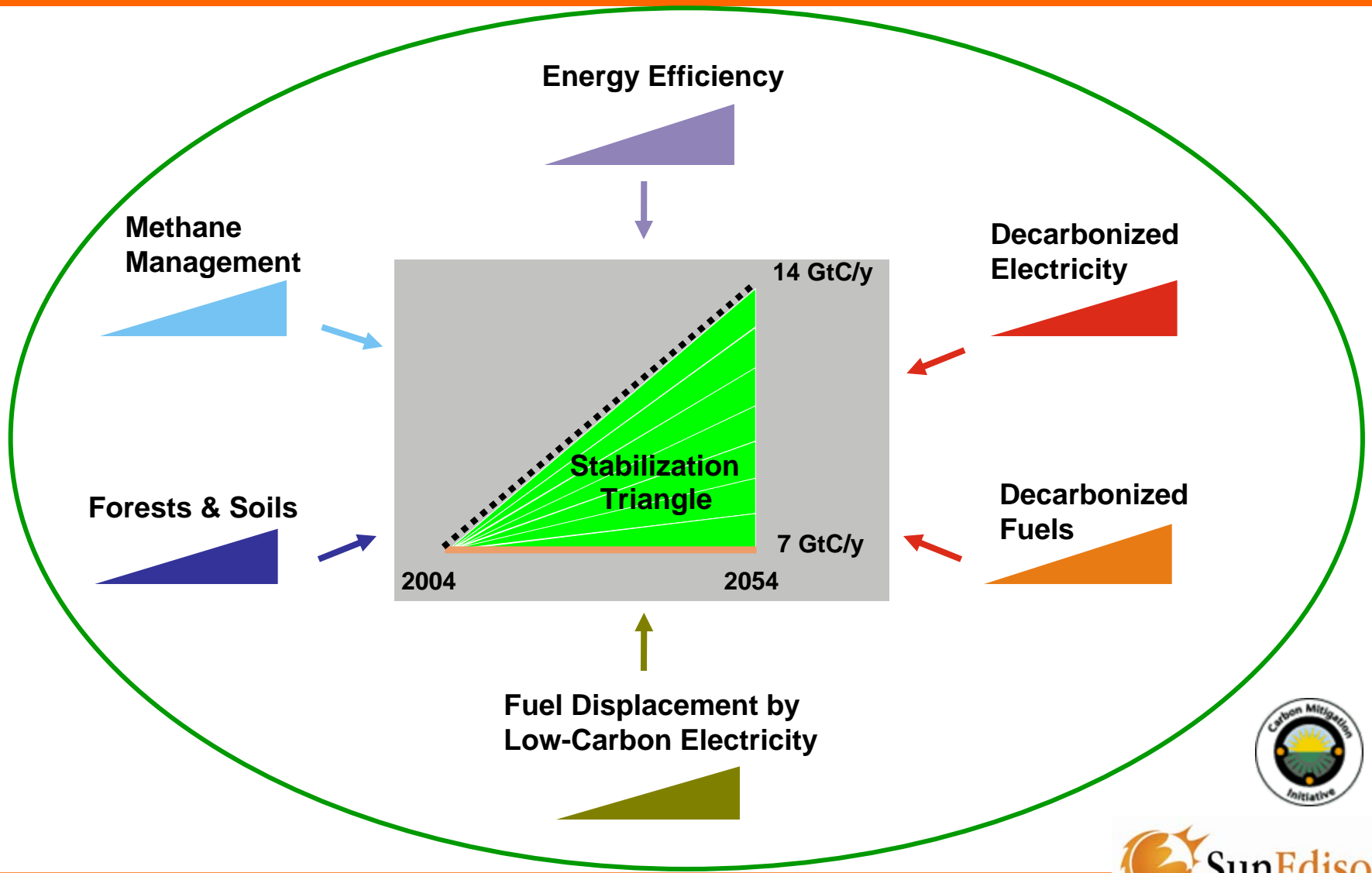
- 41% growth per annum for the solar industry since 2001
- The solar industry exceeds \$16B per year – equal to the global wind industry
- Solar enjoys more uniform support from the general public than any other technology
- As a distributed resource, solar generates more jobs that any other renewable energy technology per MWh
- **50% p.a. increase in solar capacity *additions* yields 65 GW**
 - ~20% of incremental US capacity over the next 10 years
 - Critical to achieve zero net incremental GHG production from electric utilities



Mitigation Policy Time Frames



Stabilizing Global Carbon



Achieving Carbon Stabilization in the Electric Industry

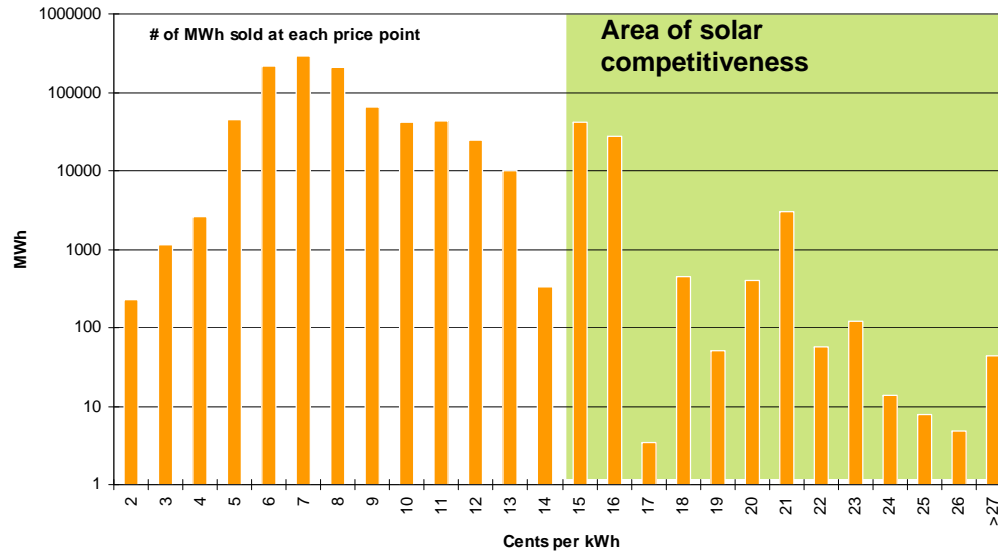
	Quantity to Save One Wedge by 2050
Nuclear Electricity	700 GW offsetting Coal power
Wind Electricity	2,000 GW (9% CAGR from today)
Solar Electricity	2,000 GW (13% CAGR from today)
Carbon Capture	800 MW of Coal Power plants
Energy Efficiency	Title 24 instituted nationwide
Efficient use of Fuel	50% of Cars are Plug-ins

- NC needs roughly 2,000,000 MWh of new generation per year. This could be met by:
 - 1,500 MW of wind, solar, landfill gas, biomass, and efficiency
- US needs roughly 48,000,000 MWh of new generation per year. This could be met by:
 - 9,000 MW of wind = 18,000,000 MWh
 - 7,000 MW of Solar = 10,000,000 MWhs
 - 1,000 MW of Geothermal = 5,000,000 MWhs
 - 1,000 MW of Biomass = 5,000,000 MWhs
 - Balance of 10,000,000 MWhs of energy efficiency or 1,500 MW of Nuclear Power
- Globally we need 420,000,000 MWh of new generation per year



Distributed Solar Economics

\$21 billion (approximately 10% energy) of U.S. retail electricity demand from commercial users can be competitively addressed with solar power



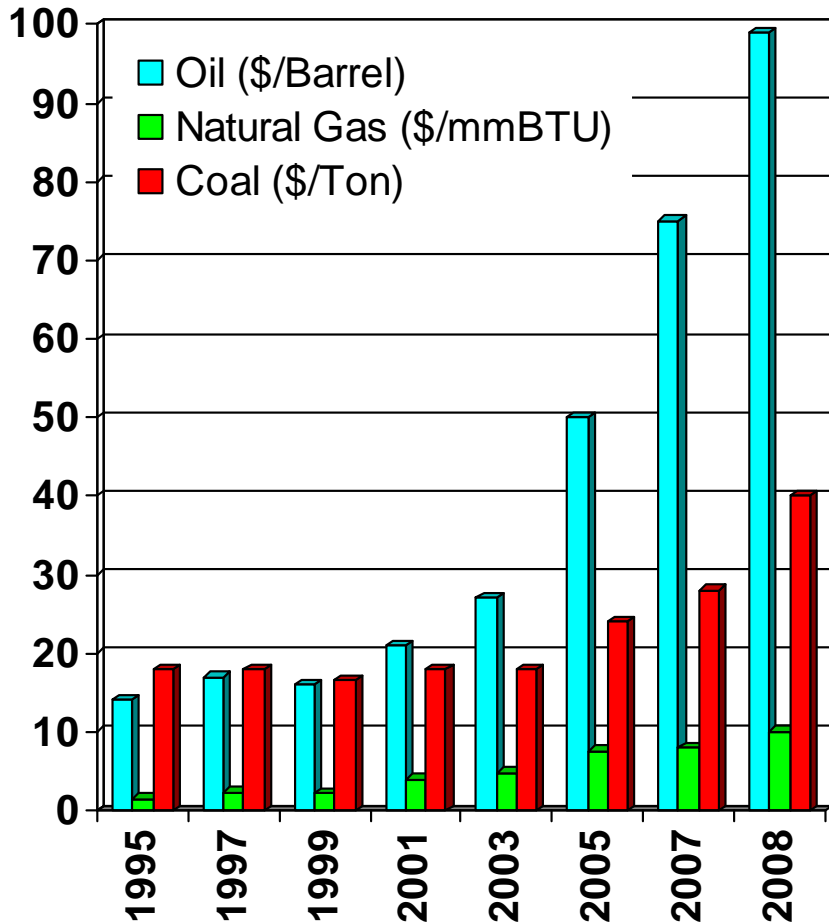
Limitations of centralized generation

- Centralized utility planning models have reached their limits of scalability
- Political environs, telecom industry show good examples
- Centralized generation, transmission & distribution (T&D) costs are increasing and will continue to increase

Distributed energy systems

- A more dynamic and flexible approach
- **Solar is the only fuel hedge available for DG in the U.S.**

Rising Long-term Costs . . .



Renewables in Perpetuity

terawatt hours
EACH

YEAR

Direct Solar Radiation	350,000,000
Wind	200,000
Ocean Thermal	100,000
Biofuel	50,000
Hydroelectric	30,000
Geothermal	10,000
Tidal	1,000

Energy Stored in the Earth

terawatt hours
TOTAL

Coal	6,000,000
Uranium 235	1,500,000
Petroleum (US ½Gone 1970)	1,000,000
Natural Gas (US ½Gone 2005)	400,000
Tar Sands	200,000

2004 Global consumption of stored energy = 80,000 terawatt hours/year



SOLAR

World Energy Use

Hydro

Biomass

OTEC

Wind
waves

Petroleum

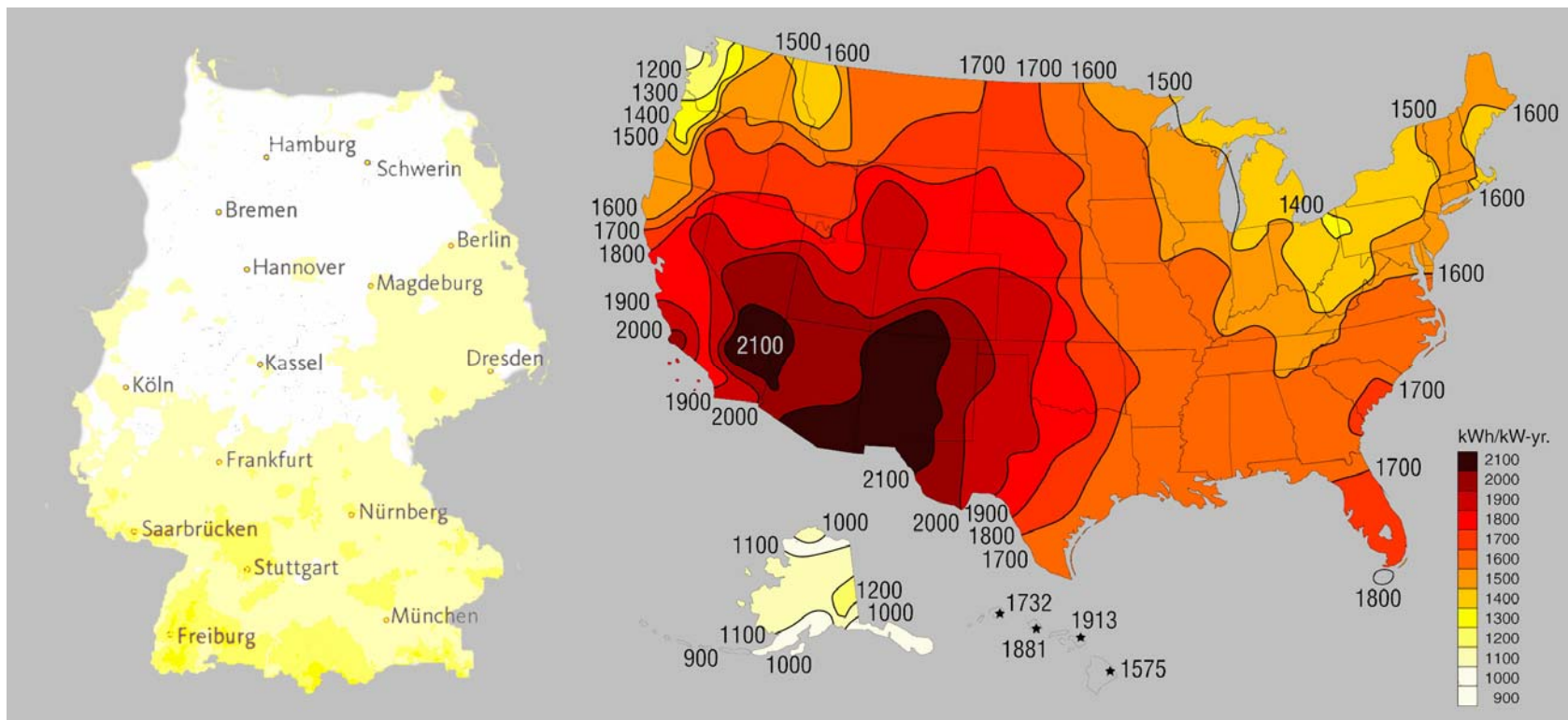
Natural Gas

Uranium

Coal

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Solar Policy: Feed-in-Tariff vs. Customer Incentive



Feed-in-Tariff

- Better at reaching scale, easy to finance
- Skews towards large ground-mounted projects
- Centralized command & control approach
- Customers not ready for grid parity
- Very expensive today

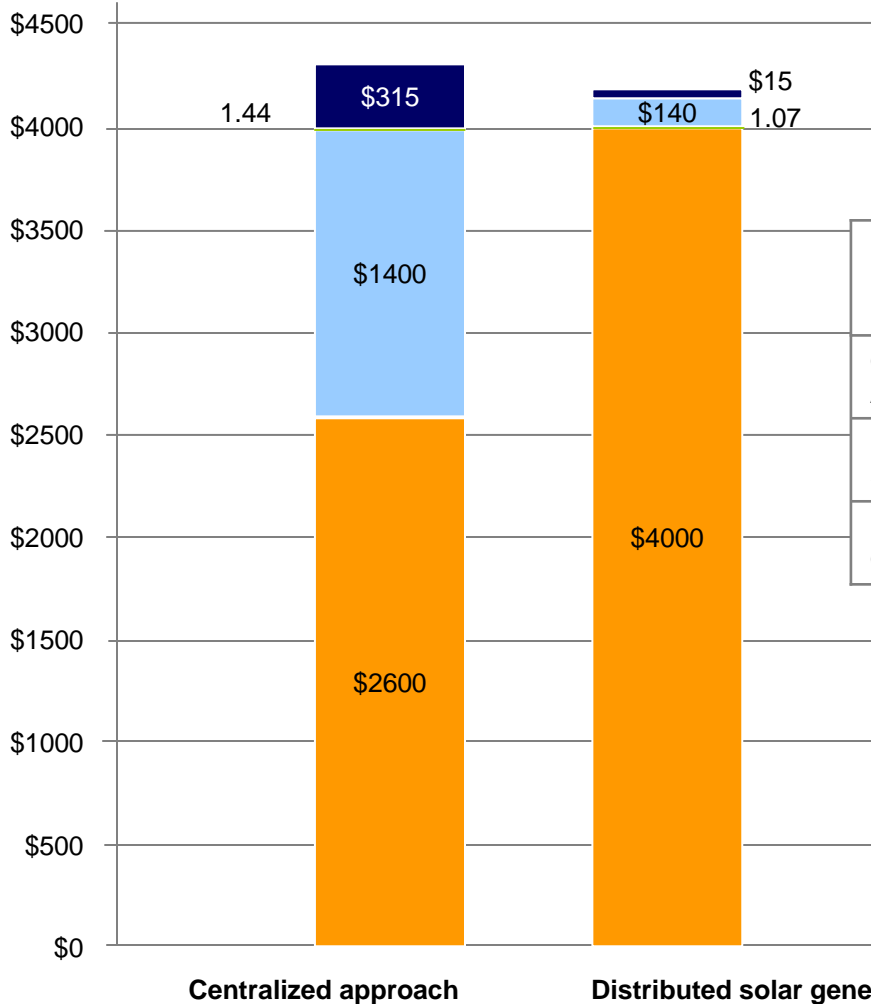
Customer Incentive

- Customer receives “price predictability”
- Banks developing credit models
- Market approach
- True competition with the “grid”
- Fixed budgets



Economic Impact

Distributed Solar Generation is LESS EXPENSIVE than Centralized Generation



Capitalized in \$/kW	Generation	T&D	Line loss & redundancy	Cap. O&M Cost	Total Capital
Centralized Approach	\$2,600	\$1,400	\$1.44	\$315	\$4,316
Distributed Solar	\$4,000	\$140	\$1.07	\$15	\$4,156
Comparison	Adds \$1400	Saves \$1260	Saves \$0.37	Saves \$300	SAVES \$160/kW

This does not include environmental costs associated with fossil fuel generation



Solar is a Better Energy Product

It is widely understood that solar is a zero-emission energy source. BUT

- **Solar is scalable** and growing
 - Solar is growing globally at 41% per annum
 - Solar combined with other smart grid technologies can meet 100% peak load growth
- **Solar is competitive**
 - Nuclear, coal, natural gas power plant costs have increased significantly
 - Transmission infrastructure has increased in costs and takes significantly longer
 - Distributed technologies can be built quickly, averting power crises more effectively
- **Solar is predictable**
 - Combined with demand response, solar is as predictable as a fossil fuel peaking plant
 - Solar is well correlated to air conditioning loads
- **Solar uses available space**
 - Each year over 2 billion square feet of new roofs are installed – supporting far more than 40 GW solar needed to meet 100% of incremental load growth in the US
 - Brownfields, airports, wastewater treatment facilities, public lands are excellent sites

Policy Framework

- Existing solar legislation

- California: Fixed budget, complex to administer
- New Jersey: Performance based incentives without long-term contracts
- Maryland:
 - » 2% solar with max. 1% rate increase
 - » Performance based contract with mandatory 15 year commitment
 - » Legislatively mandated for utility companies to make little profit

- Utility rates & revenue policies

- Electricity rates can be structured to encourage energy saving measures
- Some states structure rates to discourage energy savings (AZ as an example)

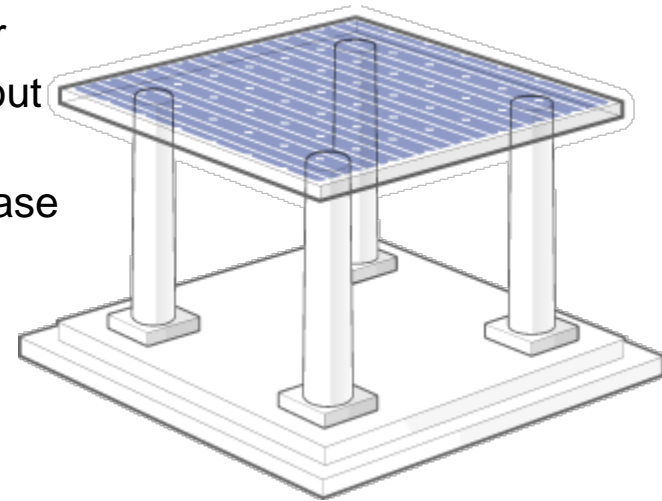
- Net metering

- Positions clean, on-site power the same as efficiency
- Attached to a rate tariff so that utilities cannot adjust tariff after installation

- Interconnections

- FERC Order 2006 allows but limits systems to 2MW
- Need simpler, standardized forms

The four pillars of cost-effective solar policy
(Solar Alliance)



Societal Demand for Solar

- Utility companies have experienced ratepayer dissatisfaction
 - Increasing and volatile rates
 - » \$160B costs predicted for transmission expansion
 - » 9.3% rate increases in 2006, above average every year since 2001
 - » GHG reductions (carbon credits of \$20/ton would add 2 cents/kWh)
 - Unreliable supplies cost U.S. ratepayers \$160 billion. Consumers lose power:
 - » 214 min/yr in U.S., compared to
 - » 70 min/yr in UK and
 - » 6 min/yr in Japan
 - Electric generators are the largest polluters globally
- Solar enjoys more support from the general public than any other renewable resource
 - Approval ratings over 90% since the late 1990s
 - » Florida: 78% of residents willing to pay 25 cents or more extra per month
 - » Ohio: 89% of residents willing to pay 50 cents or more extra per month
 - When a nuclear power industry association asked 1,000 people what energy source would be used most for generating electricity within 15 years, 27% said “SOLAR”
- Solar equipment is poised to deliver material volumes to the marketplace

...so what's next?



How SunEdison is driving materiality

- Technology is in place and available
- \$40 billion invested into the solar industry since 2001
- Services infrastructure is developing to meet goals of materiality
 - Investments contribute to domestic job growth versus off-shore migration
 - 65 GW of solar additions would create 450,000 job-years
- **Where are the gaps?**
 - Regulatory and market structuring
 - Industry Collaboration
 - Finance and site aggregation
 - Registration of renewable energy and GHG credits
 - Operations and dispatch integration with Utilities





Thank you

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