

U.S. DEPARTMENT OF ENERGY



# SOLAR DECATHLON 2009

## Solar Panels and the Smart Grid

In the Pepco Region

U.S. DEPARTMENT OF  
**ENERGY**



National Renewable  
Energy Laboratory  
Innovation for Our Energy Future



Your life. Plugged in.™



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## Outline

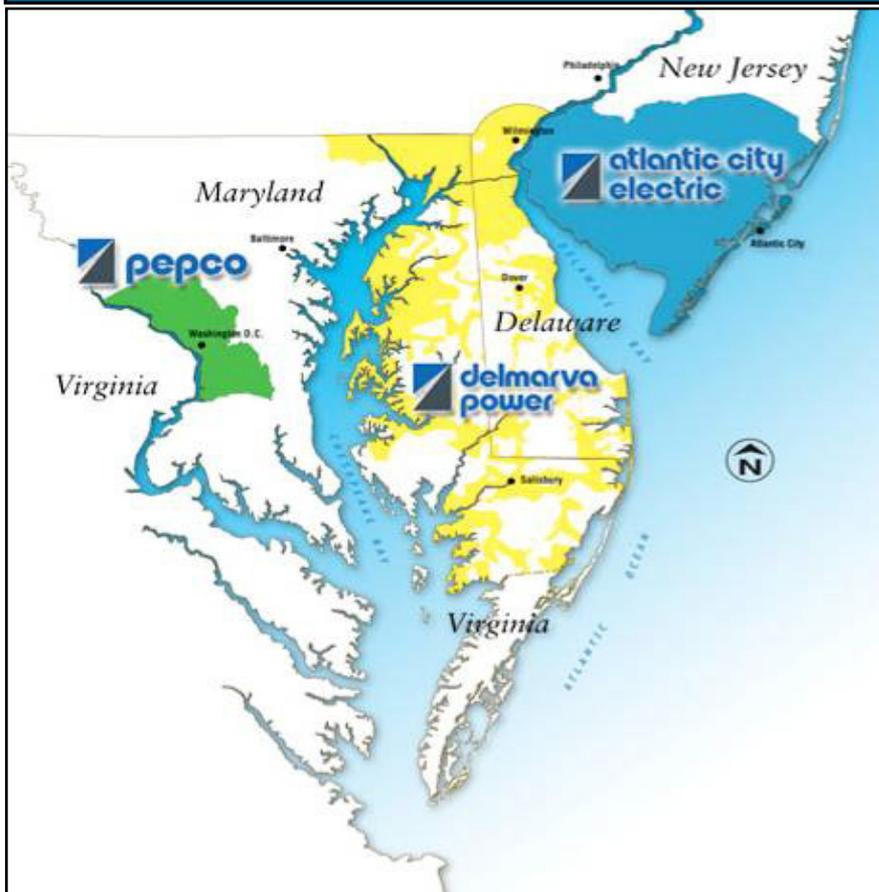
- Pepco Region Background
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## Pepco Region Background

Combined Service Territory



Pepco is a regulated electric utility delivering electricity to more than 750,000 customers in Washington, D.C., and its Maryland suburbs

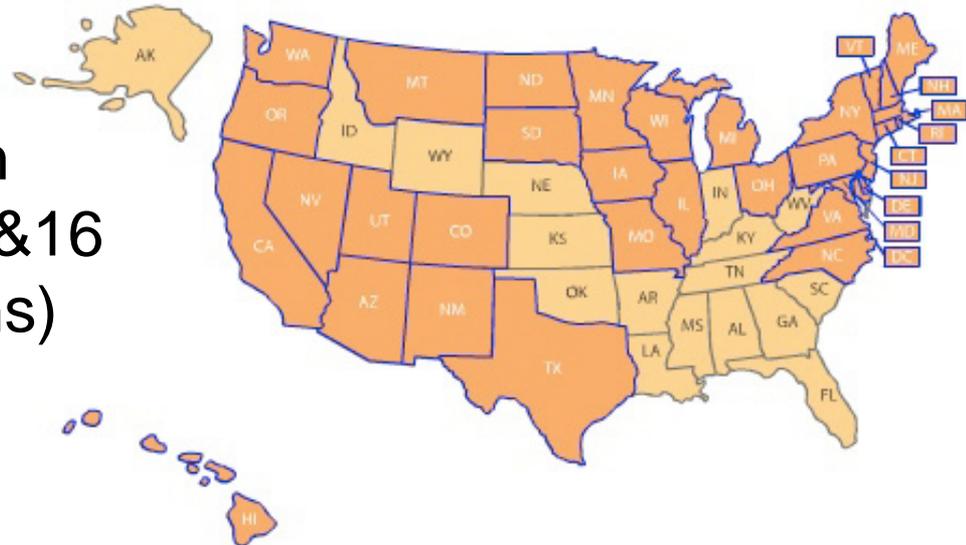


## Renewable Portfolio Standards

- RPS requires electricity suppliers (all utilities and competitive retail suppliers) to use renewable energy sources to generate a minimum portion of their retail sales

32 States + DC with RPS's (5 voluntary & 16 with Solar Provisions)  
( [www.eere.energy.gov](http://www.eere.energy.gov) )

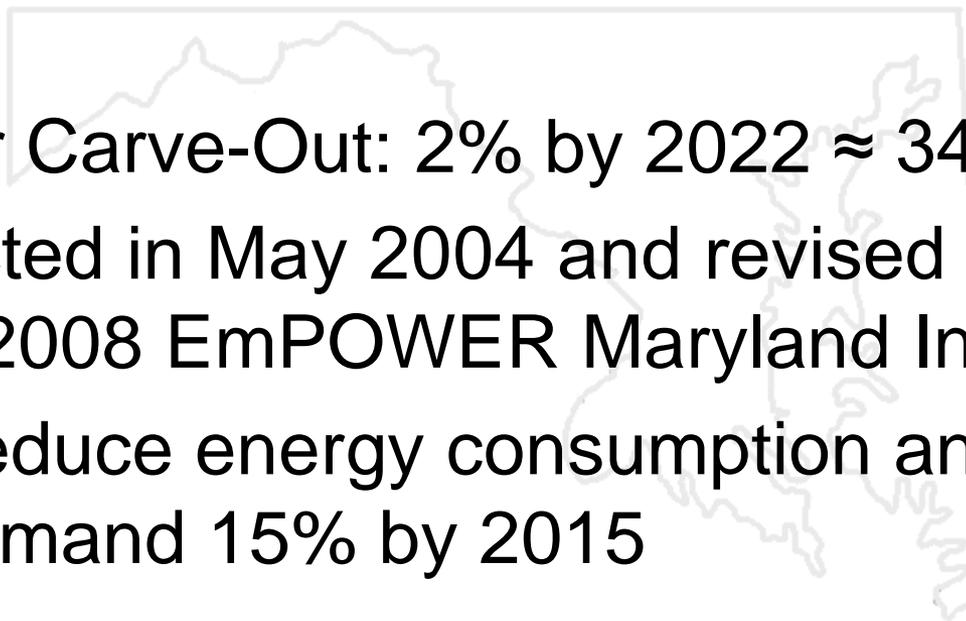
May 2009





# Maryland RPS & EmPOWER

- Standard: 20% renewables by 2022:  $\approx 3,457$  GWh
- Solar Carve-Out: 2% by 2022  $\approx 346$  GWh
- Enacted in May 2004 and revised in 2007 and 2008 EmPOWER Maryland Initiative:
  - Reduce energy consumption and electric demand 15% by 2015





# District of Columbia RPS

- Standard: 20% renewables by 2020:  $\approx$  2,638 GWh
- Solar Carve-Out: 0.4% by 2020  $\approx$  53 GWh
- Enacted in January 2005, applies to all retail electricity sales in the District. Amended in October 2008 by the Clean and Affordable Energy Act of 2008

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## Pepco's Blueprint for the Future

- Comprehensive Plan to help meet RPS & Minimize Carbon Footprint
  - Demand Response
  - Conservation
  - Renewable Energy Programs
  - Energy Efficiency
  - Smart Grid initiatives
    - Advanced Metering Infrastructure
- Will help Pepco customers:
  - Conserve energy
  - Reduce peak electricity demand
  - Manage future energy costs





# Net Metering

- Definition: The difference between energy supplied and energy consumed at the customer meter on a kWh basis
- The grid remains the constant back-up for the customer



## Net Metering

### Maryland

- Up to 2 MW system
- Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle

### DC

- Up to 1 MW system
- Credited to customer's next bill at retail rate; carries over indefinitely

[www.dsireusa.org](http://www.dsireusa.org)



# Solar Electricity – The Big Picture

- United States: For use in electricity generation in 2007, renewable energy accounted for 8% in which solar was just 0.2% of the 8%  
([www.eia.doe.gov](http://www.eia.doe.gov))
- Pepco DC currently has 73 solar installations totaling 536 kW
  - Average 7.3 kW
- Pepco MD currently has 160 solar installations totaling 1.62 MW
  - Average of 10.1 kW



# Solar Electricity – The Big Picture

- PV panels generate electricity from sun light and can interconnect with a utility's power grid
- One of the biggest drawbacks is the high capital costs and installation costs (Washington DC is expensive urban area and labor costs are high)
- The use of solar energy is expanding rapidly even though total contribution remains low
- On-going research improves efficiency



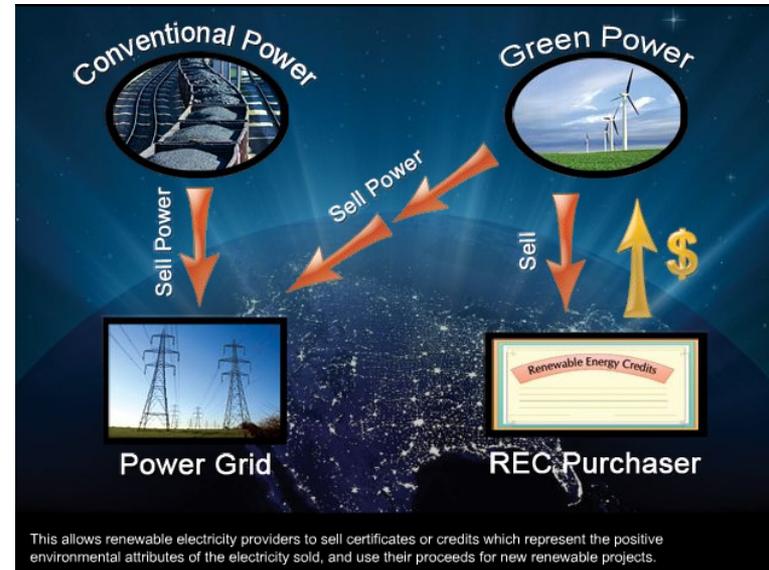
## Solar Electricity – Benefits

- Environmental (offsets CO<sub>2</sub> & curbs climate change – renewable resource)
- Improve grid reliability & energy security
- Provide new jobs in a growing industry
- Meets demand and capacity challenges
- Good alternative for satisfying peak electricity loads
- Gaining energy independence
- Supports RPS goals and Pepco's Blueprint goals
- Lower electric bills
- Costs of solar panels going down because of the current economy & on-going research



## Solar Electricity – RECs

- Renewable Energy Certificates (REC's) represent attribute & benefit of green power
- 1 REC = 1MWh energy produced
- Can be sold and traded separately from the electricity



Solar RECs  $\approx$  \$330.00/MWh  
for MD



## Solar Electricity – Current Incentives

- Federal:
  - Tax credit of up to 30%; no cap (Must be placed in service before Dec. 31, 2016) ([www.IRS.gov](http://www.IRS.gov))
- Maryland: *Solar Energy Grant Program*
  - \$1.25/Watt for the first 2kW of capacity. \$0.75/W for 2-8kW. \$0.25/W for 8-20kW (Max of \$10,000) ([www.energy.maryland.gov](http://www.energy.maryland.gov))
- DC: *Renewable Energy Incentive Program*
  - \$3/Watt for first 3 kW installed capacity. \$2/W for each of the next 7 kW. \$1/W for each of the next 10 kW (Max of \$33,000) ([www.green.dc.gov](http://www.green.dc.gov))
- Also check with your local county

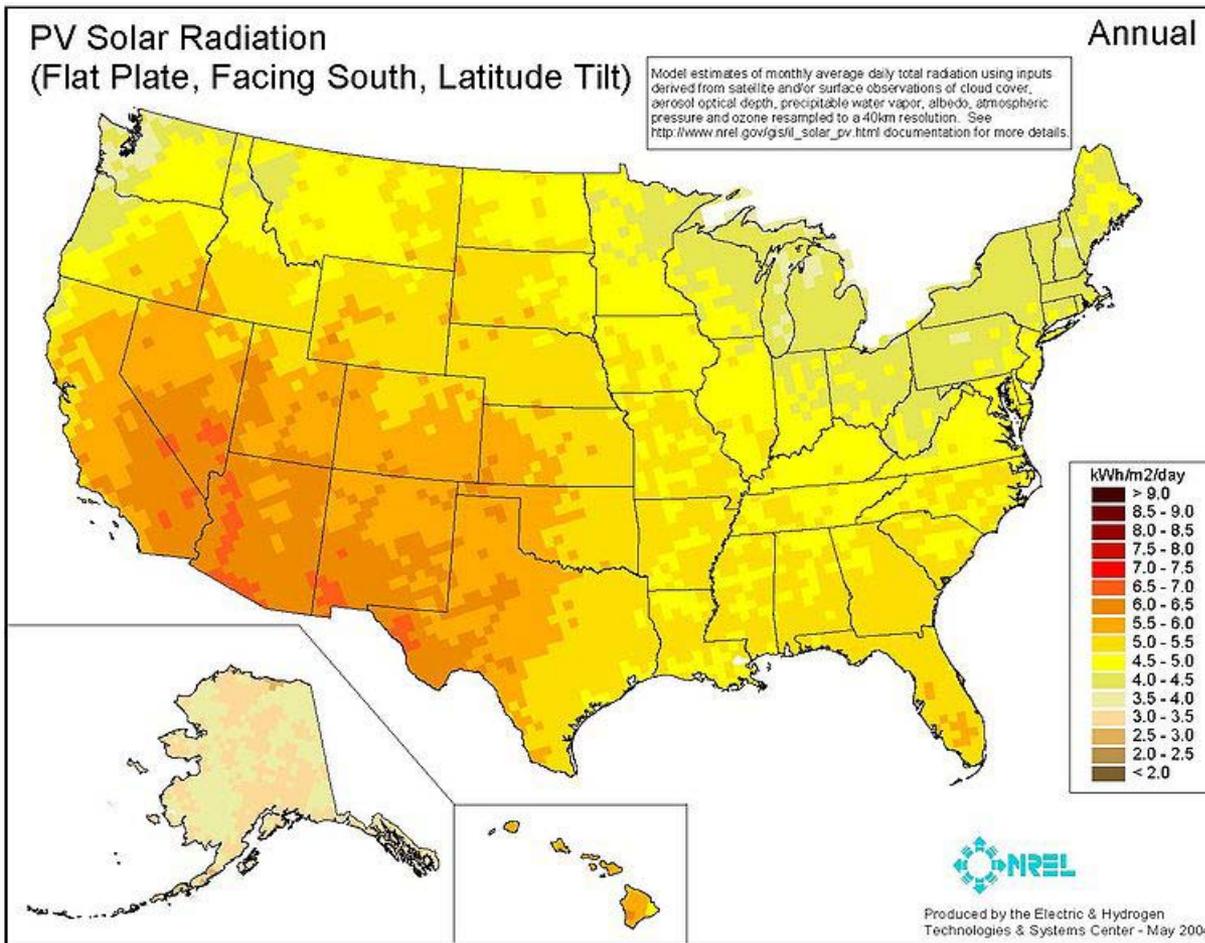


# Solar Electricity - Interconnection

- Green Power Connection™
  - Pepco makes the process of green power interconnection easy
  - Our Green Power Connection™ website provides useful information including:
    - Scenarios
    - Application Process
    - Incentives
    - Pepco Tariffs
    - Important links
  - [www.pepco.com/energy/renewable/connection/](http://www.pepco.com/energy/renewable/connection/)



## Solar Electricity – In DC



**Solar Hours = # hours per day that there is 1 kW/m<sup>2</sup> (STC) of sunlight for a given area**

**DC & MD at 38.5 Latitude & has 4.7 solar hours avg.**

**Cold winters – improves efficiency**

**Building height restricted in DC**



# Solar Electricity – In Maryland

- Example in Maryland
  - 2 kW system
  - 4.7 average daily solar hours
  - 0.80 - De-rating factor of system – ie. Inverter
  - $2 \text{ kW} \times 4.7 \text{ hours/day} \times 0.8 \times 365$ 
    - = 2745 kWh/year  $\times$  14¢ kWh (residential)
    - = \$384/year
  - Incentives can offer pay-back in half the time & selling RECs can often lower pay-back significantly



## Solar Electricity – In DC

- Pepco's substation in DC
- 48 panels
- 210 Watts each
- 10 kW total



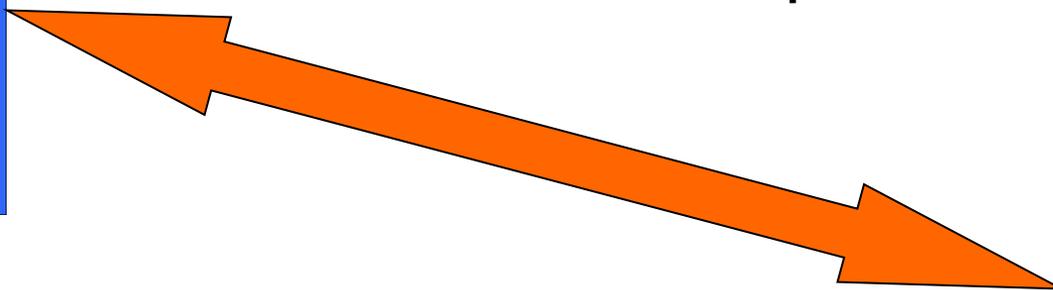
*The solar panels supply power to the substation, reducing its use of conventional power, and associated power plant emissions.*



## The Link: Smart Grid ↔ Solar



As you have seen Solar and Smart Grid support many of the same benefits & plans at all levels



When implemented together, there is a greater chance for customers to benefit and for states to reach their RPS goals





# Smart Grid – The Whole Story

- Smart Grid: One of the most profound technological evolutions of the electric grid
- And allows the grid to use new state-of-the-art innovations
- ‘Smart’ means the grid has two-way communications with home meter & utility
- Smart Grid requires a more sophisticated 2-way metering and data communications network known as Advanced Metering Infrastructure (AMI)



## Smart Grid – The Whole Story

- AMI smart meters collect and communicate transactional data at the point of delivery to the customer



- Thus, AMI is key to the deployment of the smart grid



# Smart Grid - Benefits

- What are the Benefits:
  - Supports new rate options
    - Pricing for renewable generators
    - Pricing for Plug-in Vehicles
    - Dynamic pricing
  - Distribution System Management
    - Outage reporting/Quick outage dispatch
    - System Monitoring/Performance/Reliability
    - Tamper Detection
    - Provides knowledge of what is happening on grid which allows better planning in order to optimize distribution system design
    - Integrating small scale renewable generators to function in a way that supports the grid



# The Link: Smart Grid ↔ Solar

## The Solar Decathlon

- Pepco has installed net meters for the solar homes in the Decathlon
- Net metering is most heavily weighted scoring category in the competition this year
- Demonstrates, in a village setting, how net metering can integrate solar energy into the energy mix



## The Solar Decathlon





## The Link: Smart Grid ↔ Solar

- Net Metering supports and encourages solar installations, becomes easier to implement because AMI smart meters can separately record flows of energy in each direction
- AMI enables the increased use of solar by making it easier to integrate them into the grid



# The Link: Smart Grid ↔ Solar

- With AMI enabled dynamic pricing, customers with solar can lower energy costs by monitoring prices and choosing to use more of their solar resources during peak pricing
- Customers with solar will not have to compromise by reducing electrical usage during peak pricing periods – they will be able to run A/C and other appliances during those periods without being affected by higher peak prices (or gain a greater rebate for peak rebate pricing)



# Additional Information

- Pepco: [www.pepco.com](http://www.pepco.com)
- Green Power Interconnection™:  
[www.pepco.com/energy/renewable/connection/](http://www.pepco.com/energy/renewable/connection/)
- Department of Energy: [www.doe.gov](http://www.doe.gov)
- Energy Information Administration: [www.eia.doe.gov](http://www.eia.doe.gov)
- DOE Energy Efficiency and Renewable Energy:  
[www.eere.energy.gov](http://www.eere.energy.gov)
- Database of State Incentives for Renewables and Efficiency:  
[www.dsireusa.org](http://www.dsireusa.org)
- Maryland Energy Administration: [www.energy.state.md.us](http://www.energy.state.md.us)
- District Department of the Environment: [www.green.dc.gov](http://www.green.dc.gov)
- [www.IRS.gov](http://www.IRS.gov)
- [www.energystar.gov](http://www.energystar.gov)



## Questions

