Villanova University
Making Sustainability the Economic Choice - Smart Grid as a Revenue Stream

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Redefining Power Economics:  
*Transforming energy investments into savings and revenues*

Virtual Power Generation

Integrated and Optimized Demand Response + Distributed Generation + Storage that results in controlled and defined load curtailments that are scheduled onto the grid as capacity, energy and ancillary services

*Viridity Integrates Customer Energy Assets onto the Grid via 24/7 Market Participation*
What is a Smart Grid?

SMART GRID
A vision for the future — a network of integrated microgrids that can monitor and heal itself.
The Smart Grid is the Game Changer

- Two-way communication makes customer-owned distributed generation and demand management available to the grid
- Customers are suppliers to the market
- Grid-based generation is coupled and optimized with customer generation and controllable demand to maintain system balance at the lowest possible price
Peaking Power Plants Avoided
— Brattle Report

- Business As Usual: 506 Power Plants Avoided
- Expanded Business As Usual: 1093 Power Plants Avoided
- Achievable Participation: 1840 Power Plants Avoided
- Full Participation: 2611 Power Plants Avoided
PJM – Impact of Demand Response on Prices

August 1 – 4, 2006
Savings attributable to DSR: $650,000,000
Payments to DSR Providers: $5,000,000

August 2, 2006

Estimated prices without Demand Reductions
Prices with Demand Reductions
Viridity 24/7 Optimization Process

Customer Added-Value

Energy Efficiency
Supply Savings
Carbon Reduction

VPower™
Aggregates Customer Loads & Bids into Markets

RTO/ISO Energy Market Operations

Wind Resources
Solar Resources
Electric Vehicles
Energy Purchases
Energy Storage & Fuel Cells
Building Management Systems
Energy Price & Load Forecasts
Combined Heat and Power
Weather
From Peak Shaving to Virtual Generation

Price Duration Curve

Traditional DR Capture
100 Hours (Super Peak)
Average RT Price: $175
From Peak Shaving to Virtual Generation

Price Duration Curve

**Viridity Capture**
1700 Hours
Average RT Price: $75 or higher

**Viridity Value**
10mw x 100 x 175 = $175,000
3mw x 1700 x 75 = $382,500
Est. Total Revenue with Viridity = $557,500

11/18/2009
The Total Value Proposition

*Providing optimal economic and environmental value to energy customers*

**Demand Side Management**
- Optimize Distributed Generation and Curtailment Capabilities in response to prices, weather and supply purchases
- Provide predictable, controlled, measured, and auditable resources to be sold into markets

**Supply Side Benefits**
- By virtue of Demand Side Management, electricity usage is optimized leading to better efficiency and reduced cost of electricity supply per energy use.

**Carbon Footprint Reduction**
- Carbon footprint can be a stated goal that can be managed via Viridity

**Distribution Utility/Customer Partnership**
- Utilities have access to distributed energy resources.
  - Load is a predictable and controlled resource on the grid
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Thank You.

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