A landscape photograph featuring a vibrant rainbow arching across a blue sky with scattered white clouds. In the foreground, there is a field of dry, golden-brown grass. In the middle ground, several tall, white metal lattice towers for power lines stand prominently. In the background, a city skyline with various buildings and structures is visible under the rainbow's glow.

**Massachusetts Institute of
Technology**

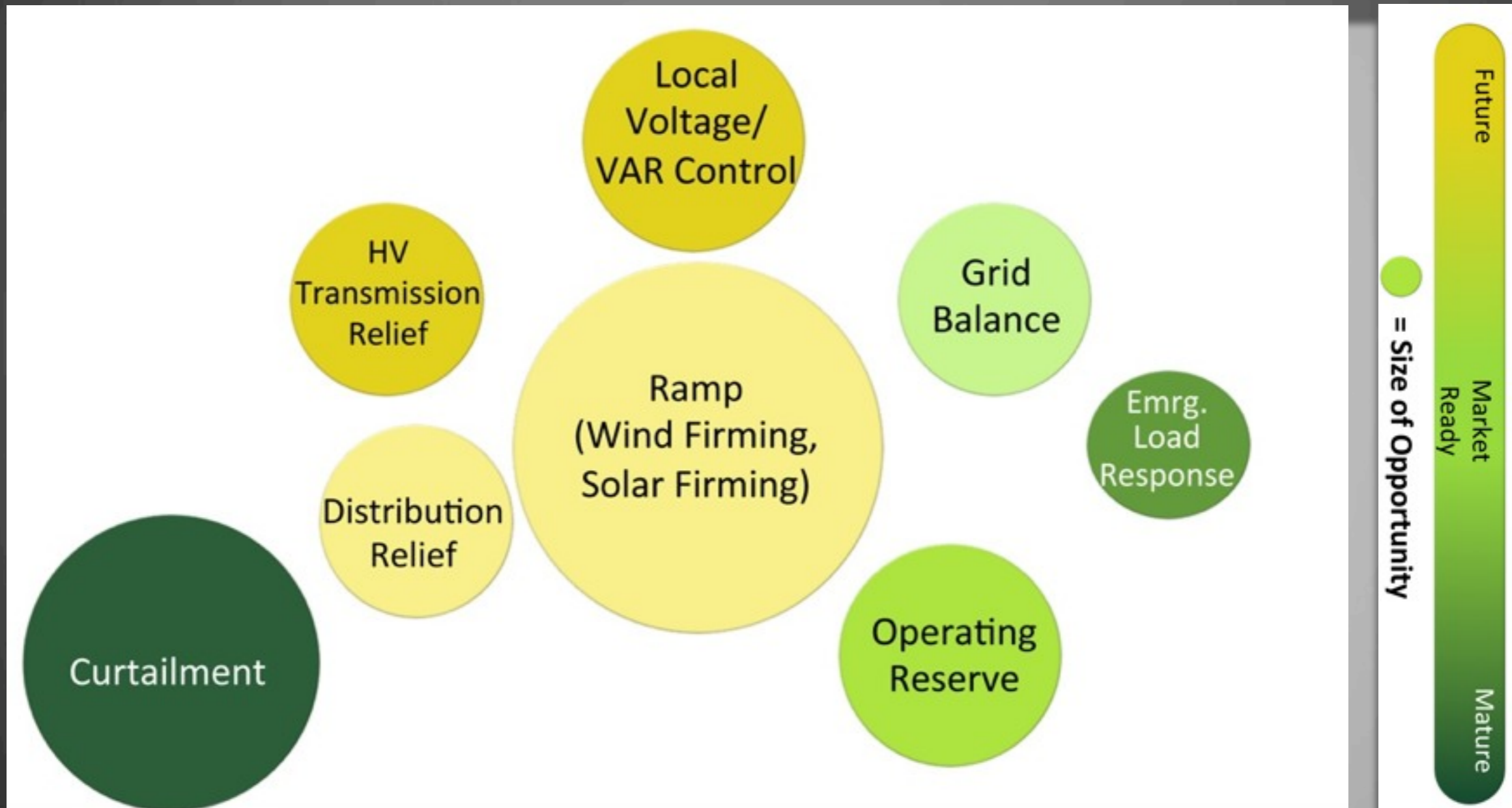
“Demand Response”

**November 4, 2011
Afternoon Session**



Market Maturity for Demand-Side Assets to Participate

Technology Required



Speed of Response



Carrier 5:35 PM

TENDRIL

DASHBOARD

Current price per kWh	\$0.10
Estimated bill	\$126.54
Today's cost	\$0.95
Yesterday's cost	\$1.30
Last hour usage	0.36 kWh



Dashboard Control Settings

3G 9:42 AM

Voice Control

call
play
shuffle

Cancel

4G 9:42 AM

315° NW



37°19'55"N, 122°1'48"W



UNIVERSITY OF DELAWARE

PJM

Pepco Holdings Inc

V2G

Pepco Holdings Inc V2G

Vehicle-to-Grid Power (V2G)
How does it work?

Summary: Vehicle-to-Grid Power (V2G) is a technology that allows electric vehicles (EVs) to store and supply power back to the grid. This can help balance the grid, reduce peak demand, and provide a source of renewable energy.

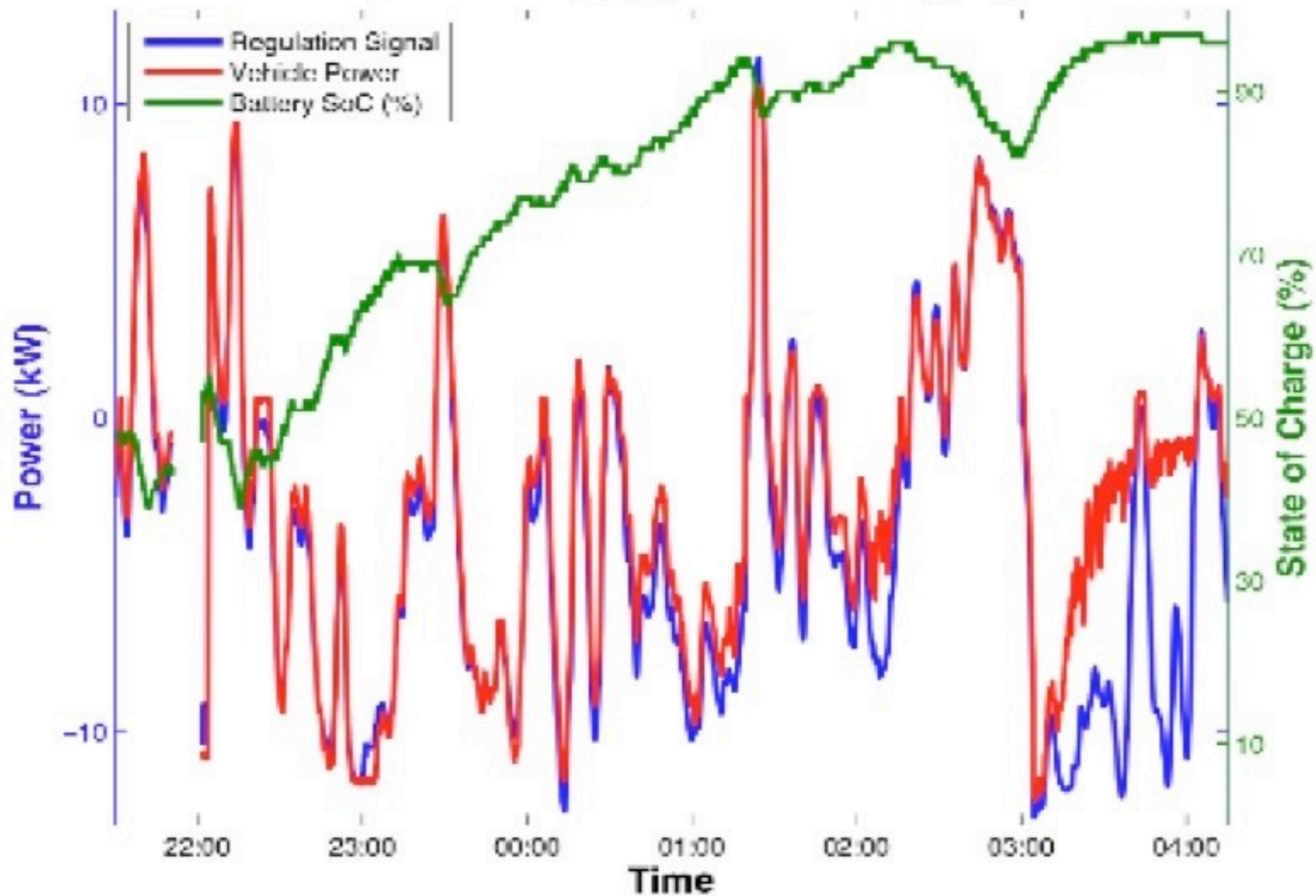
Applications: V2G can be used in a variety of ways, including: providing backup power for homes and businesses, providing power to the grid during peak demand, and providing a source of renewable energy for homes and businesses.

Benefits: V2G offers several benefits, including: reducing peak demand, providing a source of renewable energy, and providing a source of backup power for homes and businesses.

Challenges: There are several challenges associated with V2G, including: the need for a dedicated charging station, the need for a dedicated power source, and the need for a dedicated power distribution system.

Diagram: A diagram showing the connection between a vehicle and a power source, illustrating the flow of power from the vehicle to the grid.

Regulation Supply (incidental charging)



LI-ION BATTERIES

Regulation Services and the Cashback Car

Cumulative Cost

\$50,000

\$40,000

\$30,000

\$20,000

0

0

5

10

15

Years After Purchase

\$4.00/gal.
\$0.09¢/kWh (2009 avg)
Maintenance costs and rebate not applied



Payment to owners of cashback vehicles average \$2,400 annually



Schneider
Electric

Schneider
Electric

Schneider
Electric

Transactive Load



ETS Heat



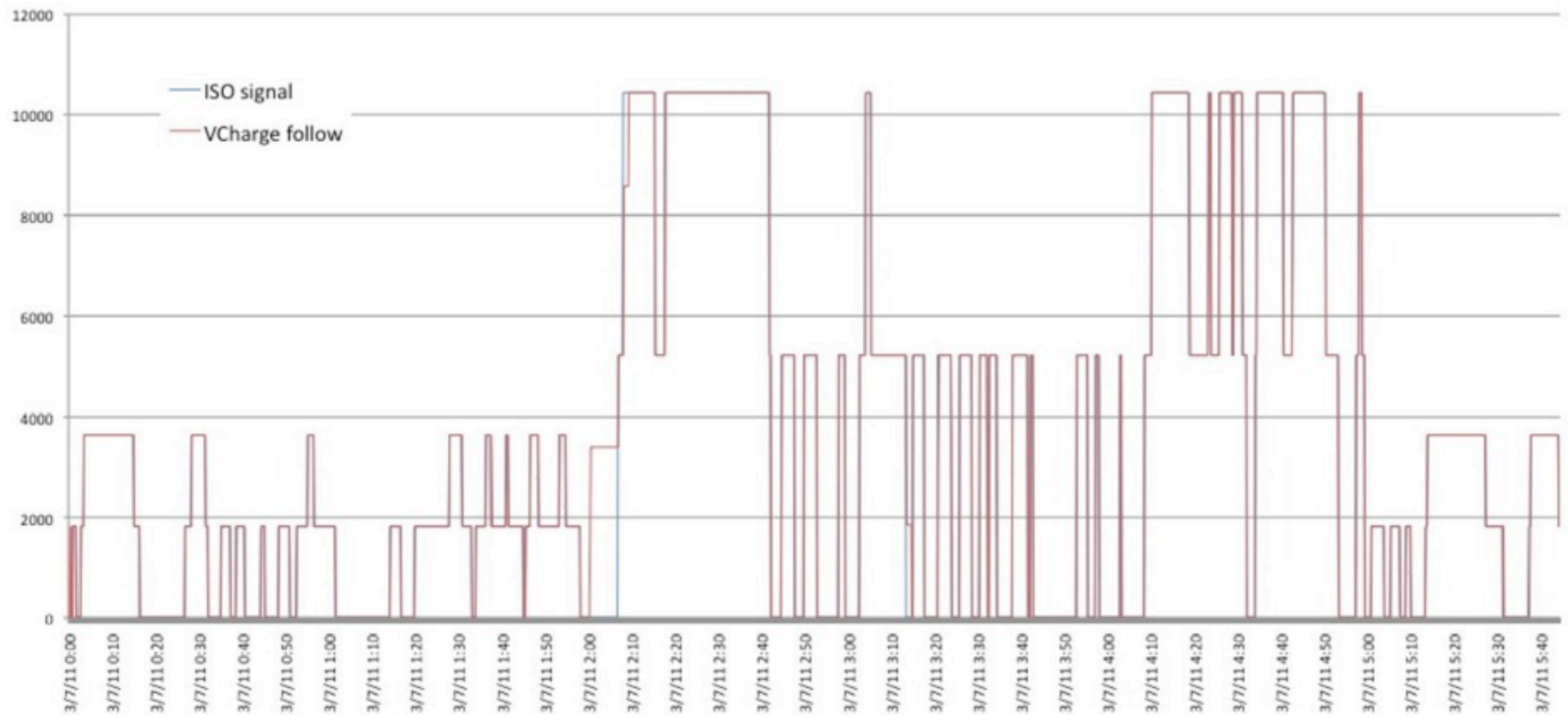
Ice-based AC



EV's

SmartBricks™ Value Drivers

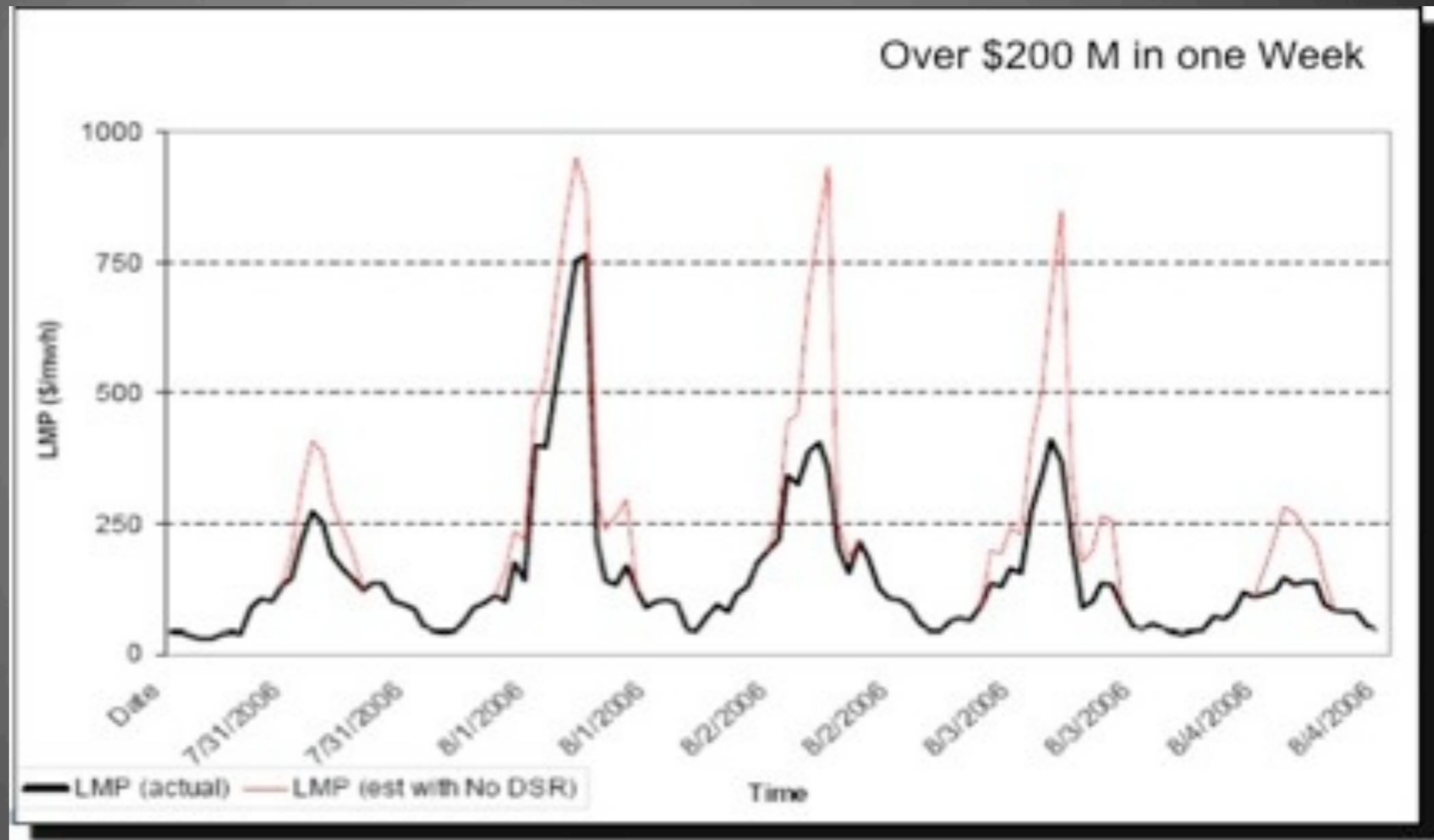
Provide Regulation to grid operator



Grid Benefits of Demand Response

- PJM Study- a 3% Reduction in Demand of Top 20 5hr Blocks in 5 Mid-Atlantic States Could Save \$280 Million annually

- Brattle Group- a 5% Reduction in Grid Peak Load (757 GW) Can Result in \$3 Billion Savings Annually, for PV Over 20 Yrs of \$31 Billion







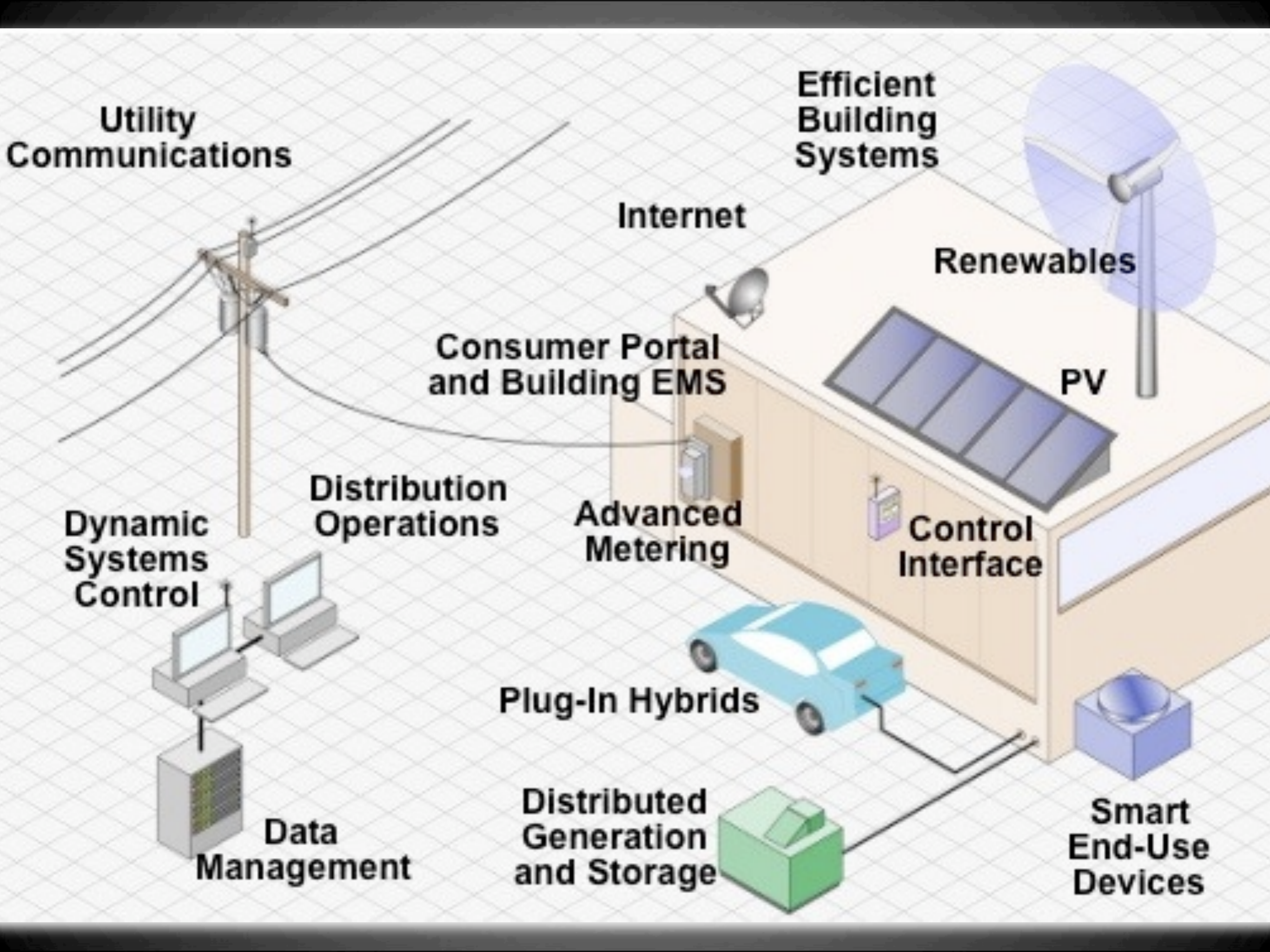


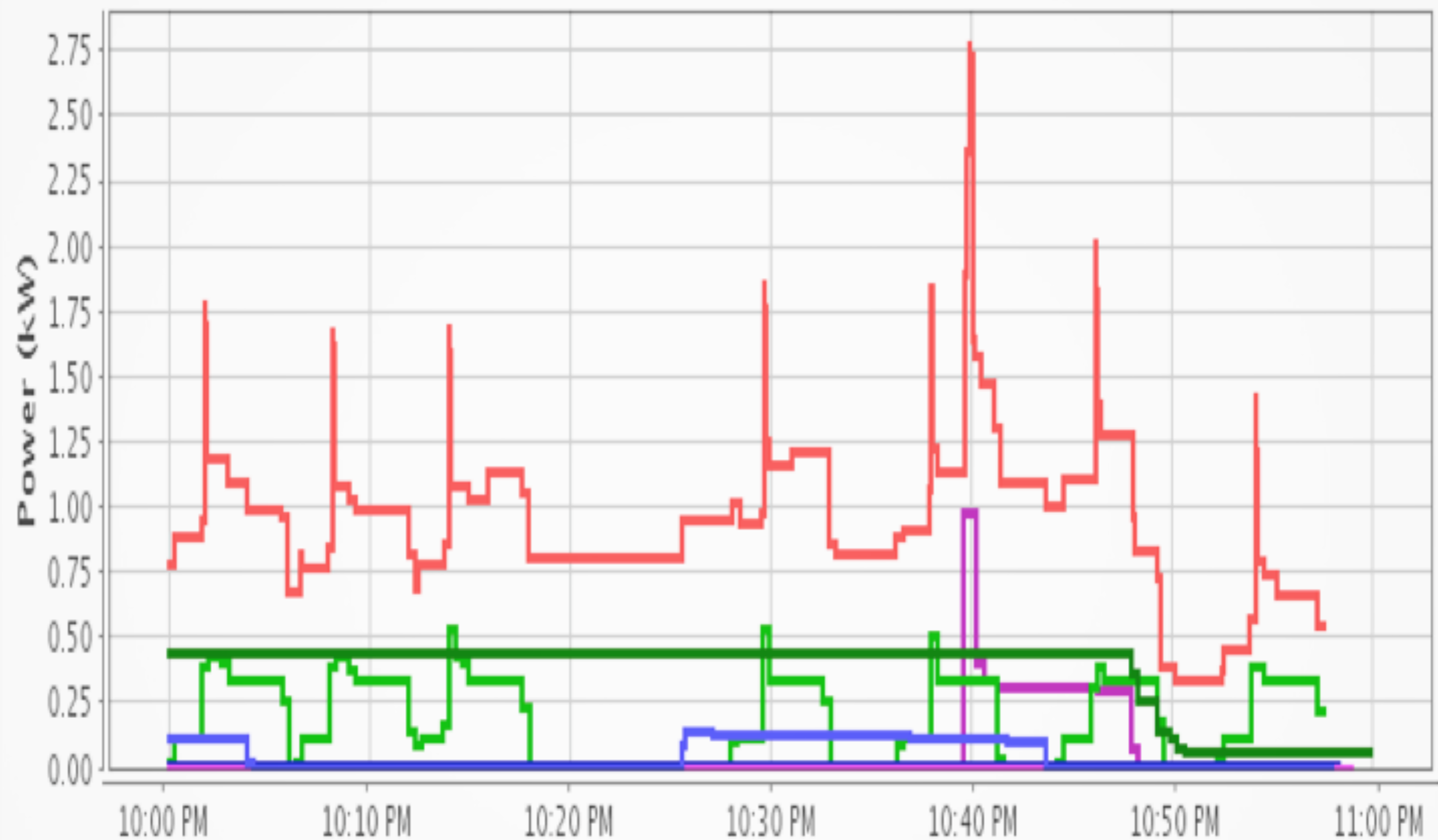
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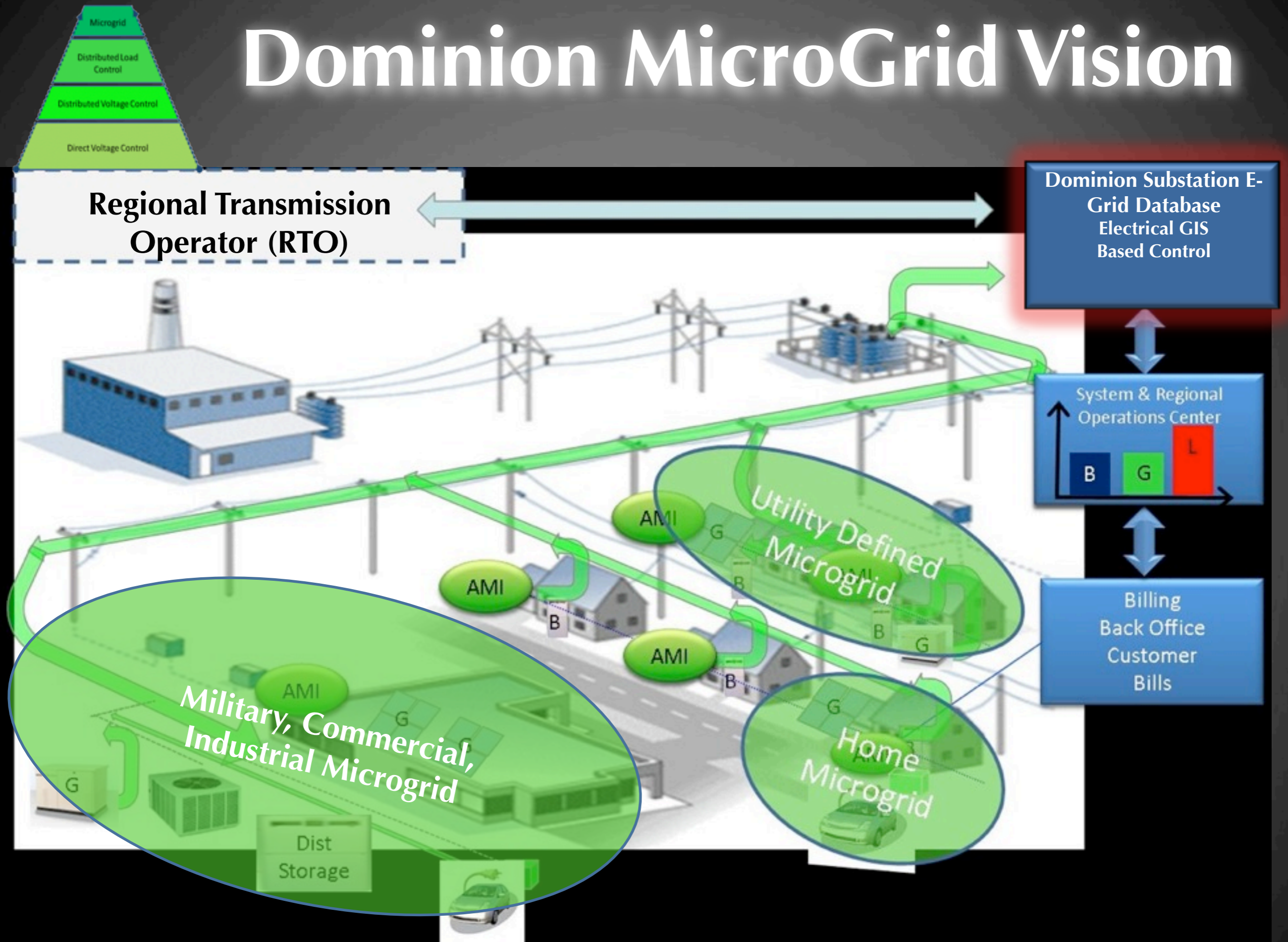






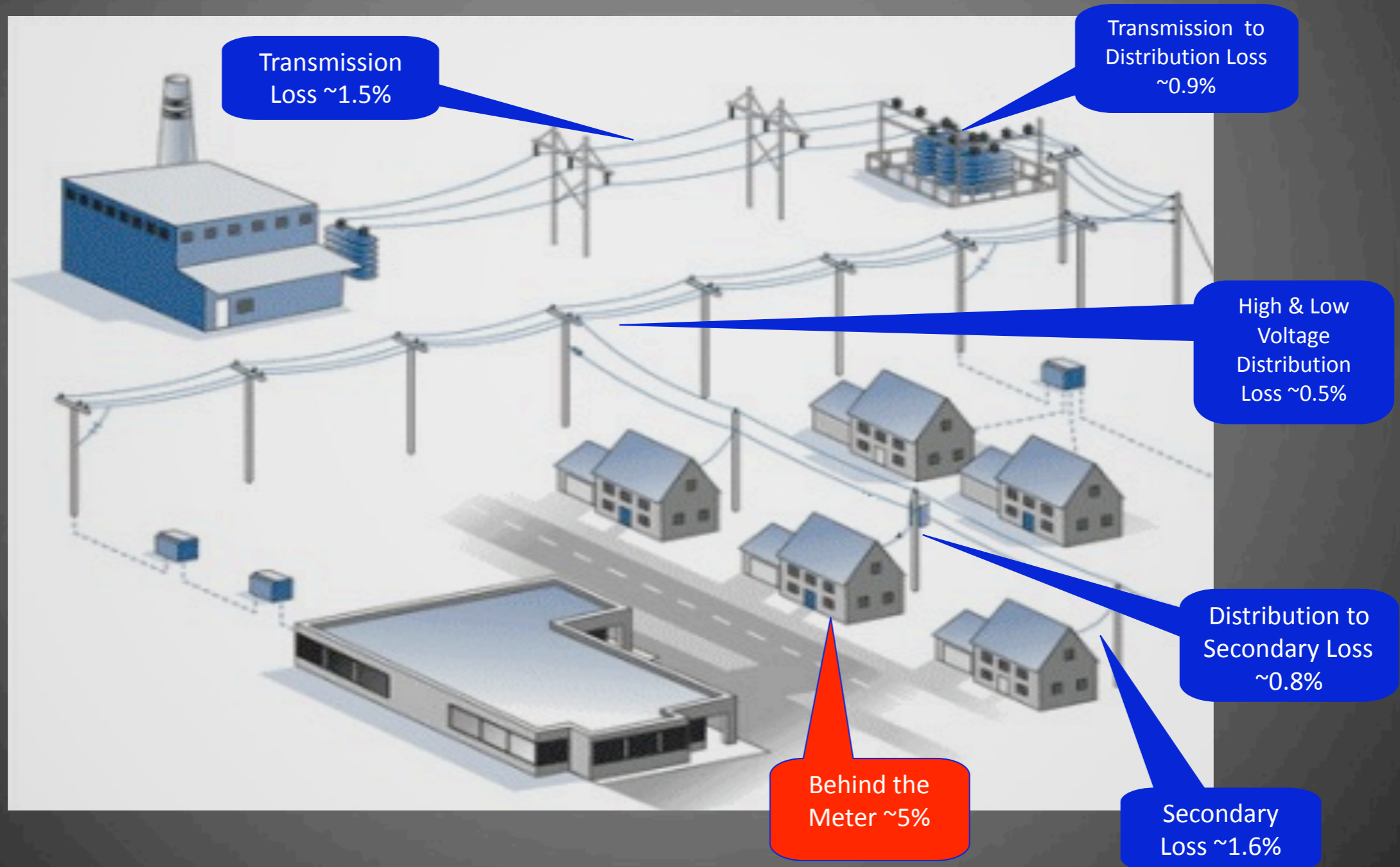
— Mains
 — Refrigerator
 — Family room
 — Dishwasher
 — Laundry
 — A/C - Down
 — A/C - up
 — Air Handler - up
 — Furnace - down
 — Sump pump

Dominion MicroGrid Vision

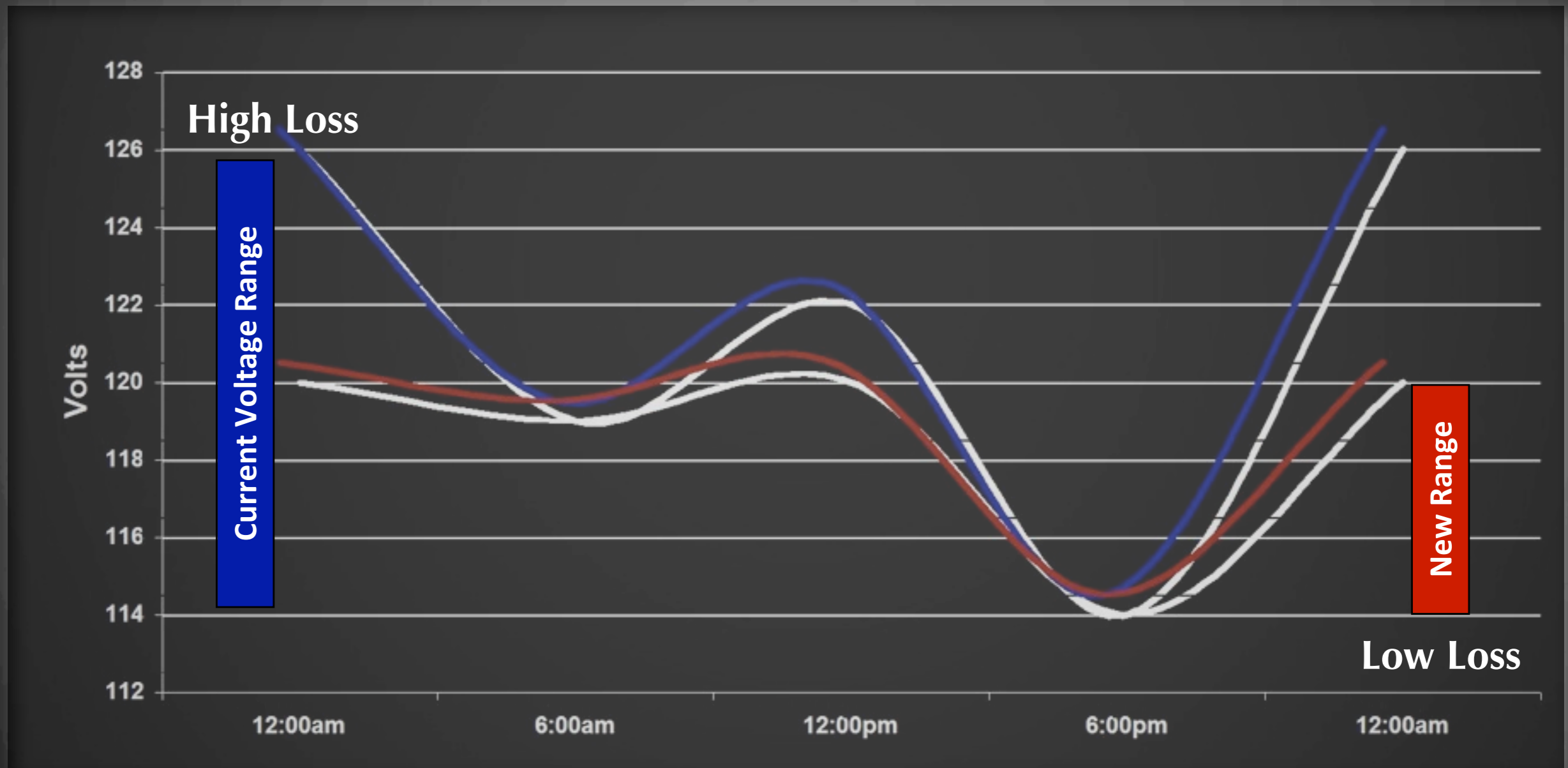


The Hunt for Transmission and Distribution Losses

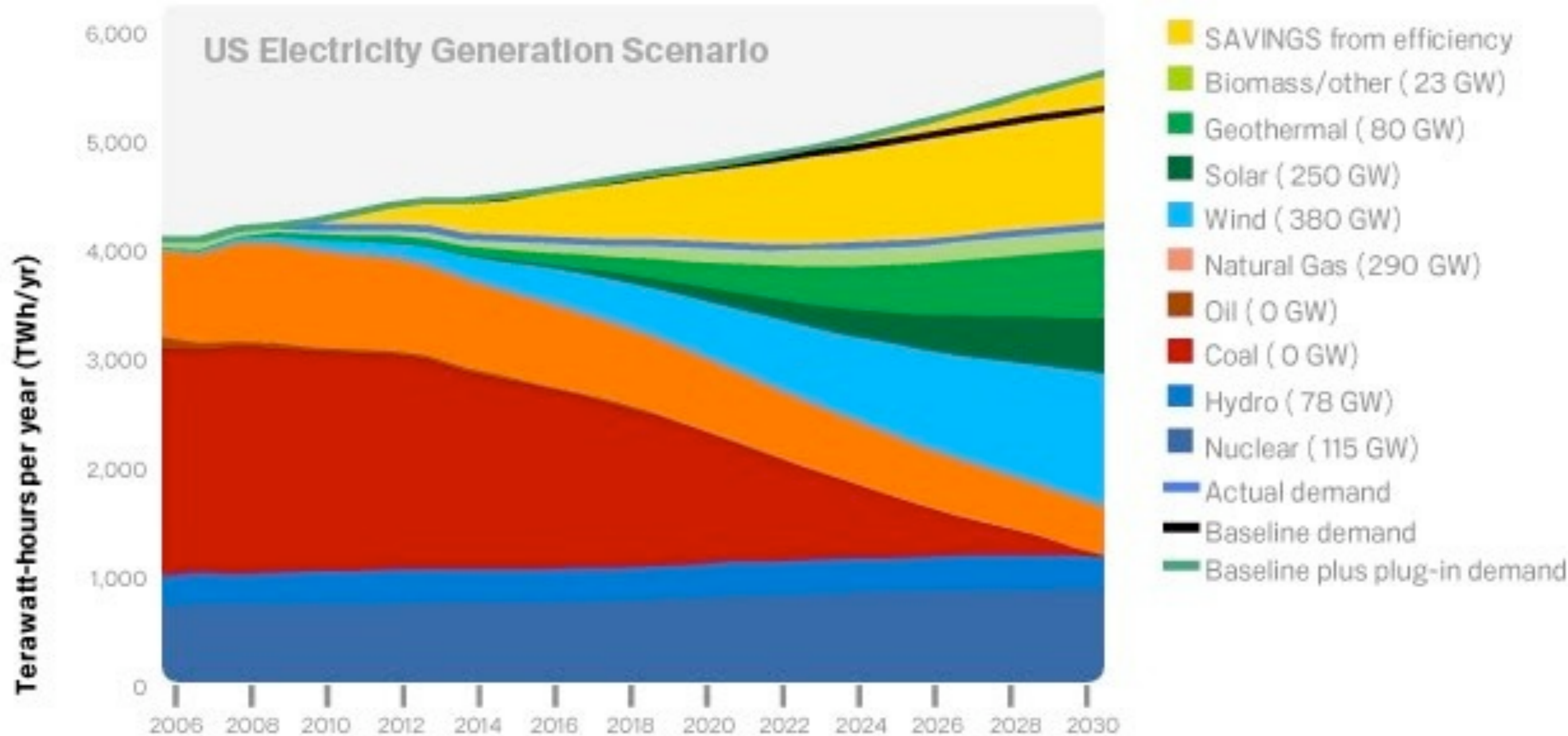
2010 Electric System Loss ~ 10.3% Includes Transmission, Distribution and "Behind the Meter"



Precision Power: How it Works



Google Electric Future



When there's a huge solar energy spill,
it's called a "nice day."

Pass the NY Solar Jobs Act

ENTER

A landscape photograph featuring a rainbow arching across a blue sky with scattered white clouds. In the foreground, there is a field of dry, golden-brown grass. Two large, white metal lattice power line towers stand prominently in the middle ground, with several power lines stretching across the frame. In the far distance, a city skyline is visible, including several tall, thin structures. The overall scene is bright and clear.

Thank you!