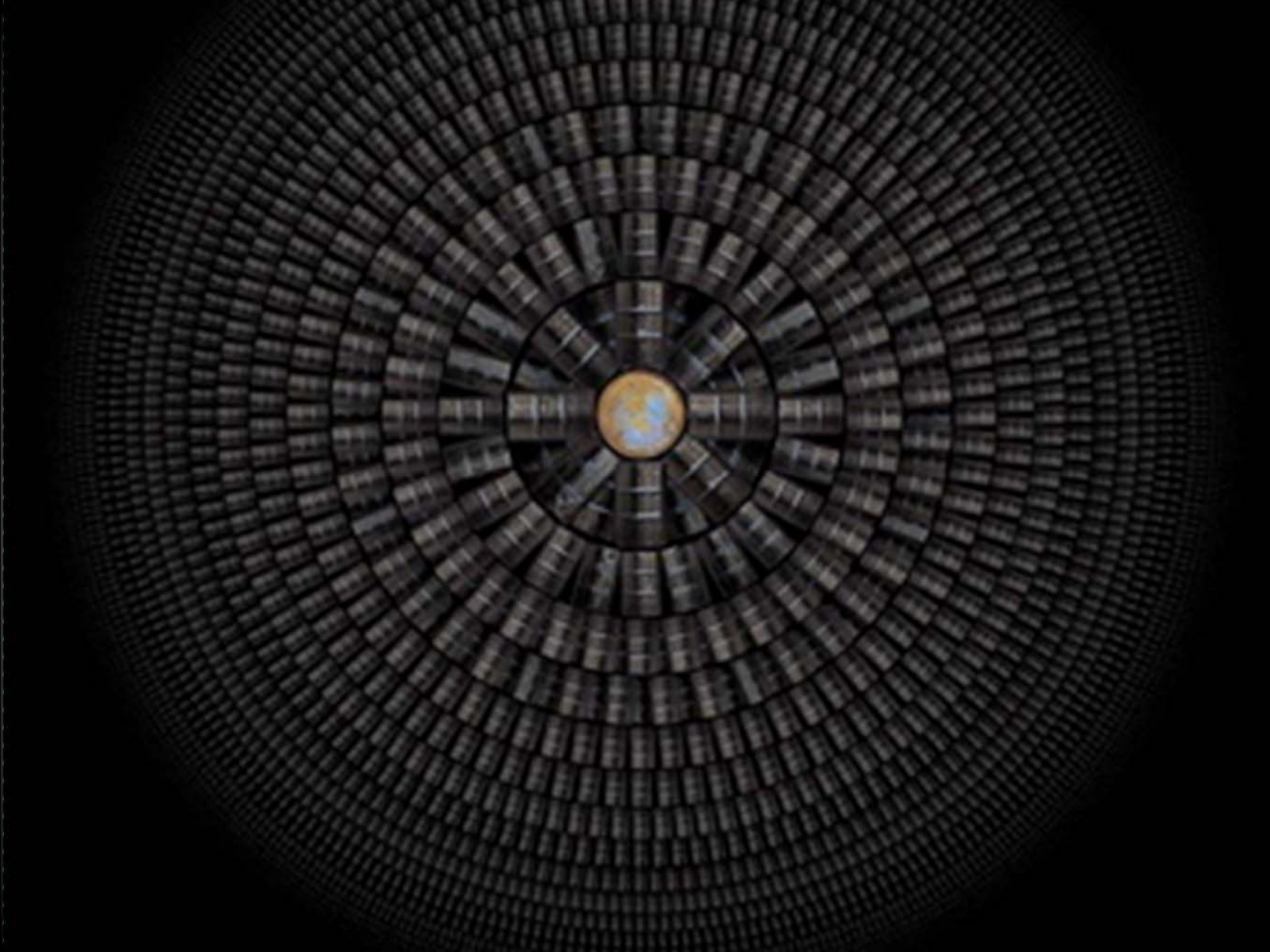


**University of Pennsylvania
Institute for Urban Research
June 14, 2011**

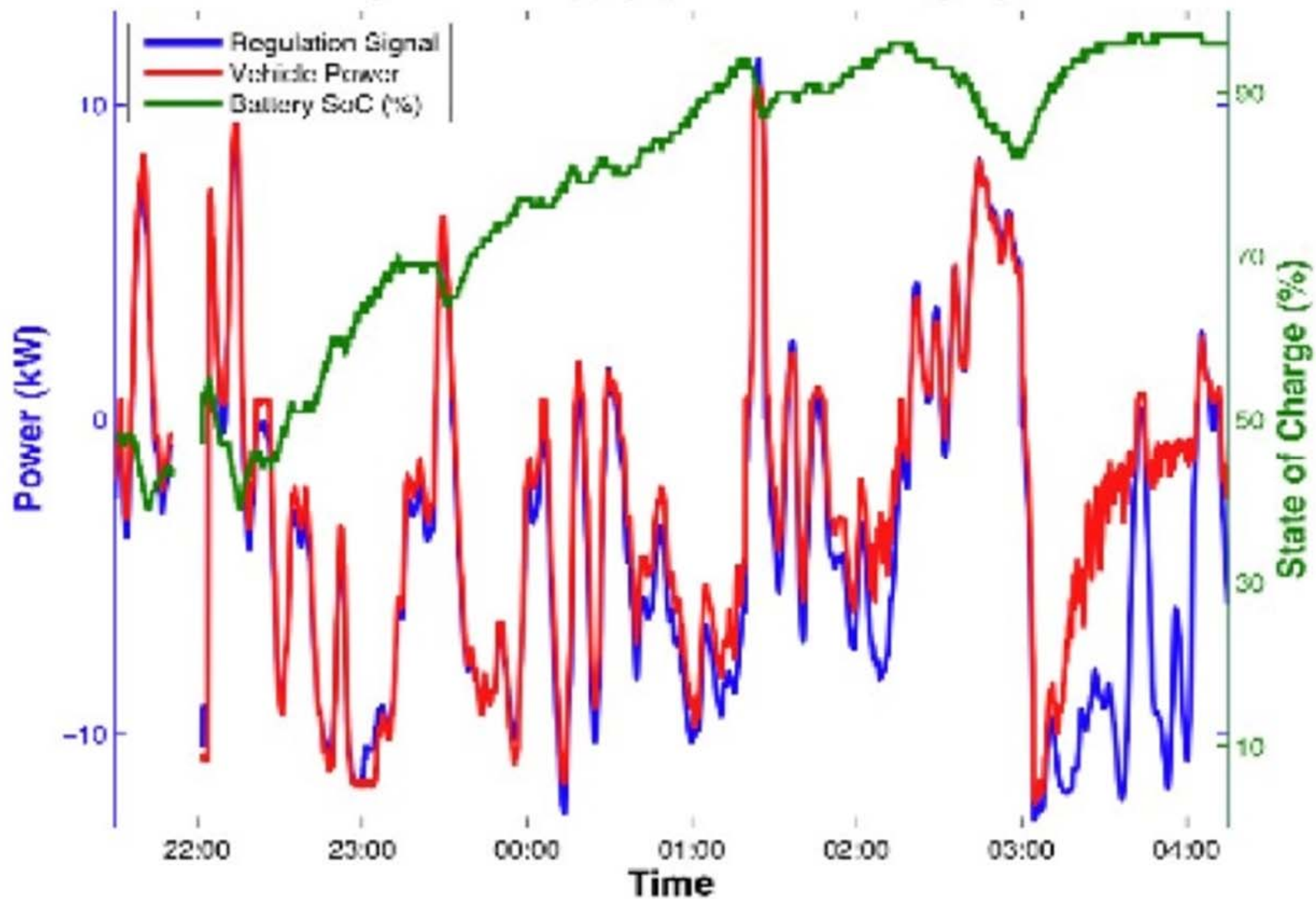






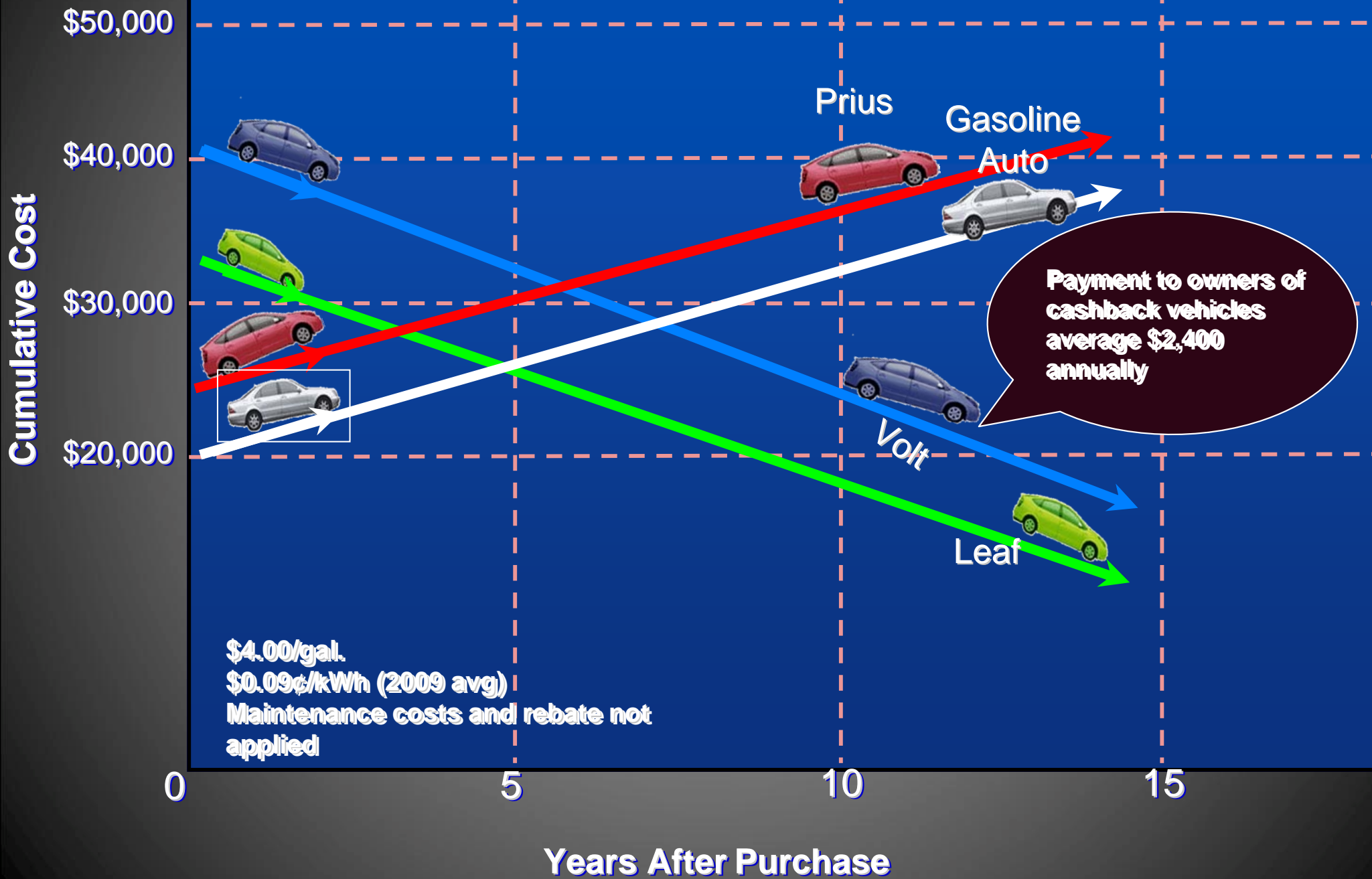


Regulation Supply (incidental charging)



Regulation Services and the Cashback Car

LHON BATTERIES

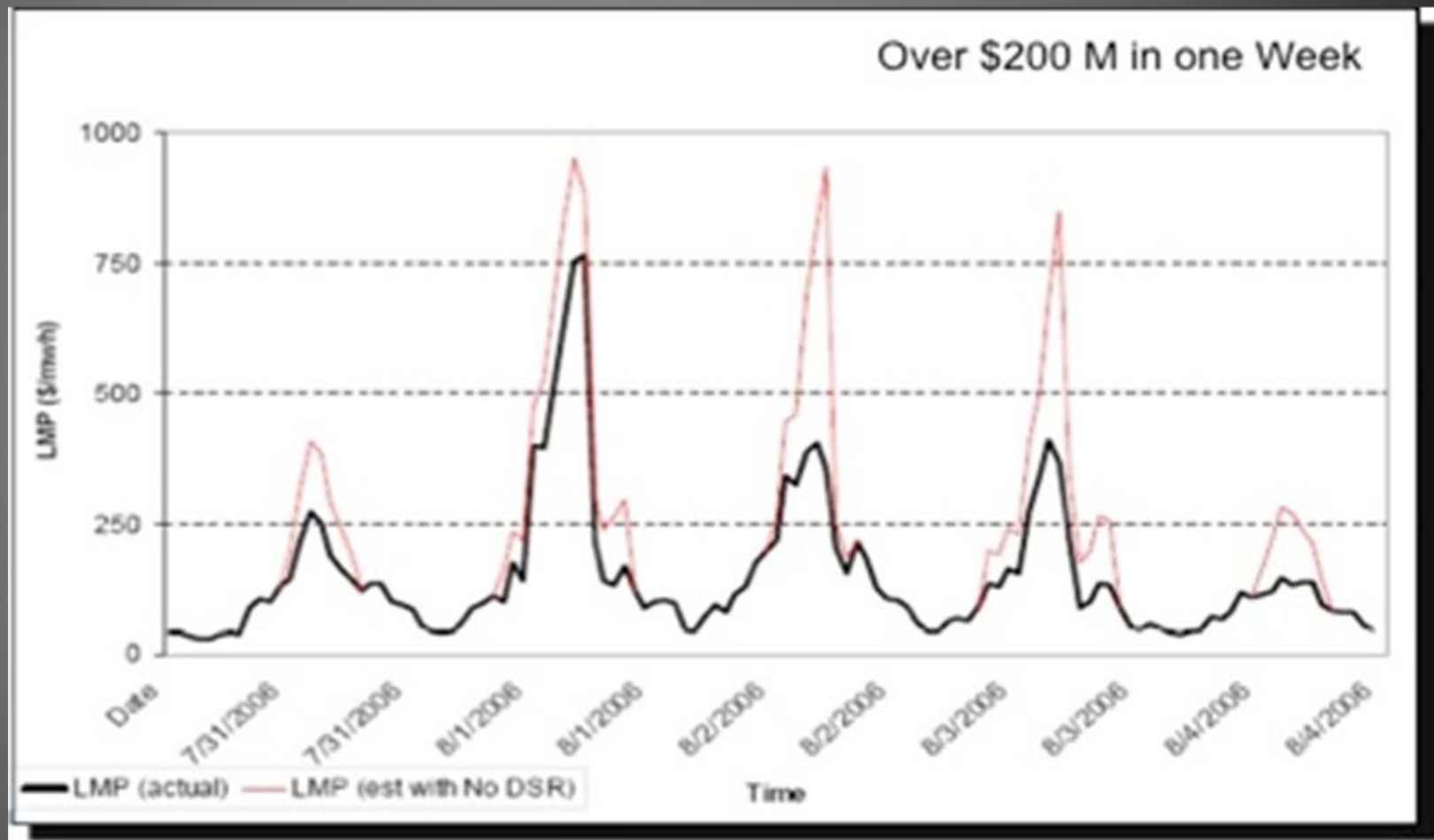




Grid Benefits of Demand Response

- 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





**Utility
Communications**

**Efficient
Building
Systems**

Internet

Renewables

**Consumer Portal
and Building EMS**

PV

**Distribution
Operations**

**Advanced
Metering**

**Control
Interface**

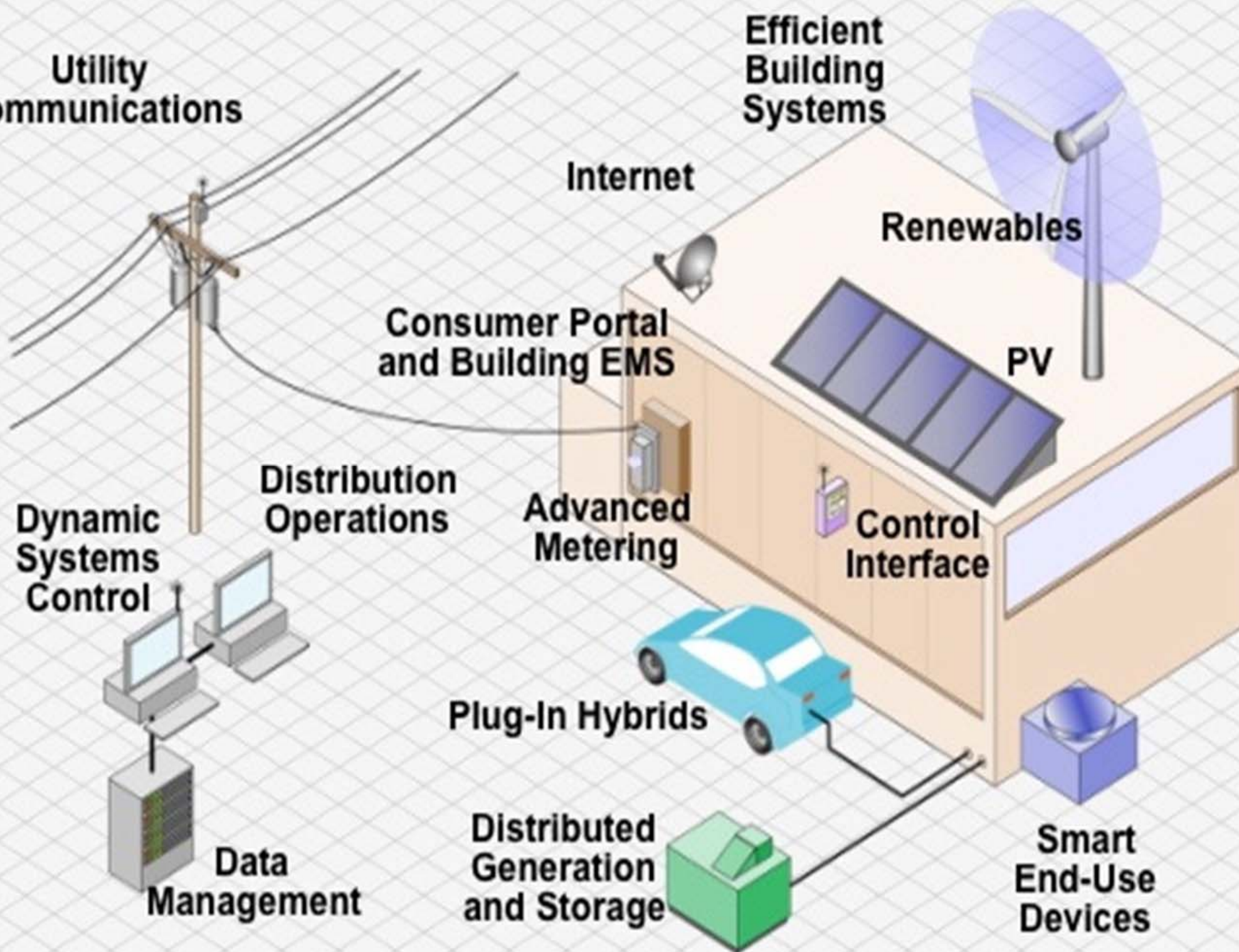
**Dynamic
Systems
Control**

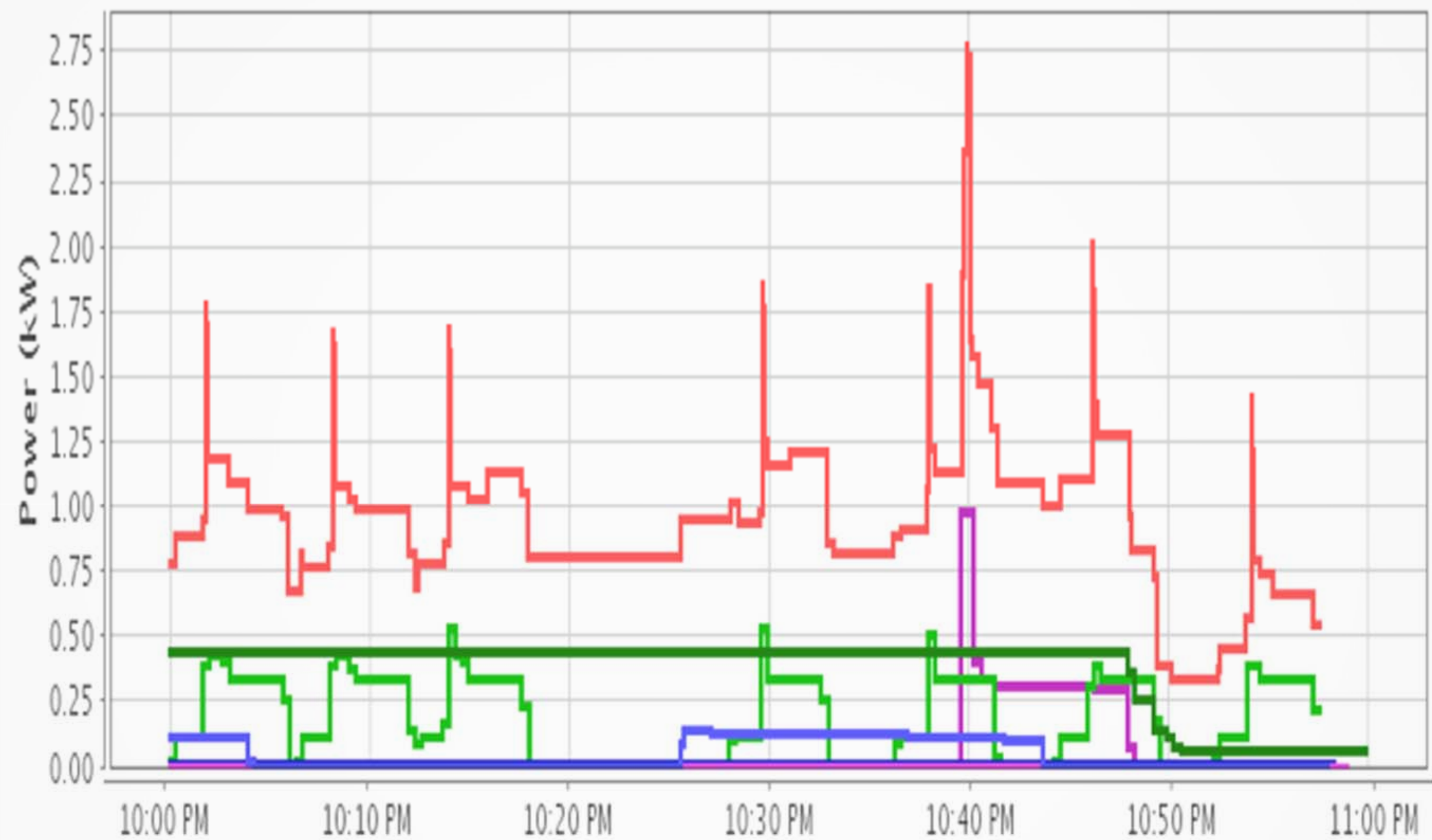
Plug-In Hybrids

**Data
Management**

**Distributed
Generation
and Storage**

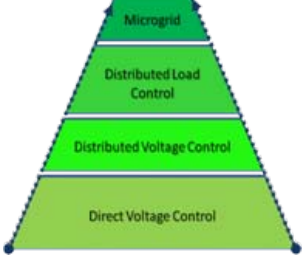
**Smart
End-Use
Devices**





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

Dominion MicroGrid Vision



Regional Transmission Operator (RTO)

Dominion Substation E-Grid Database
Electrical GIS
Based Control

System & Regional Operations Center

B G L

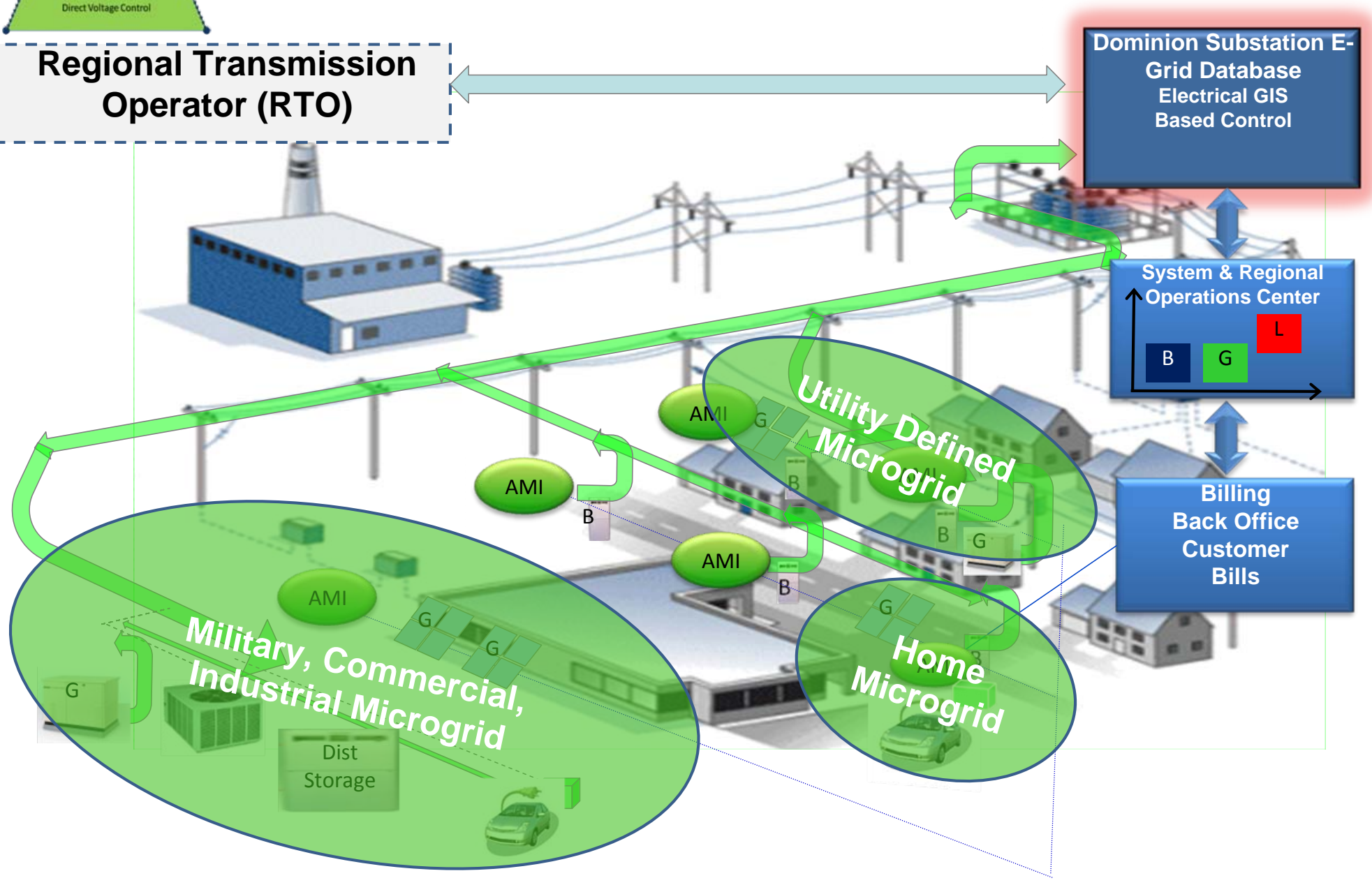
Billing Back Office
Customer Bills

Utility Defined Microgrid

Home Microgrid

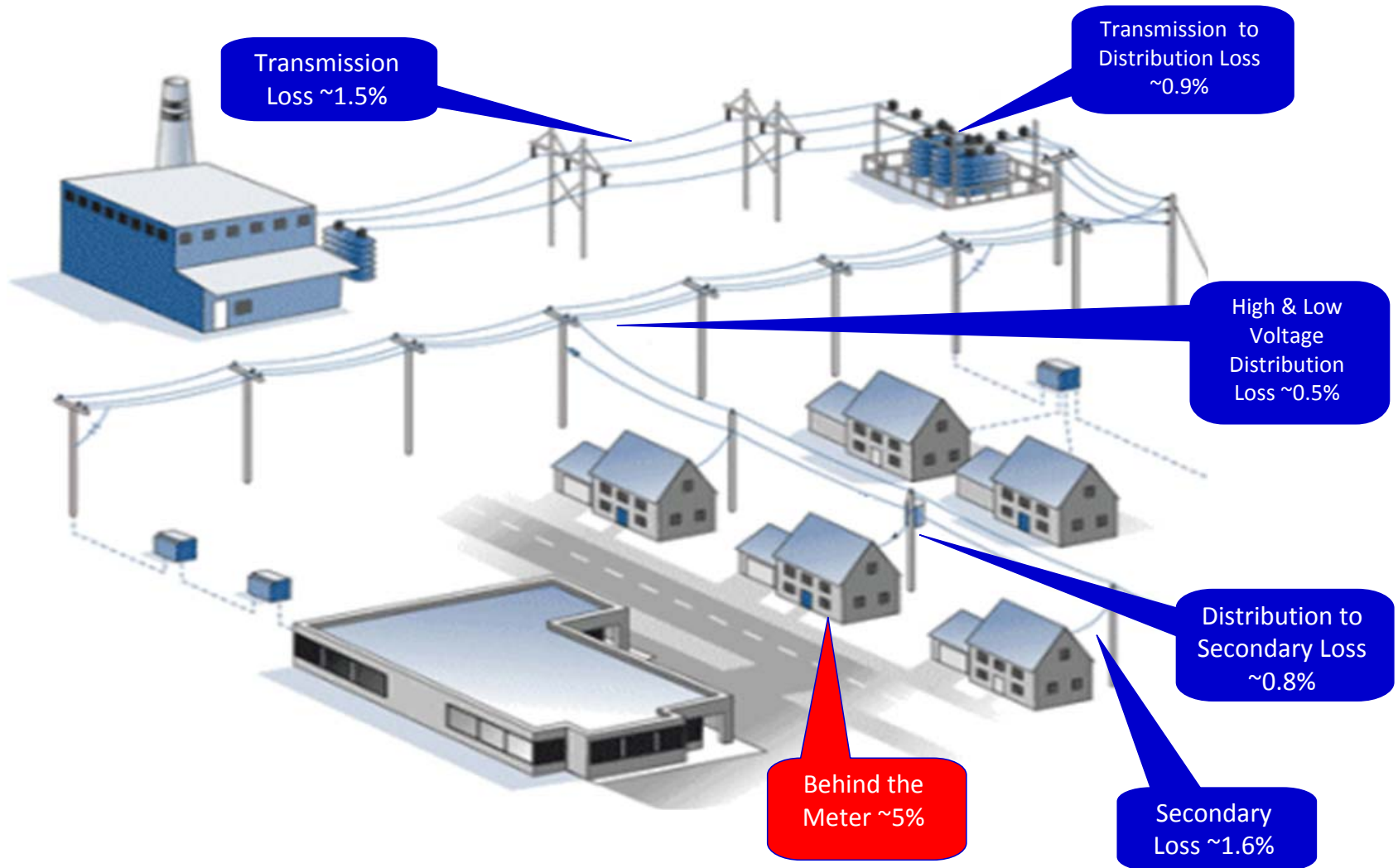
Military, Commercial, Industrial Microgrid

Dist Storage



The Hunt for Transmission and Distribution Losses

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



Google Electric Future

