



IBM Point of View

Plug in Vehicles and Recharging Infrastructure Implications

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Smarter Power rethinks the electrical grid and empowers customers to make intelligent choices about energy use

Monitoring power everywhere on the grid



Real-time line of sight to energy consumption



Reducing waste and greenhouse gas emissions



INSTRUMENTED

Remote monitoring devices tell when and where faults occur, alert to impending overload condition, and locate inefficiencies are enabling smarter sourcing and distribution of power.

INTERCONNECTED

Virtual market-places between consumers and providers, allowing consumers to trade flexibility in usage for lower costs.

INTELLIGENT

Power grids that use sensors, smart meters, pricing, digital controls and analytic tools to automatically monitor and control two-way energy flow.

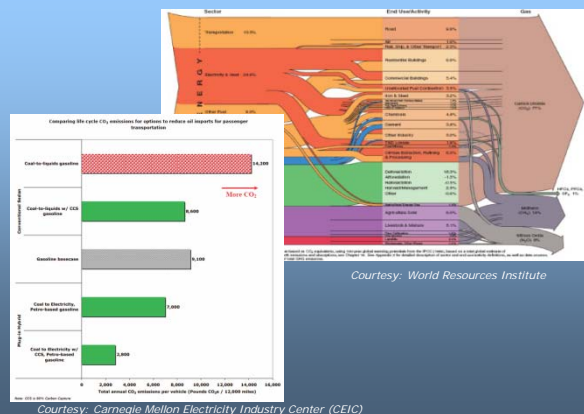
Plug-in Electric Vehicle (PEV) Current State of Affairs

- **Automaker activity ramping up, forecasting production levels by 2010**
 - 2008: Tesla Roadster, Think!
 - 2009: Fisher Karma
 - 2010: **GM Volt**, Saturn Vue Green, Toyota, Nissan, Mercedes
 - Post 2010: Renault/Nissan, Ford, Volvo, Volkswagen,
- **Utilities are forming partnerships, preparing for pilots**
 - SCE/Ford
 - EDF/Toyota
 - Dong Energy/Renault/Better Place
 - Vattenfall/Saab/Volvo
- **IBM working with utilities, governments and automakers on plug-in car enablement**



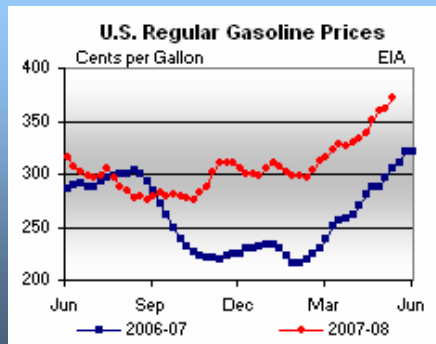
Behind the momentum...

Climate Concerns

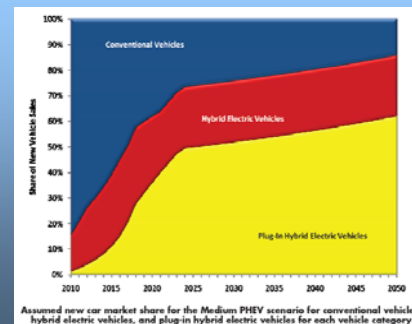


Courtesy: Carnegie Mellon Electricity Industry Center (CEIC)

Fuel Prices

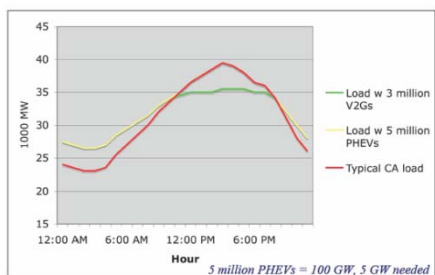


Consumer Support



Utility Grid Pressure

Grid integration of plug-in hybrids could also provide storage for vehicle-to-grid (V2G), as cars are parked 95% of the time; reducing peak demand by 5000 MW could be worth \$3 billion, or \$600/car



Courtesy: Rocky Mountain Institute

Government Funding



Technology

THE WALL STREET JOURNAL.

Start-Ups Race to Produce 'Green' Cars

FORTUNE

A smarter, greener grid

Significant Policy Issues

▪ Tax Collection

- What mechanisms will be used to replace lost road and excise tax revenue due to the reduced consumption of gasoline or diesel?

▪ Demand Management

- Will automakers support systems that allow utilities to manage vehicle recharging (beyond price signals) to avoid local and system grid overload?
- Will the potential buy-back of electricity from the vehicles by the utility be supported?

▪ Carbon Caps

- Will utilities be granted a credit against their carbon cap if increased electric sales are displacing carbon emissions from gasoline and diesel?

▪ Interoperability and the Role of Standards

- What standards are needed to ensure transactional convenience and economy between the cars, the grid, the recharge infrastructure, and other enabling technology?

▪ Incentives

- What incentives will be available to consumer for the purchase of plug-in cars?
- Will utilities offer special electric pricing for vehicle recharging, especially discounted off peak pricing? Will these be cost based, or subsidized?
- Will charging infrastructure providers get tax or other incentives to build public infrastructure?

Three Charging Infrastructure Scenarios

RESIDENTIAL CHARGING DOMINATES

Easy availability of home infrastructure for likely market results in buyer self selection, and little demand for public charging

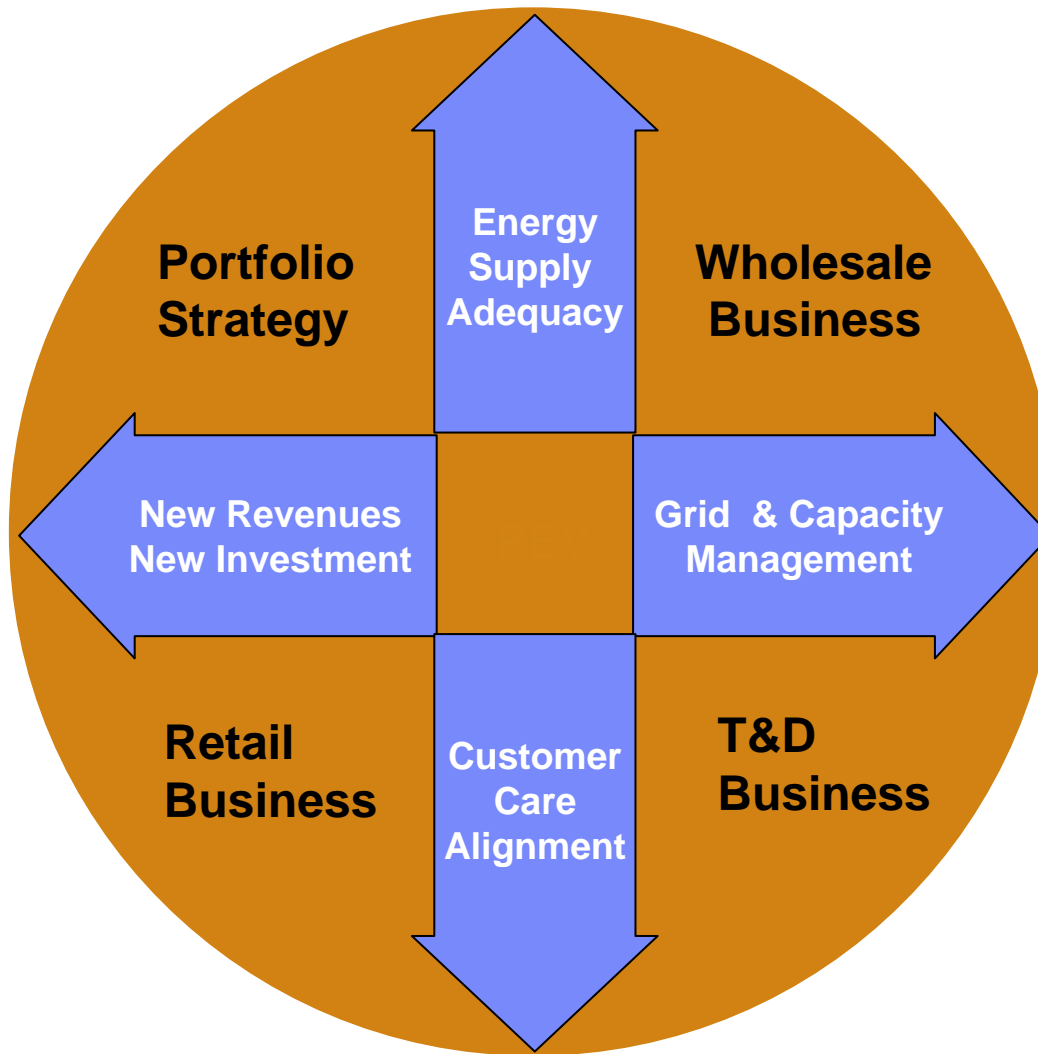
PRIVATE PARTY SEEKS ATTRACTIVE DRIVER

Not a personal ad, but business operators see driver profile match appealing market demographic and make investments in public charge points. Arms race for charging offers ensues

PUBLIC INVESTMENT APPEALS TO AUTO MAKERS

Lack of convenient home charging, and to achieve energy security and environmental goals, policy makers encourage public charging infrastructure, via incentives or direct investment

Four Key Impact Areas for Electricity Industry



Key Questions for Energy Retailers, Network Operators, and Integrated Utilities

- ✓ Business Model, New Revenue Streams
 - Charging facilities construction & management
 - Vehicle/battery financing
 - Non-discriminatory access and transaction enablement
 - CO2 offset measurement and reporting

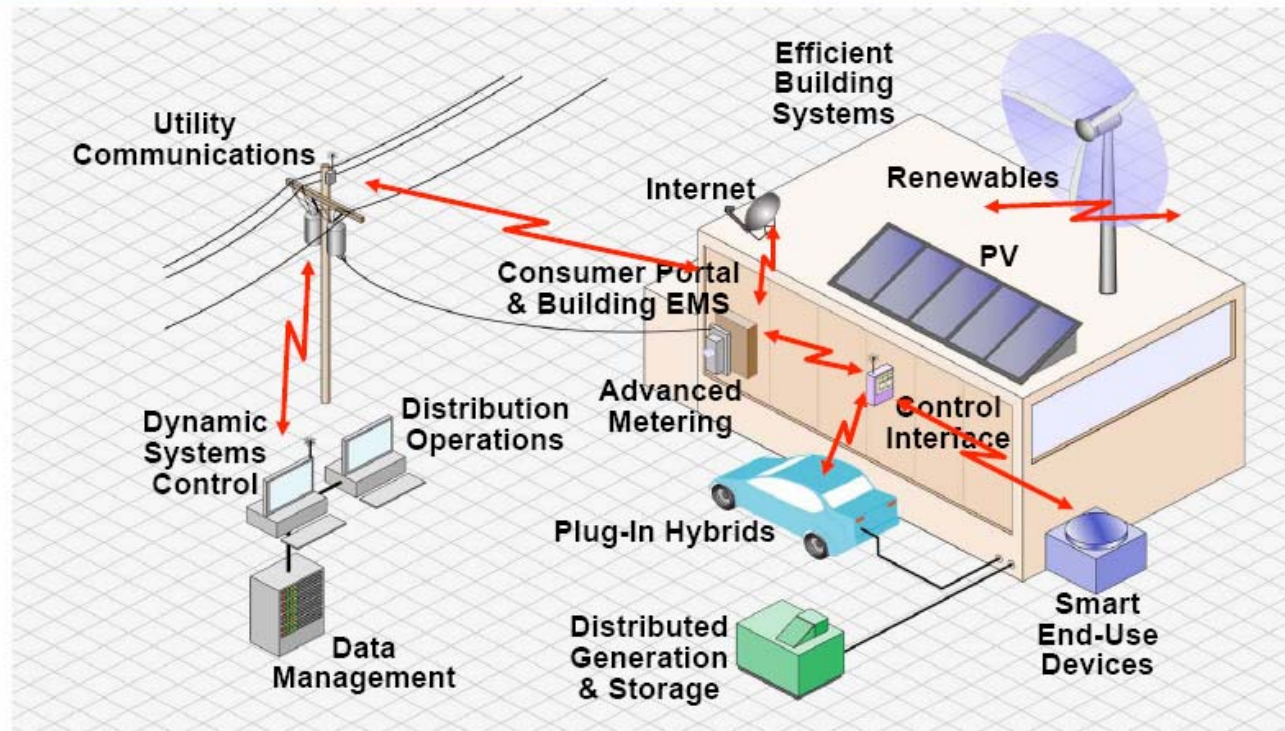
- ✓ System Adequacy and Network Management?
 - Generation supply
 - Local distribution capacity
 - Renewables integration

- ✓ Business Process Adaptation?
 - Time based pricing and incentives
 - Electricity resale program for public charging
 - Vehicle sales process and electrical survey at homes

- ✓ Systems Readiness?
 - Separate metering and TOU billing
 - Point of sale and payment systems support
 - Roaming

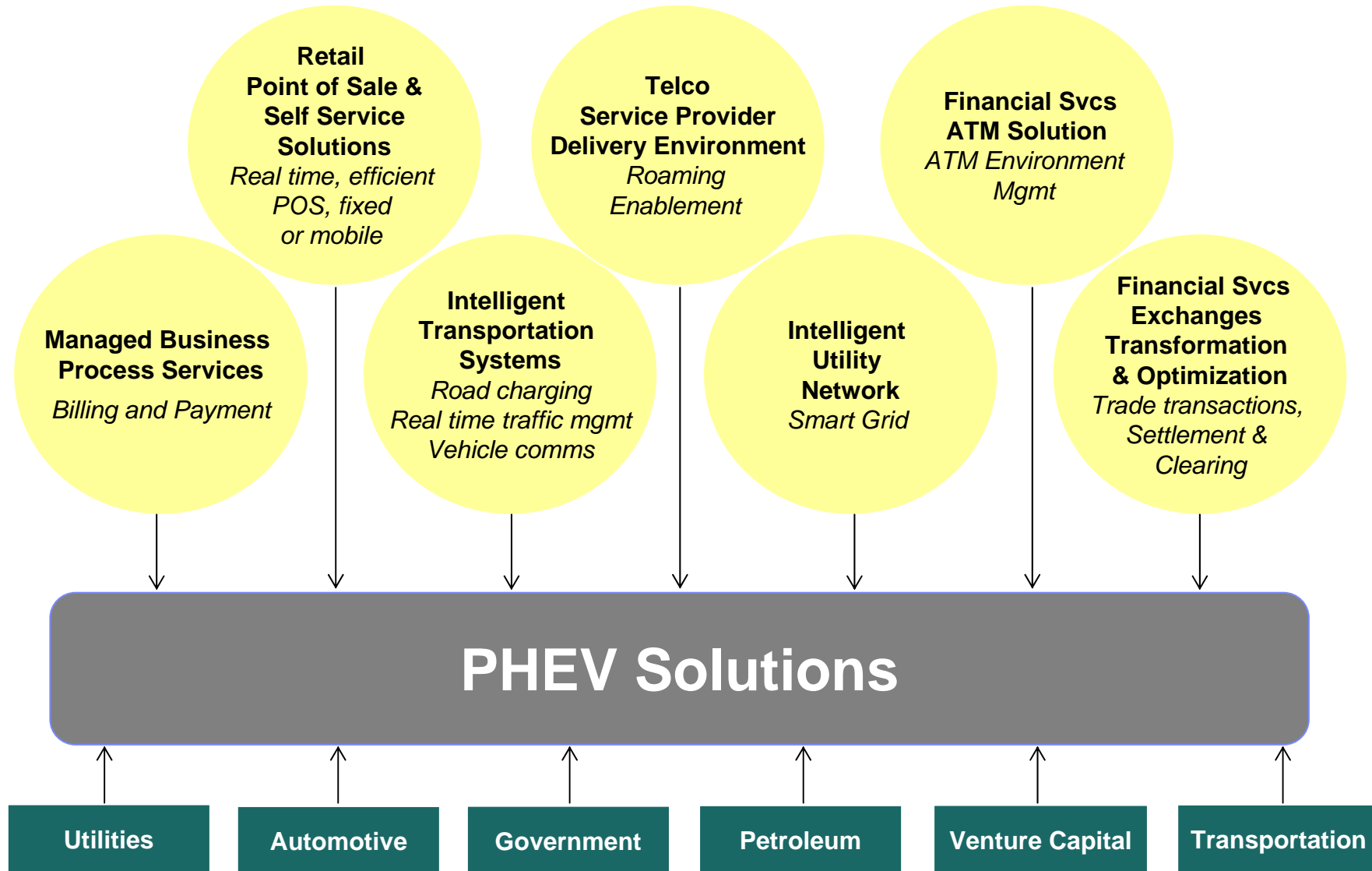
From EPRI, a vision of Plug-in Cars and Smart Grid

PHEV an Integral Part of Tomorrow's Intelligent Power Delivery Infrastructure



Enabling PHEV: Power Delivery Infrastructure of the Future

IBM Capabilities and Industry Relationships





Thank You

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