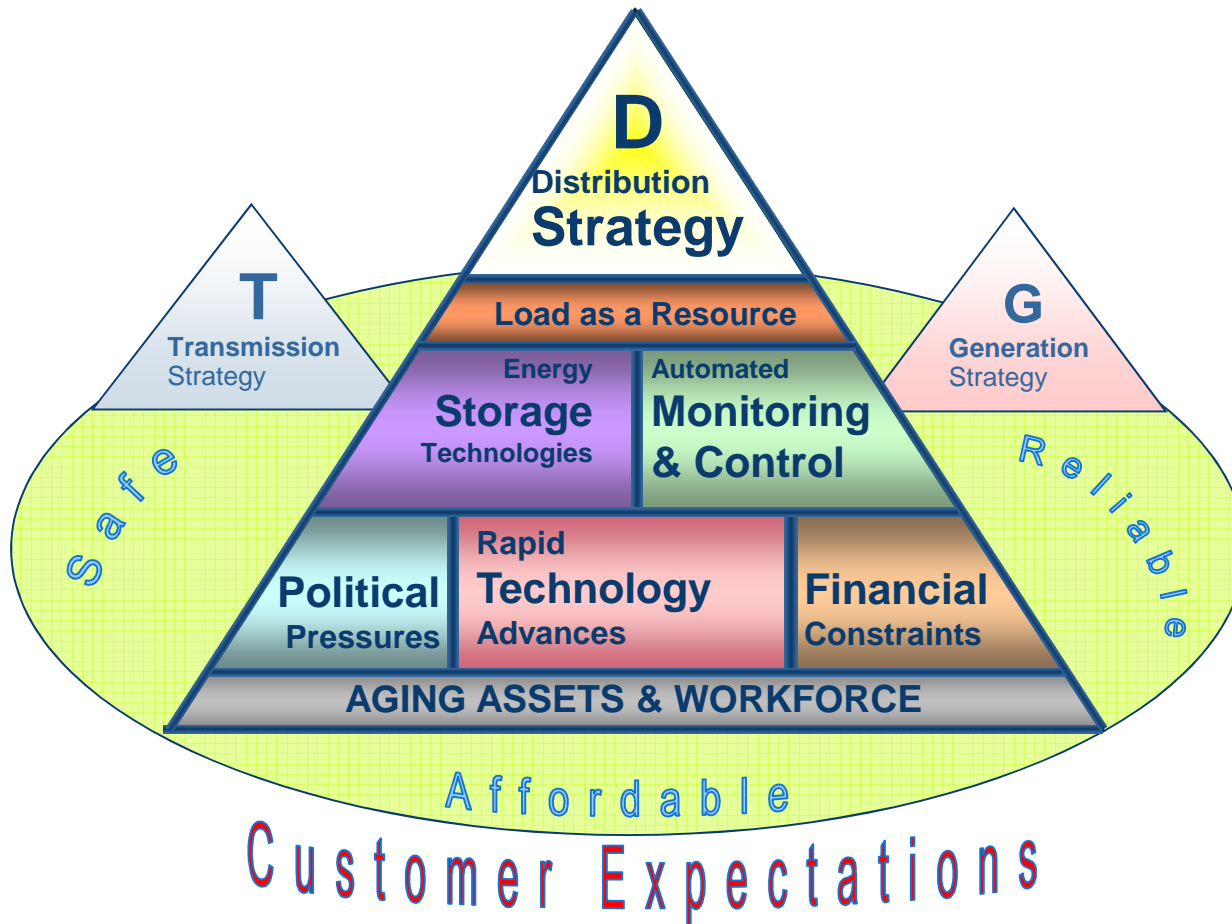




Smart Grid 101

April 26, 2011

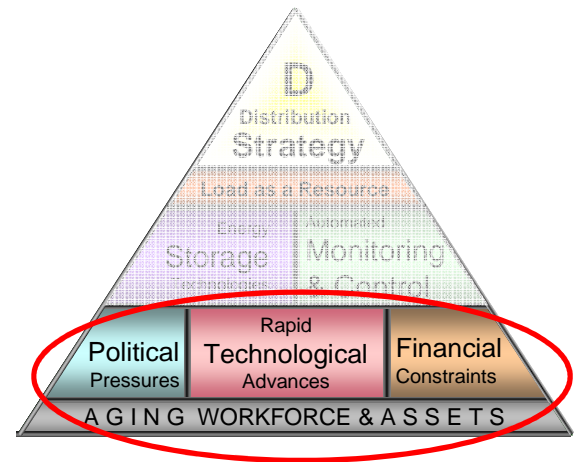
Building Towards a Sustainable Strategy



Confronting:

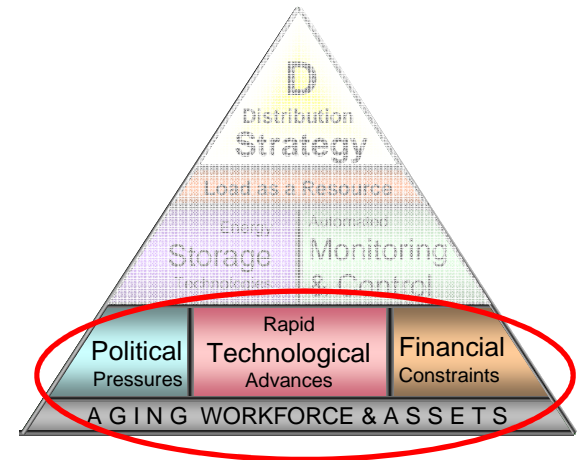
- Aging workforce
- Aging assets
- Politics
- Technology
- Financial issues

The Landscape



- **High Energy Costs**
- **Electricity is Cheap Compared to Petroleum**
- **Aging Assets and Workforce**
 - Large percentage of assets to be replaced within the next 15 years
 - Hard to attract qualified workers to the power industry
- **Political and Regulatory Issues**
 - Federal and state legislatures demonstrating increased interest in energy efficiency initiatives
 - State commissions investigating benefits to consumers
 - Jurisdictional smart grid and smart meter collaboratives and initiatives

The Landscape



- **Rapid Technological Advances**

- Smart meters and control devices are common in distribution
- Communication networks are universally available
- Energy storage is enabling renewables and plug-in electric vehicles
- MW scale Solid Oxide Fuel Cells

- **Financial Constraints**

- Many competing priorities for capital investments
- Opportunity for investments to improve G, T & D
- Investments must be synched up with rate case activities/climate

Customer Expectations & Trends

Expectations

- Safe, affordable, reliable electricity
- Utility outage notification and information
- Web-based customer service options
- 24/7 customer service access
- Innovative rate design

Trends

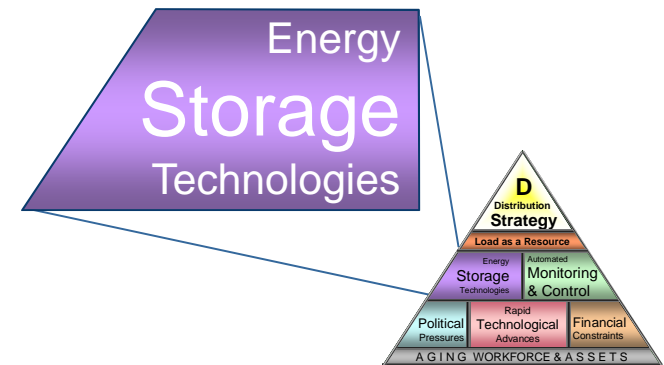
- Larger footprints for homes and businesses
 - Increase use of electronics and automation
- Increase in customer owned generation (reliability and cost)
 - Wind
 - Photovoltaics
 - Combustion
- Energy efficiency part of the national dialogue
 - Education programs
 - Appliance standards and building codes
 - DSM programs
 - Energy efficiency
 - Demand response

Storage Applications

Utility

- **Base-load generation**
- **Grid optimization**
 - Base-load assets
 - Increase reliability
 - Upgrade deferral
- **Distributed generation/Renewables**
 - Accommodate fluctuation in supply and demand
- **Ancillary services**
 - Energy arbitrage
 - Frequency & voltage regulation
- **Plug-in hybrid electric vehicles**
 - Reduced U.S. net carbon emissions
 - Low-cost storage driver for other applications

Flattens demand



Customer & End Use

- **Transparent demand management**
 - Customer-owned renewables
 - Large appliances
- **Plug-in hybrid electric vehicles**
 - Lower cost transportation
 - Reduced dependence on foreign oil
 - Low-cost storage driver for other applications

Improves reliability

Electric Vehicles

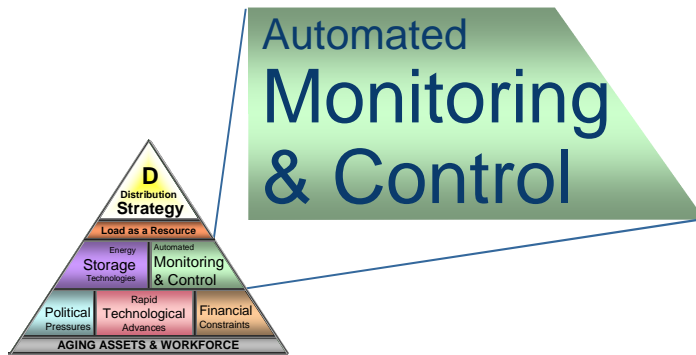
USA 220 million light vehicles

PHEV Market Penetration	Increase in Annual Energy Sales (%)
10%	2% to 3%



** This is for light vehicles only, excluding sales to fleet cars & trucks.*

Advanced Monitoring & Control



Utility

- Intelligent distribution grid operation
 - Real time, information-based automation (Self-healing grid)
 - Load response to real-time system conditions
- Optimal integration of Distributed Resources
 - Both storage and generation
 - Aggregated control

Improved reliability & increased efficiency

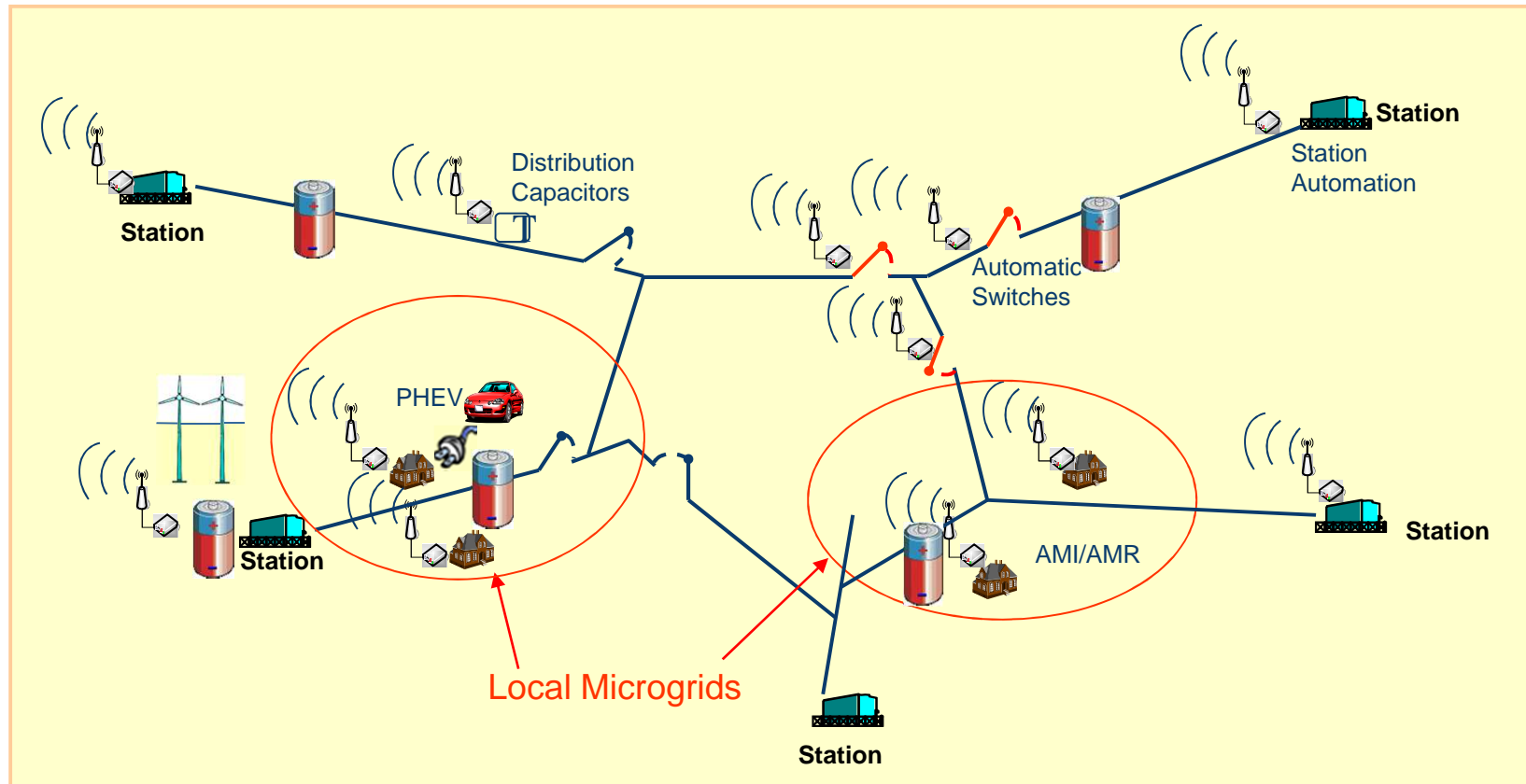
Customer & End Use

- AMI
 - Customer portal
 - Bi-directional communications and control
 - Integrated load intelligence/control
 - Additional services
- Smart, customer end-use devices
 - Passive & *active* load management
 - Compounds benefits of high efficiency with optimal control

Energy cost control

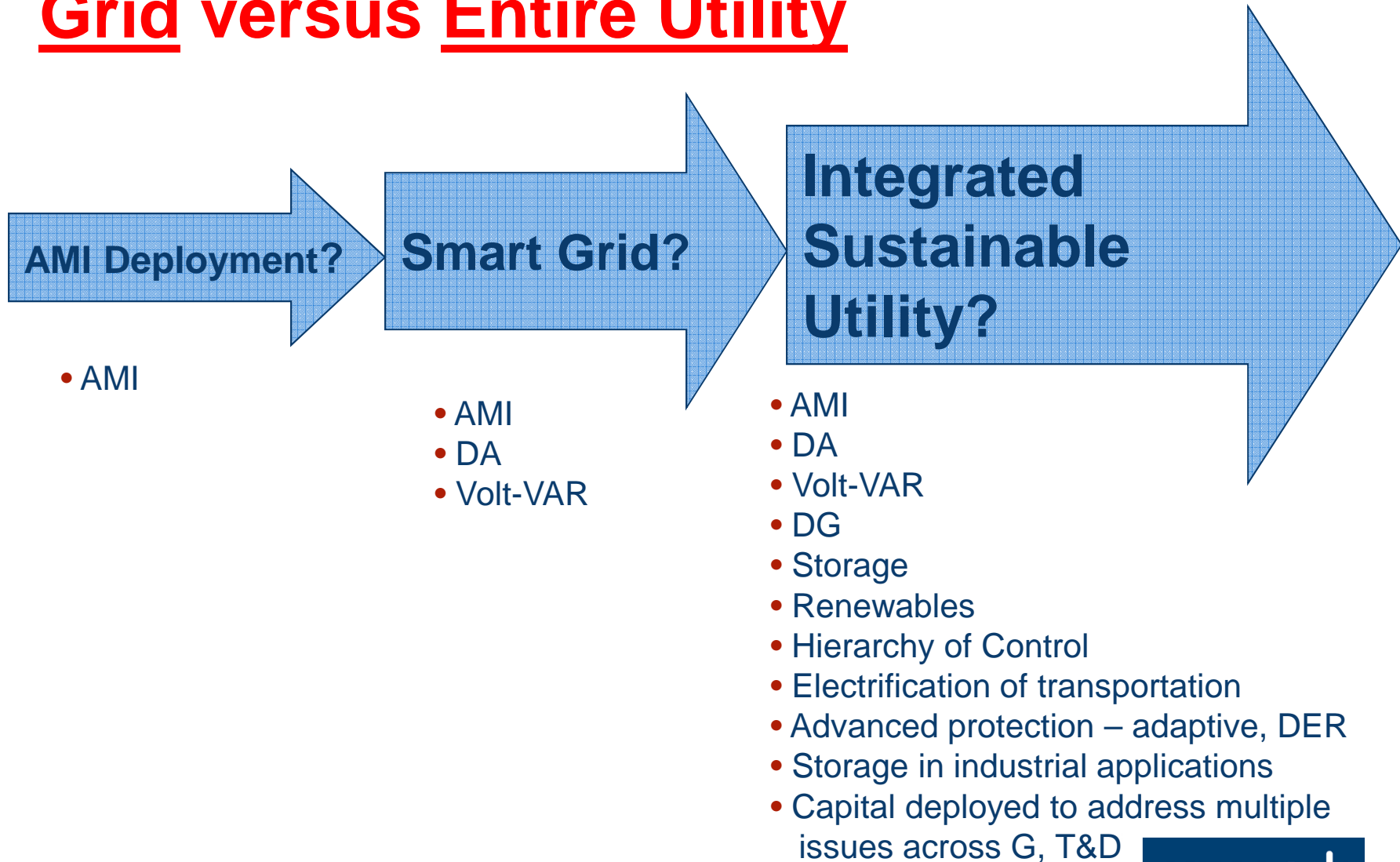
Distribution Grid of the Future

 Distributed Energy Storage  Advanced Monitoring, Communications & Control



- *Intelligent distribution grid operation*
- *Optimal integration of distributed resources*

Smart versus Sustainable Grid versus Entire Utility





Thank you.

Larry Dickerman

Larry.dickerman@kema.com

919-931-9068