SMART *power*

Climate Change, the Smart Grid, and the Future of Electric Utilities

The Future of Utilities:
Business Models and Strategy

Presented to Accenture

by Peter Fox-Penner

Wednesday, October 19, 2011

ISLAND PRESS
Solutions that inspire change.

Views expressed in these slides are solely those of the author.

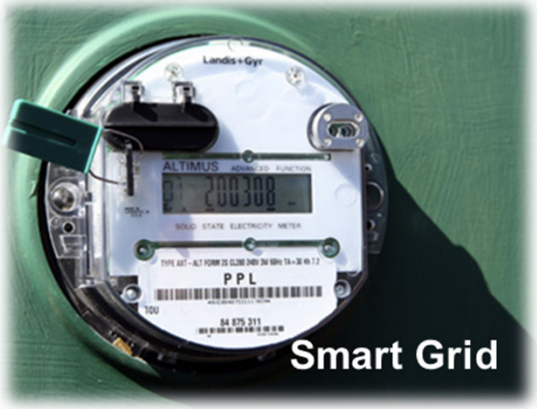
The Brattle Group

Outline

- The Forces of Change: U.S. versus E.U.
- The Current Situation
- Emerging New Utility Business Models

The Forces of Change:
U.S. versus E.U.

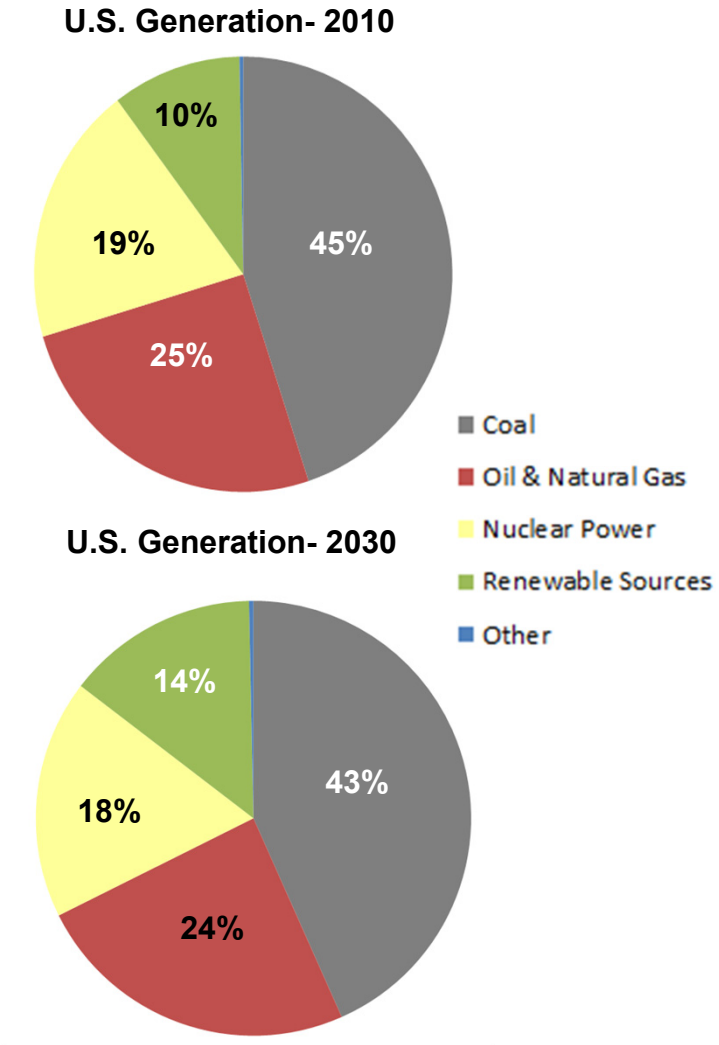
Utilities Everywhere Face Four Gigantic Disruptive Forces



Exacerbated in the U.S. and E.U. by
(-) the Economic Crisis, (-) Energy Security,
(-) Climate Disruptions, and (+) Shale Gas

Decarbonization – U.S.

- No U.S. national climate policy likely until ~ 2018.
- Few new coal-fired plants and no CCS; all fossil fuel additions will be gas.
- Environmental rules could force 30-60 GW of coal plant closures.
- $130 billion in new transmission investments, ~ all onshore.
- State and federal renewable laws mandate 65 GW (2025) - - mostly wind.
- Regional GHG trading in CA, Northeast.
- U.S. GHG emissions projected to increase 15% through 2050 (!) under current policies.

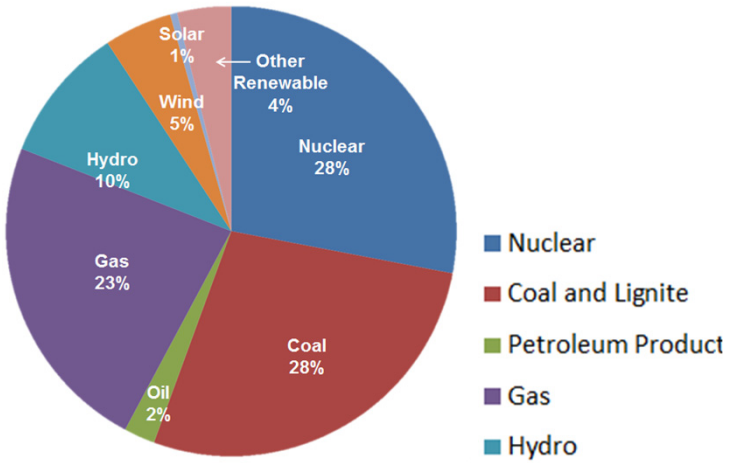


Source: "Annual Energy Outlook 2011," Energy Information Administration, 2011.

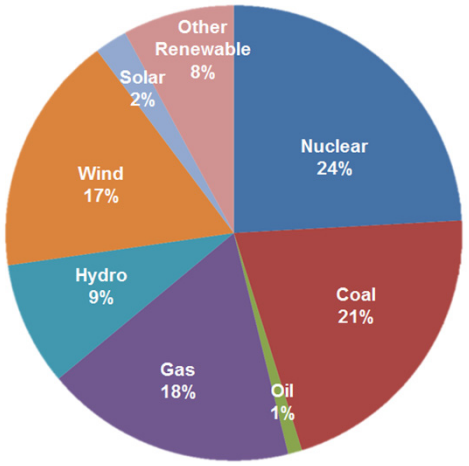
Decarbonization – E.U.

- **20-20-20 Strategy:** EU is on track to increase renewables and reduce emissions- efficiency is still a challenge.
- **The EU Emissions Trading System (EU ETS):** by 2020 emissions will be 21% less than 2005.
- **Clean Development Mechanism:** unclear if there will be a second commitment; CDM board says it is not tied to a specific commitment period and will continue.
- **Energy 2020:** pan-European trade in renewable energy and convergence of national schemes.

E.U. Generation- 2010



E.U. Generation- 2030



Source: "EU Energy Trends to 2030," Directorate-General for Energy, Update 2009.

The Massive Costs

U.S. Estimates

- 350 TWh new green energy from state RPS by 2030- $120 billion
- Total generation decarbonization ~ $1 trillion
- New transmission to integrate renewables and maintain reliability- $ 250 billion
- Replace aging distribution system with smart grid - $600 billion

E.U. Estimates

- € 1 Trillion over the next 10 years
- The Strategic Energy Technology (SET) Plan:
  - € 35 bn for renewable technologies
  - €10-12 billion for Smart Cities
  - € 2 billion for smart grid transmission and distribution

U.K. Estimates

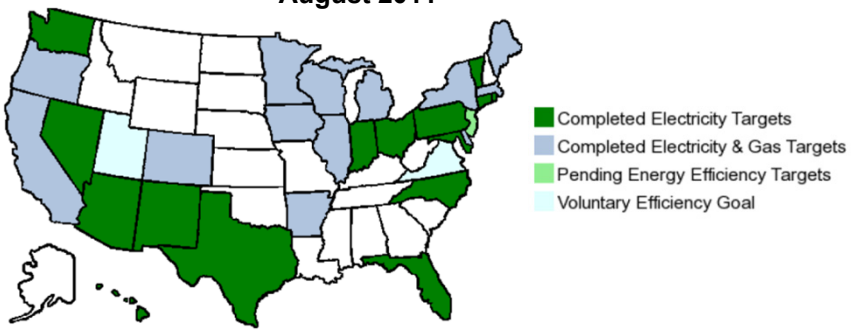
- Estimates for UK alone range from £200 billion to £1 Trillion

Sources:
Peter Fox-Penner, "*Smart Power*," Presented at Exelon's Annual Attorney Meeting, Philadelphia, PA, July 14, 2011; "Energy 2020," European Commission, 2011; "The Green Investment Bank," Parliament, United Kingdom, March 11, 2011.

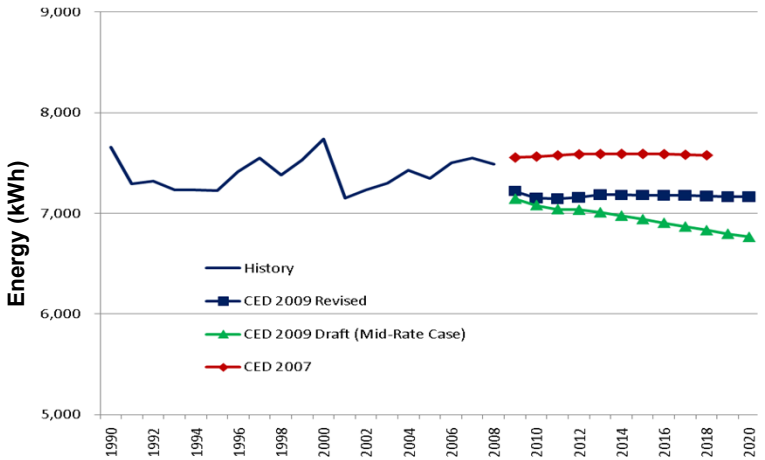
Power Sales and Energy Efficiency – U.S.

- In the U.S. power use is projected to increase 0.74%/yr with current policies.
- I think this is an overestimate due to higher prices, low growth, and EE policies.
- 26 states have enacted energy savings goals, or Energy Efficiency Resource Standards (EERS).
- EE policy in the U.S. is a mixture of national standards and state utility programs.
- No white tag market/limited ESCOs.

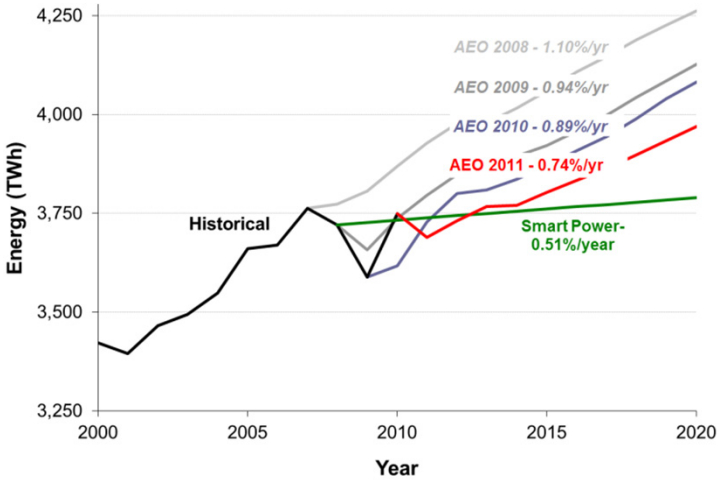
State Energy Efficiency Resource Standards (EERS)
August 2011



CA Projected Power Demand Per Capita



U.S. Projected Power Demand



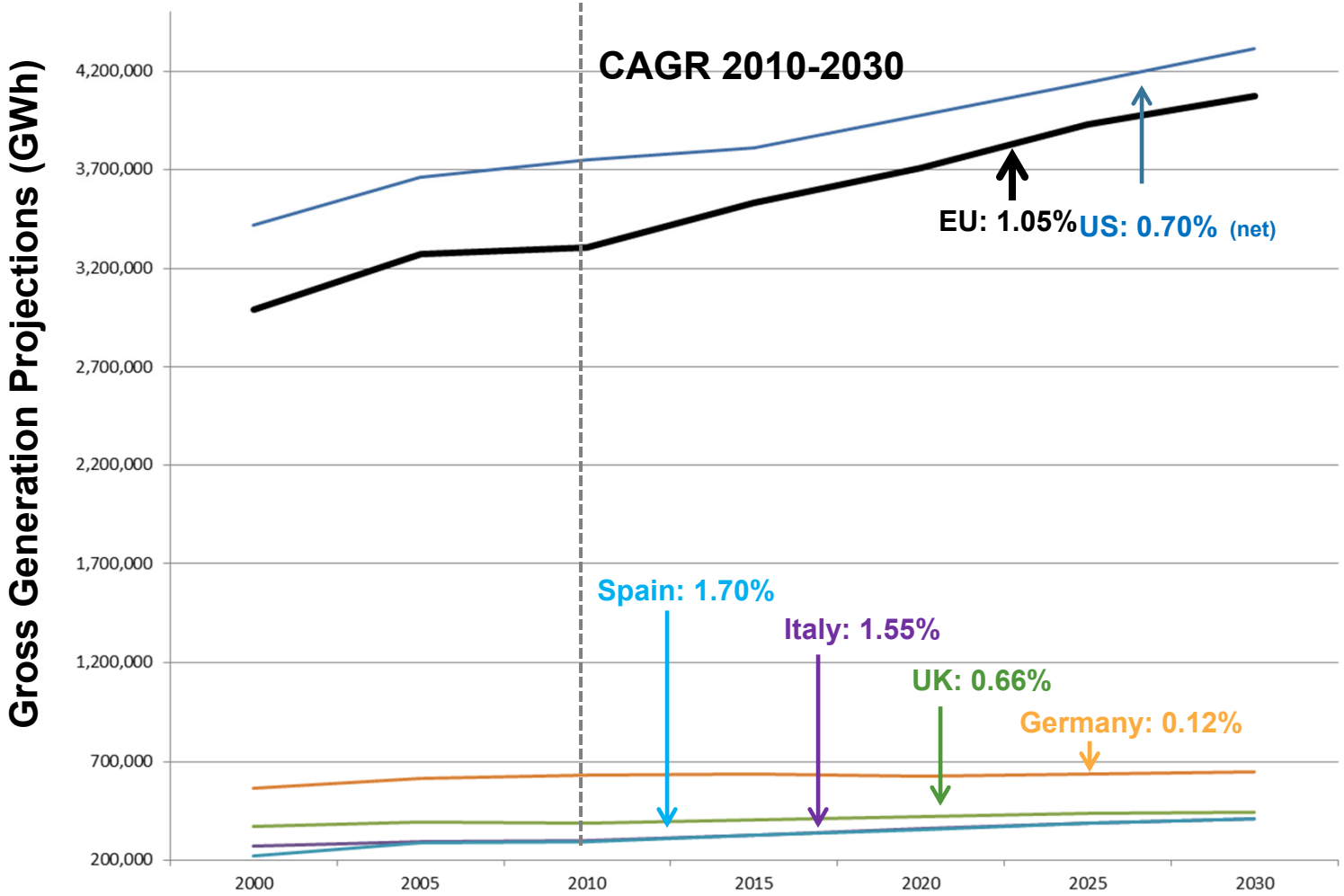
Sources:
"Energy Efficiency Standards and Targets," PEW Center on Global Climate Change, August 2011.
"Adopted California Energy Demand Forecast 2011-2022," California Energy Commission, December 2009; "Annual Energy Outlook 2011," Energy Information Administration, 2011.

SMART power

The Brattle Group

Country Level Demand Projections

European Commission's "Trends to 2030"



Source: "The Annual Energy Outlook," The Energy Information Administration, 2011; "EU Energy Trends to 2030," Directorate-General for Energy, Update 2009.

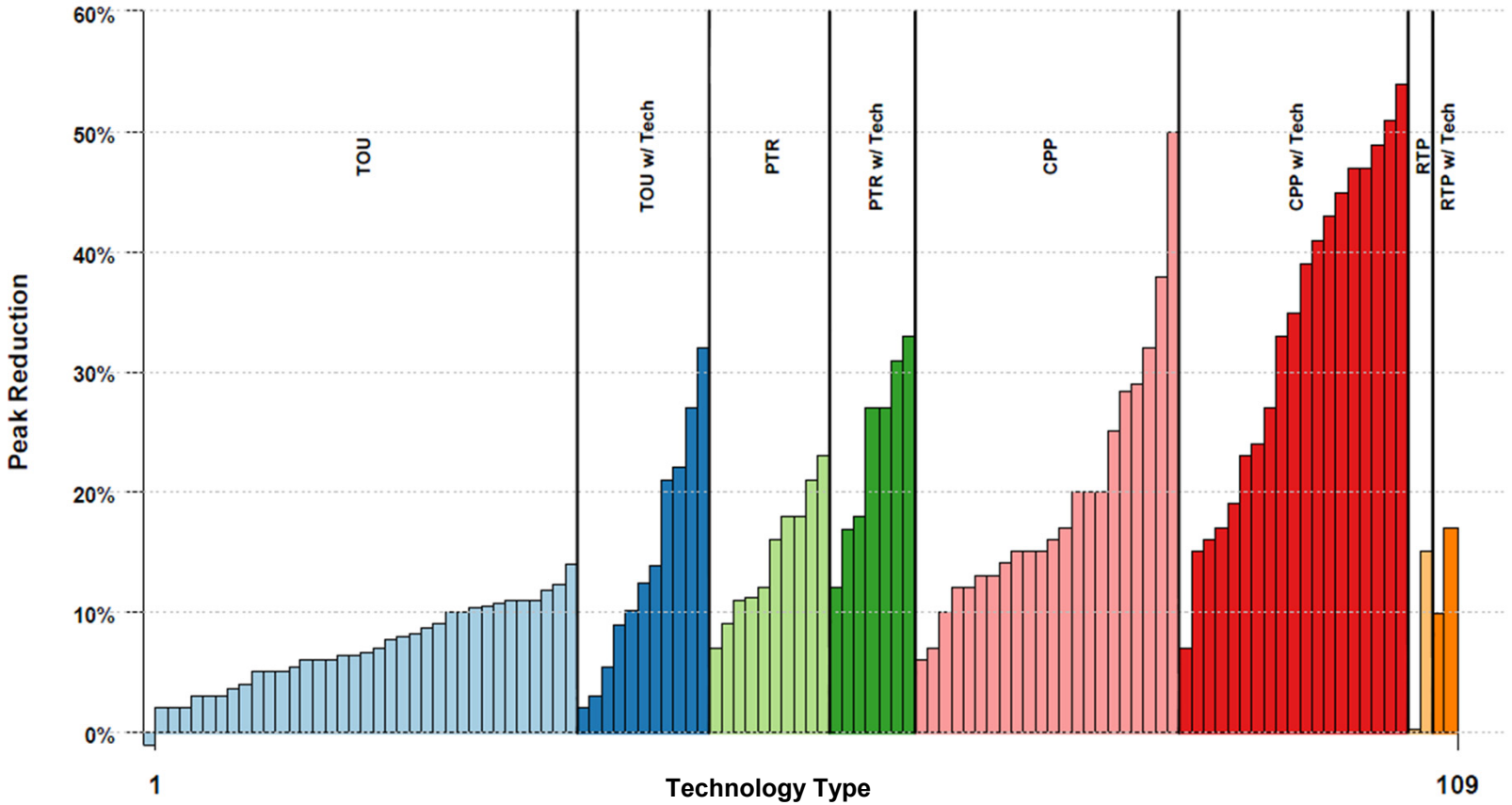
SMART power

The Brattle Group

Over Time, the Smart Grid Will Change Everything

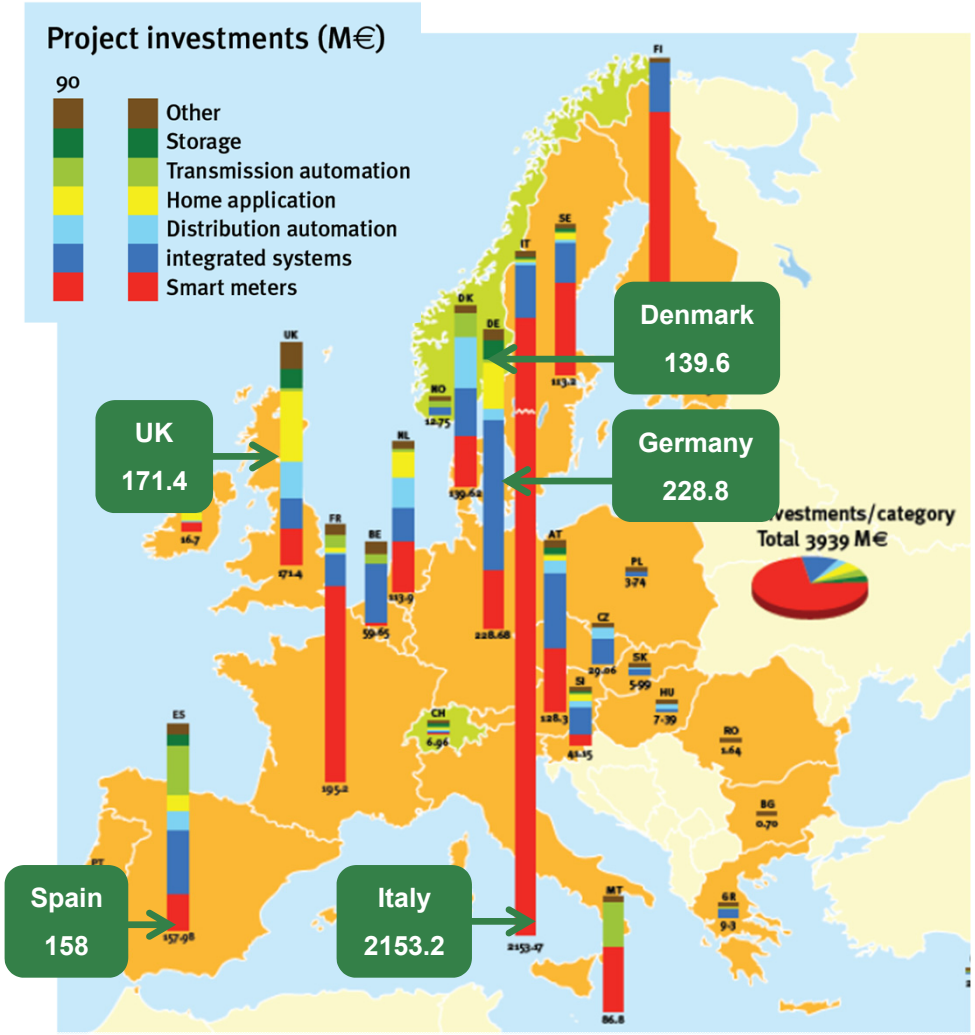
- Enable time-based rates ("dynamic pricing") and smart EV charging with 5-15% bill savings.
- End billing based on cumulative commodity KWh – enable value-added services.
- Enable behavioral and information-based energy efficiency.
- Create multidirectional distribution grids with storage.
- Allow better management of distribution grid: outages, voltage, maintenance, more.

Peak Demand Reductions- by Rate & Technology



Source: Ahmad Faruqui, "The Tao of The Smart Grid," Michigan Smart Grid Collaborative, Lansing, Michigan, August 24, 2011. Contact Dr. Faruqui at Ahmad.Faruqui@Brattle.com.

Smart Grid - Investments in the EU



Source: Vincenzo Giordano, et al., "Smart Grid projects in Europe: lessons learned and current developments," European Commission- Joint Research Centre Institute for Energy, 2011.

- 10% of EU households currently have smart meters
- € 3,939 million has been invested in the EU. Smart meter investments are the largest.
  - Denmark, Germany, Spain, and the U.K. have half of total projects.
  - Italy has over half of total investments. These investments are heavily focused on meters.
- **Electricity Directive of 2009** mandates at least 80% smart meters by 2020.
- Implementation plans due September 2012.

Distributed Generation and Storage

EU:

- Distributed generation (DG) and energy storage are included in the EU SET plan.
- EU shares same vision for DG- needed for renewable growth, can "green" buildings, support PHEV deployment, and tied to Smart Grid investments.
- Targets for EU storage are likely.

US:

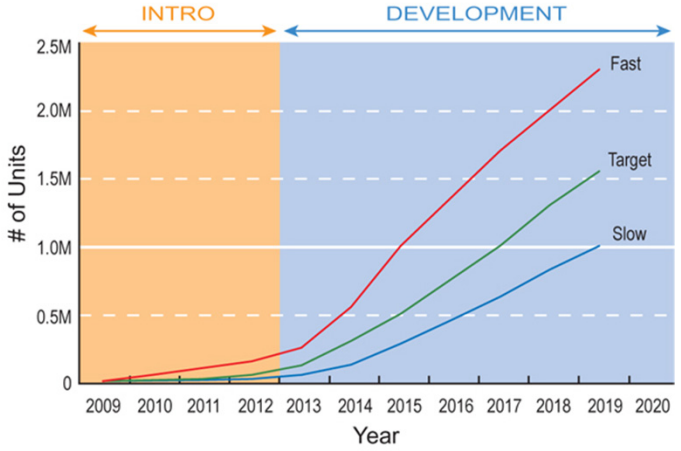
- Policy is developing for transmission planning, ancillary services, and storage needed to support DG.

Italy:

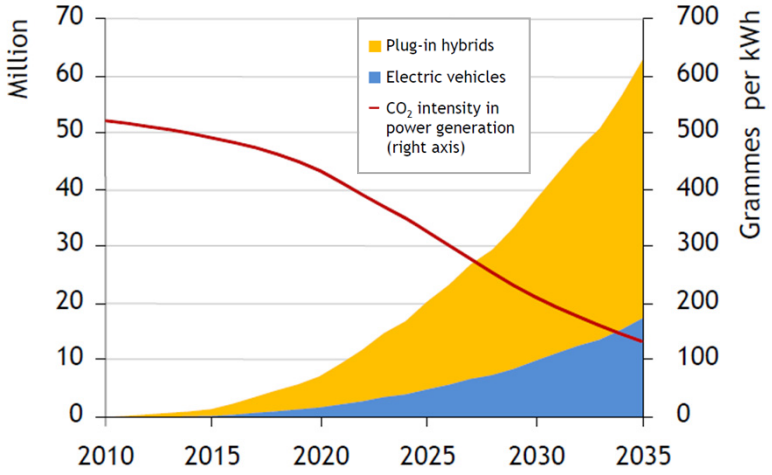
- Italy has removed solar incentives cap of 8 GW in decree.
- Also launching new cogeneration power subsidies

Electrification of Transport

U.S. PEV Growth Rates—Scenarios



Global Sales of Sales of Plug-in Hybrid and Electric Vehicles



Source: "Assessment of Plug-in Electric Vehicle Integration with ISO/RTO Systems," ISO/RTO Council, March 2010; Nobuo Tanaka, "World Energy Outlook," OECD/IEA, 2010.

U.S. Goals & Status:

- Obama's goal: 1 million vehicles by 2015.
- 4,000 charging networks and distribution upgrades.
- 13% power sales increase by 2050 or later.

Global Goals & Status:

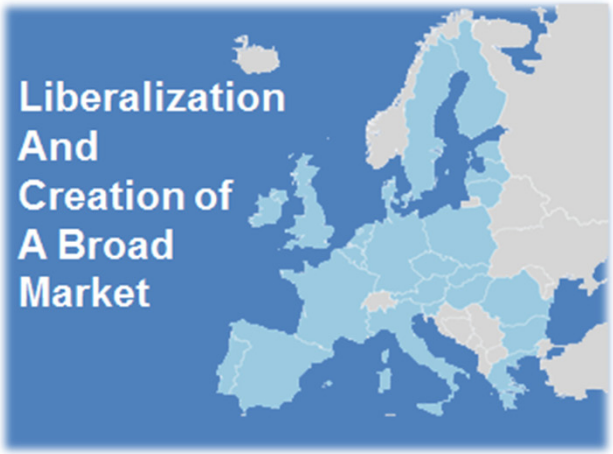
- Advanced vehicles could represent 70% of new car sales by 2035.
- Plug-in hybrids & electric vehicles could reach 39% of light-duty vehicle sales by 2035.

E.U. Goals & Status:

- 1.5 million vehicles by 2015.
- E.U. lacks monetary incentive to purchase EVs like the U.S.
- Emission controls: Target of 130 g/km CO2 emissions by 2015
- Mandate for recharging stations.

Current Situation

E.U. Pursuing Three Major Energy Policy Goals



Policy Drivers in High Gear

Decarbonization:

- Emissions trading
- 20% CO2 reduction by 2020
- EU renewable energy mandate and National Green Tags
- National feed-in tariffs for energy efficiency
- Proposed new EU directive
- White Tag markets
- Smart Grid directive – National Plan by 2012
- Roadmap to 80-95% GHG cuts by 2050

Security of Supply:

- New EU policy on external negotiations.
- IEA reviews.

Liberalization:

- Priority Interconnection Plan.
- Competition inquires in E.U. and member states.
- Concentrated research.
- Advocacy against incumbent default tariffs.
- IEA reviews.

Utilities in the Crosshairs

- Unregulated markets provide capital based on risk-adjusted expected returns.
- E.U. energy markets require trillions of Euros quickly to meet policy goals.
- Fast shifts in capital deployment raise energy prices and policy shift risks.
- E.U. authorities and energy companies recognize that private market will not provide sufficient E.U. energy capital to meet goals.
- Smart Grid undermines traditional business; many new entrants seeking utilities' markets.
- Survival of well-functioning national and multi-state markets constrained by multiple and conflicting policies requires intensive oversight.
- Electric utilities are at the intersection of this conflict and need new coping strategies.

Emerging New Business Models

Strategy Paths for Utilities

Electric utilities unable to remain financially successful while meeting policy constraints have several basic choices:

- Retreat from high-capital, contested segments into lower-risk network role:

"Smart Integrator"

- Integrate vertically along the value chain to provide Best-In-Class Price/Service:

"Energy Service Utility"

- Secure and keep a strong low-cost position in one segment or geography.
- Mix and match strategies by market.

Potential U.S. Business Models: The Smart Integrator (SI)

The Smart Integrator operates a regulated Smart Grid offering independent power and other services at market prices.

- The distribution (wires) company is incentive-regulated or publicly owned.
- The distco integrates upstream supply, local supply and storage, and operates the grid to ensure reliability.
- It may directly control some customer systems for grid management.
- Emphasis is network operator, not commodity sales.
- Energy efficiency is not a natural role of the Smart Integrator, but it can be added on.

Example: National Grid

Potential U.S. Business Models: The Energy Services Utility (ESU)

The Energy Services Utility changes the utility from a pipes-and-wires business to a customer-service-centric model:

Unlike the Smart Integrator:

- The utility is strongly and directly incentivized to get into the business of energy efficiency.
- The ESU might own and generate power or buy generation to bundle with energy service technology.

All other roles are the same as the Smart Integrator:

- Delivering energy
- Operating Smart Grid
- Dynamic pricing – possibly less nodal

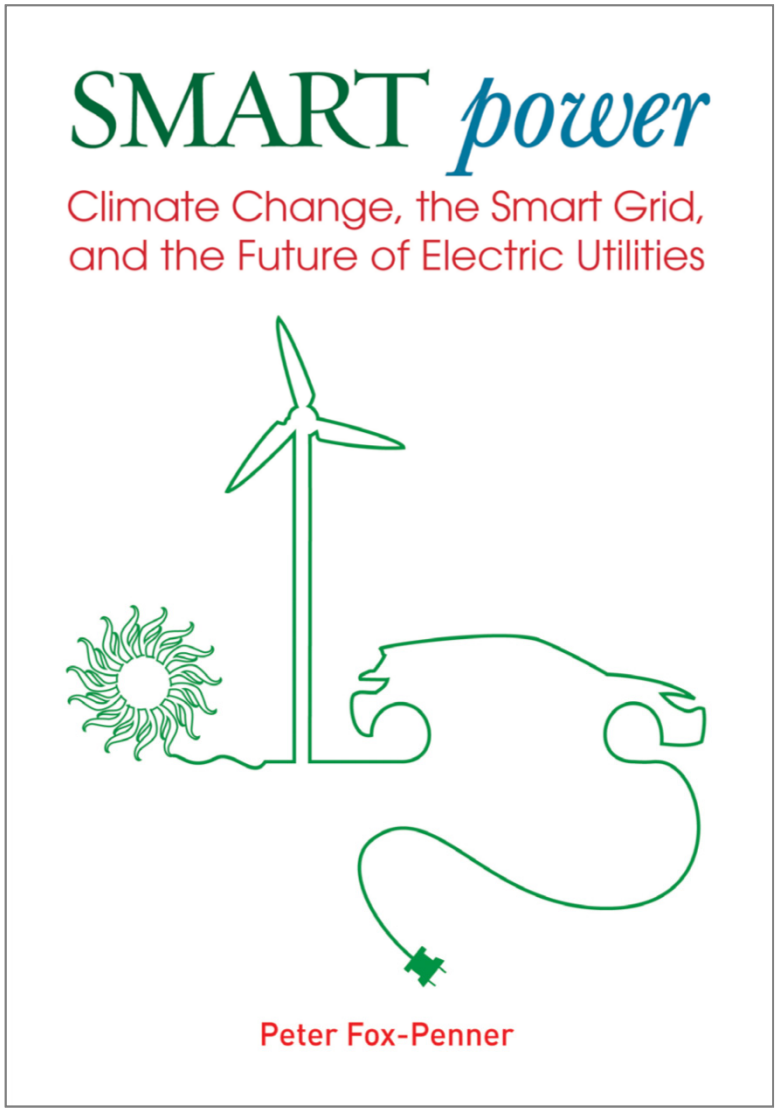
Examples: SureWest and Seattle City and Light

Future of EU Utilities

- Reintegrated and re-concentrated ESUs?
- Smart integrators?
- Portfolio players?
- Messy mix?

Regardless, maintaining sound liberalized markets in a policy-driven march will be an extreme challenge.

Thank You



SMART power

The Brattle Group

About The Author

Peter Fox-Penner
Principal and
Chairman Emeritus
The Brattle Group

Dr. Peter Fox-Penner is a consulting executive and internationally recognized authority on energy and electric power industry issues. He is a principal and chairman emeritus of *The Brattle Group*, a leading international economic consulting firm.

In his consulting practice, Dr. Fox-Penner advises energy companies, government agencies, and their counsels on energy regulatory and market policy issues. Although his work has spanned most areas within the energy field, his current primary focus is on electric industry competition and structure, global climate change, and energy efficiency policies.

Dr. Fox-Penner's background includes co-founding Environment2004, the Environmental Alliance, and Patriot's Energy Pledge; service as a senior official in the U.S. Department of Energy and the White House Office of Science and Technology Policy; and staff positions in the Illinois Governor's office. He has a Ph.D. in economics from the business school at the University of Chicago and M.S. and B.S. degrees in engineering from the University of Illinois.

Contact: Peter.Fox-Penner@brattle.com or +1.202.955.5050.

The Brattle Group

The Brattle Group (www.brattle.com) provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world.

We combine in-depth industry experience and rigorous analyses to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

ISLANDPRESS

Island Press, a nonprofit organization, is the nation's leading publisher on environmental issues. Their topics are both timely and wide-ranging, from biodiversity and land use to forestry, agriculture, marine science, climate change, and energy use.

Island Press believes in transforming science and evidence-based information into understanding and action.