Growing Information Intensity of Energy

GT Clean Energy Series
GT Venture Lab
April 30, 2014

Peter Evans, PhD
Vice President
Center for Global Enterprise
Information failures = Market failures

Information failure exists when:

• some, or all, of the participants in an economic exchange do not have *perfect knowledge*

• one participant in an economic exchange knows more than the other, i.e. the problem of *asymmetric*, or unbalanced, information
History of the energy sector

Plagued by information failures
Spectrum of information availability

Consequences of scarcity
- Less efficient operations
- High transaction costs
- Reactive maintenance
- Accident prone

Consequences of greater abundance
- More efficient operations
- Lower transaction costs
- Predictive maintenance
- Less accident prone
Why did Google buy Nest?

To move into devices?

or

To access data?
Forces for change
Information (packaged as bits) about energy is growing

Benefits

1. New sources of valuable data at
   - machine level
   - facility level
   - fleet level
   - network levels

2. Expanded remote monitoring and analysis

3. Greater potential for fleet optimization

4. Shift from reactive to predictive maintenance

5. Rise of matching digital platforms
   - reduce transaction costs
   - enhance expert networks
   - expand social --- behavioral change

Source: John Canny, "Designing with Data", UC Berkeley, EECS, July 2013
Global fleet of major power plants

Large information opportunity and challenge

Fuel type
- Coal
- Natural Gas
- Nuclear
- Hydro
- Wind
- Oil
- Biomass
- Solar
- Geothermal
- Other

Source: UDI World Electric Power Plants Database, Platts, 2012

Consider information flows
- Machine level
- Facility level
- Fleet level
- Network level

~6,000 GWs
132,900 units

% GW % Units
Coal
Natural Gas
Hydro
Nuclear
Oil
Renewables
Other

Source: UDI World Electric Power Plants Database, Platts, 2012
52 million man-hours to service annually*

Major power plant inspections
- 6 field engineers & 24 craft labor
- Tools, crane, scaffolding,
- 25 – 30 day outage duration

Power plant manuals → Easier and faster access to critical information

Digitized work instructions + Platform for collaboration
A modern F1 car is fitted with ~130 sensors, which send enough information to fill several telephone books by the end of a two-hour race.

Real-time information on the car’s engine, clutch, gearbox and tires is radioed to pit crew and mission control.

Types of platforms

1. **Product**
   - **Description**: Component & subsystem assets shared across family of products
   - **# of participants**: Single firm/ several firms within supply chain
   - **Examples**: Sony, Boeing/ automobile industry

2. **Industry**
   - **Description**: Products, services, techs that serve as foundation for other firms to build complementary products
   - **# of participants**: Large clusters or ecosystems of interdependent firms
   - **Examples**: Operating systems; gaming; cloud

3. **Market Networks**
   - **Description**: Products, services, firms, or institutions that mediate transactions btw groups of agents
   - **# of participants**: Multi-sided markets
   - **Examples**: Credit card payment networks, shopping malls, search engines

Digital platform dynamics

Leverage networks

Match service providers to customers

Mobile Device Platform Ecosystem

Source: Rahul Basole, 2009

Source: Geoffrey Parker 2009
Solar... internet+ digital imaging
Not just panel costs are falling...

“Solar designers” use satellite imagery and a sophisticated set of algorithms to remotely design solar panel systems.

Benefits

Speed  
Customer quote within 24 hours

Lower cost  
Reduce inefficient truck rolls

Greater reach  
From offices in the Bay Area can size systems in Indiana or India

Platform plays in energy efficiency?

Nearly 40 percent of U.S. energy consumption in 2012 was by residential and commercial buildings.
Information in regulatory dynamics
Rise of low cost leak detection and mapping technology

CH₄

New Monitoring Capabilities

- Accurate
- Low cost
- Easy to deploy
- Mobile
- Reports data directly into Google maps

Methane leaking from the fracked oil fields of Kern County, California measured with the Picarro spectrometer

Source: Picarro, 2014
Conclusion

- Information failures have historically plagued the energy sector
- Information streams about energy is growing and cost is falling
  - Machine level
  - Facility level
  - Fleet level
  - System level
- Growing energy intensity can yield important benefits
  - More efficient operations
  - Lower transaction costs
  - Shift from reactive to predictive maintenance
  - Enhanced safety
  - New regulatory dynamics including new levels of transparency for monitoring and enforcement
Growing Information Intensity of Energy

GT Clean Energy Series

GT Venture Lab

April 30, 2014

Peter Evans, PhD
Vice President
Center for Global Enterprise