Challenges to The Utility Business Model

Geoffrey Heal
Columbia Business School
May 2, 2017
Power Generation is Changing

- Concerns about climate change
  - Reduce the use of fossil fuels

- New technologies
  - Distributed generation
  - Intermittent power supplies
Four Challenges

- Decoupling
- Intermittency
- Behind-the-meter solar
- Large scale storage
  - No base load
  - No peakers
Decoupling

- Utility incentives are to sell more power, use more fuel
- But must cut back fossil fuel use
- Find revenue model for which success does not depend on selling more power
- Typically a target rate of return, with prices adjusted ex post to achieve this
Intermittent Renewables

Output from UK wind turbines, January-April, 2011

One day moving average, Megawatts

Source: National Grid
Backup

- Currently gas in the US
- Hydro in Northern Europe
- Up to 30% seems easily managed
- As fossil fuels phased out gas must be replaced by storage
Storage

- California currently requiring utilities to invest in storage
- At costs of $200-400 kWh, 50mWh costs $10m-$20m
Behind-the-Meter Solar

- Commercial and residential users with solar pose two problems
  
  - They want to sell excess power to the grid
  
  - They want access to the grid but may pay very little towards its costs under present pricing regimes
Net Metering

- Allows sales of excess power at retail prices
- Clearly not economically justified
- Need to move to offering locational marginal prices
Pricing Grid Connectivity

- Grid access provides insurance or an option value
- Behind-the-meter users may contribute little to the costs of the grid
- Need to find a way of pricing and charging for grid connection
Large-Scale Storage

- Electric power is one of few commodities that can’t be stored
- Has to be produced exactly when it is needed by users
- Leads to great complexity in the transmission and distribution systems
GENERATION \[\xrightarrow{T \text{ AND } D}\] CONSUMPTION
• Inexpensive grid storage will change this model

• Power will be produced when convenient (when the sun shines/ wind blows)

• Stored as inventory

• Sold from inventory when needed

• Breaks the production = consumption equation
Power producers sell to inventory

Consumers buy from inventory

Utilities manage the inventory
Implications

- No need for base load power
- No need for “peakers”
- More efficient use of generating capacity
  - 20% of US generating capacity used < 100 hours/year
  - Capacity factor on gas turbines was 16% in 2015
Low Spot Prices

- Zero-marginal-cost renewables can bid prices down to gain market share
- Forces thermal plants to operate at a loss
  - Happening with nukes in New York State
  - Most US utilities don’t own thermal plants
  - But German utilities do – EON and RWE
Summary

- Renewable energy, intermittent and distributed
- Storage
- Movement from fossil fuels
- All lead to radical change in utility model