Everything Old in New Again: The US electricity industry after 20 years of restructuring

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James Bushnell, UC Davis

Based on paper available at
http://ei.haas.berkeley.edu/research/papers/WP252.pdf
(forthcoming in Annual Review of Economics)
Outline

• The political economy of US Deregulation
• Industry background
  – Costs and prices; AC in regulatory terms.
  – What exactly is restructuring?
• Why electricity restructuring has disappointed policymakers in the US
• What is next for the industry
• Caveat: this talk is not about the California Crisis
  • Market power not a big part of today’s story
Sequence of changes to the Electric Utility Business

• Traditional model of vertical integration
  – Generation/transmission/distribution/billing within one company
    • Some trading of wholesale power across utilities
  – BUT then cracks in the traditional model appeared
• First crack: independent power producers
  – Need access to transmission and utilities are only customers
• Second crack: retail choice for energy supply
  – Customers get “direct access” to generators, but need transmission
• Third crack: self (“distributed”) generation
  – But distributed solar/wind still needs to sell through the grid
• Fourth crack????: storage => grid disconnect ??
Central Premise

• The last 30 years of electricity policy have been largely influenced by attempts to avoid paying for fixed/sunk costs.
  – Regulated prices = average costs
  – Market prices ~ marginal costs
    • Buying on long-term contract versus spot market
    • Returns to each strategy fluctuate over time.
  – As “reforms” work it can reduce costs (sunk and otherwise) and provide benefits
    • But those efficiency gains are likely dwarfed by the transfers at stake
Rate of Return Regulation Produced Widely Varying Results: 1998 Average Retail Prices

USAEE-NCAC, May 22, 2015
US Electricity Restructuring: What is it?

• Transmission (vertical) reforms
  – Create ISOs – or “order” open access
  – Operate short-term “balancing” markets
  – Maintain system reliability
Defining Liberalization (1)
Organization of Wholesale Markets

[Map of regional transmission organizations in the United States]

USAEE-NCAC, May 22, 2015
US Electricity Restructuring: What is it?

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- Retail Competition
  - Customers free to migrate to new retailer (energy provider)
  - Customers who do nothing pay “default” rates
  - During a transition – default retail rates often fixed to allow for stranded cost recovery by incumbents
Defining Liberalization (2): Retail “choice”

Source: ClearlyEnergy (2014)

USAE-NCAC, May 22, 2015
Retail Choice is Thriving only in Texas
Residential Sector is Avoiding Choice

Percentage of retail sales by competitive retail suppliers by customer class, 2010

- Pennsylvania
- New Jersey
- Delaware
- Maryland
- District of Columbia

Legend:
- Residential
- Commercial
- Industrial
US Electricity Restructuring: What is it?

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  - Maintain system reliability

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  - Customers who do nothing pay “default” rates
  - During a transition – default retail rates often fixed to allow for stranded cost recovery by incumbents

- **Changes to Generation Remuneration**
  - Shift from cost-based to market based payments for production
    - Analogous to shifting to long-term contract to spot market
  - Mix of divestiture/new entry
Defining Liberalization (3): Deregulation of Generation
Wholesale Prices in Power Markets

Retail Price Effects
October 15, 2006

Competitive Era Fails to Shrink Electric Bills

By DAVID CAY JOHNSTON

The Electricity Journal

Competition Has Not Lowered U.S. Industrial Electricity Prices

Previous studies have shown that significant price reductions resulted from deregulation in airlines, trucking, railroads, and natural gas. Retail electricity price data from 1990 through 2003 show no such benefit to industrial customers.

Jay Apt

USAEE-NCAC, May 22, 2015
Retail Price Increases 2005-2008

USAEE-NCAC, May 22, 2015
Retail Price Changes: 1998-2012
The difficulty in judging the impacts of restructuring

- The challenges with a focus on retail rates
  - Tremendous time lags between wholesale and retail outcomes in many regions
  - Controlling for diversity in starting conditions
  - Isolating impacts of restructuring from other changes

- Marginal Cost (deregulation) will at times be above and at times below Average Cost (regulation)
  - Which looks better depends upon when you look
Retail Rates in Restructured vs. Regulated States

USAEE-NCAC, May 22, 2015
Retail Rate Changes Since 1997

Table 1  Summary of Retail Price Changes

<table>
<thead>
<tr>
<th>Definition</th>
<th>Status</th>
<th>Average Retail Price</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1997</td>
<td>2007</td>
</tr>
<tr>
<td>PPI Definition</td>
<td>Regulated</td>
<td>5.89</td>
<td>7.44</td>
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<tr>
<td></td>
<td>Restructured</td>
<td>8.96</td>
<td>12.53</td>
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<tr>
<td>At least 40%</td>
<td>Regulated</td>
<td>5.67</td>
<td>7.23</td>
</tr>
<tr>
<td>IPP in 2012</td>
<td>Restructured</td>
<td>8.83</td>
<td>11.99</td>
</tr>
</tbody>
</table>

USAEE-NCAC, May 22, 2015
\[ \Delta E_{lec_s,t} = \alpha + \beta_1 \text{FractionIPP}_{s,t} + \beta_2 \Delta NG_{as_s,t} + \beta_3 \text{FractionIPP}_{s,t} \times \Delta NG_{s,t}, \]  

(1)

Table 2  Summary Statistics of Retail Electric and Natural Gas Prices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td><strong>Data for 1997</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Mean</td>
<td>S.D.</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Price</td>
<td>6.72</td>
<td>2.03</td>
<td>3.87</td>
<td>11.66</td>
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<tr>
<td>Fraction IPP</td>
<td>0.03</td>
<td>0.07</td>
<td>0.00</td>
<td>0.46</td>
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<tr>
<td>Nat. Gas</td>
<td>3.54</td>
<td>0.64</td>
<td>2.12</td>
<td>5.18</td>
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<td><strong>Data for 2012</strong></td>
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<td></td>
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<tr>
<td>Price</td>
<td>9.70</td>
<td>2.30</td>
<td>6.90</td>
<td>15.54</td>
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<tr>
<td>Fraction IPP</td>
<td>0.35</td>
<td>0.33</td>
<td>0.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Nat. Gas</td>
<td>4.90</td>
<td>0.97</td>
<td>3.46</td>
<td>7.73</td>
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</tbody>
</table>
\[ \Delta \text{Elec}_{s,t} = \alpha + \beta_1 \text{FractionIPP}_{s,t} + \beta_2 \Delta \text{NGas}_{s,t} + \beta_3 \text{FractionIPP}_{s,t} \times \Delta \text{NGas}_{s,t}, \] (1)

Table 3  Analysis of Retail Price Changes

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pct IPP</td>
<td>0.006</td>
<td>0.007</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Pct Change in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nat. Gas</td>
<td>0.051</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
<td></td>
</tr>
<tr>
<td>(\Delta \text{NGas} \times \text{PctIPP})</td>
<td>NA</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>720</td>
<td>720</td>
<td>720</td>
</tr>
</tbody>
</table>

Dependent variable is change in log annual state-level average electricity rates. Standard Errors are clustered by state.
The Electricity Industry Today

- Restructuring was customer driven (particularly industrials), rather than efficiency driven in the U.S.
  - Focus on short-term advantage rather than long-term efficiencies
- Appeal to consumers depends upon market timing
  - Timing of most US states has been lousy in this regard
- Activist regulators have moved on to “greener” pastures
  - Most attention now on renewable and climate policy
- Signs of another reversal (in the US) of the AC and MC relationship
  - Carbon regulation of coal plants, gas “fracking” lowering natural gas prices, renewable energy driving prices down
- *But* rates even in restructured states are growing increasingly disconnected from wholesale market prices (marginal cost)
  - Capacity markets compensate for fixed costs, comprising increasing shares of generator revenues
  - Expansion of renewable mandates driving down wholesale prices but driving up retail rates.
The Next 20 Years

• Tension between average and marginal cost has migrated to the arena of distributed generation.
• Expansion of grid scale renewables lowering marginal costs while raising average costs
• Customer level renewables (rooftop solar) offer an escape from most fixed and sunk costs
  – Problem is exacerbated by retail rate structures
  – Almost certainly constitutes inefficient bypass
Barclays Downgrades Electric Utility Bonds, Sees Viable Solar Competition

By Michael Aneiro

Barclays this week downgrades the entire electric sector of the U.S. high-grade corporate bond market to underweight, saying it sees long-term challenges to electric utilities from solar energy, and that the electric sector of the bond market isn’t pricing in these challenges right now. It’s a noteworthy downgrade since electric utilities which make up nearly 7.5% of Barclays’ U.S. Corporate Index by market value. From Barclays credit strategy team:

Electric utilities... are seen by many investors as a sturdy and defensive subset of the investment grade universe. Over the next few years, however, we believe that a confluence of declining cost trends in distributed solar photovoltaic (PV) power generation and residential-scale power storage is likely to disrupt the status quo. Based on our analysis, the cost of solar + storage for residential consumers of electricity is already competitive with the price of utility grid power in Hawaii. Of the other major markets, California could follow in 2017, New York and Arizona in 2018, and many other states soon after.

In the 100+ year history of the electric utility industry, there has never before been a truly cost-competitive substitute available for grid power. We believe that solar + storage could reconfigure the organization and regulation of the electric power business over the coming decade. We see near-term risks to credit from regulators and utilities falling behind the solar + storage adoption curve and long-term risks from a comprehensive re-imagining of the role utilities play in providing electric power.
Technological Change Since 2000

• Large Expansion of Grid-Scale Renewables
• Rapid growth (from very small base) of distributed generation (e.g. solar rooftops)
• Large-scale deployment of “smart-meters”
• Advances in development and acceptance of home-automation systems.
• Improved sensor/switching/computational capabilities for large-scale grids
Technology and the Utility/Consumer Relationship: Two Pathways

• Path 1: Technology tightly integrates individual energy users with their regional grid
  – Two-way communication between users and wholesale market operators.
  – Massively distributed responses to changes in wholesale market conditions.
    • Responses largely automated through home automation of thermostats and management systems

• Path 2: Technology and policy encourages customers to strategically use (or drop) the grid
  – Storage and distributed generation technologies allow for virtual “cord cutting” with local utility.
Ratemaking can Determine the Pathway

- Rate design can either provide incentive for more efficient participation of customers
  - Rates that encourage dynamic participation of loads
  - Potential for incorporating distribution level conditions
- Or it can encourage the deployment of new technologies in ways that predominately avoid paying for sunk costs.
  - Rates that charge for fixed costs in variable components
- Reminiscent of factors driving retail choice in the mid 1990s.
The role of residential customer fixed charges

- Efficient pricing likely to leave a revenue gap
  - But first adjust for externalities and time-varying costs
- Fixed customer charges for *customer-specific* fixed costs are easy to justify on efficiency and equity
- But further fixed charges have no basis in efficiency, other than avoiding inefficiently high marginal prices
  - And difficult to make equity case for high fixed charges
- No perfect answer. Need to make sure that all efficient revenue capture is achieved before resorting to raising fixed charges
Not everyone agrees on prices that reflect costs

PUC Must Reject PG&E Plan to Cut Incentives
Mercury News – Letters to the Editor, September 22, 2014
PG&E has proposed changes that protect its monopoly and could cripple the market for its main competition: rooftop solar. The crux of PG&E’s proposal is to add $10 in monthly, unavoidable fixed charges to your bill. By making customer bills less dependent on actual energy consumption and forcing people to pay no matter how much energy they use, the incentive to produce your own energy and reduce dependence on dirty grid power is dramatically reduced.

Matt Vespa
Senior attorney Sierra Club
Thank You!