

A Case Study of Electricity Competition Results in Pennsylvania: Real Benefits and Important Choices Ahead

By Christina Simeone and John Hanger

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Christina Simeone
Director of Policy and External Affairs
Kleinman Center for Energy Policy
University of Pennsylvania
csimeone@upenn.edu



Introduction

- Data-driven analysis of wholesale and retail restructuring
 - Data and analysis limitations
 - Inflation adjustments using CPI
 - Opportunities for further research
- Identifies policy choices for which decisions are likely needed in short to medium term

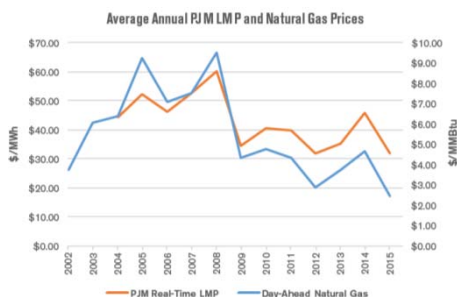
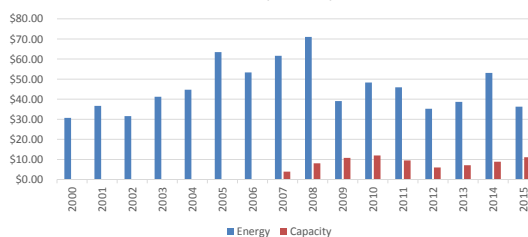


Wholesale Overview

PJM Energy Prices

In real terms (i.e. 2015 dollars), PJM's average annual wholesale energy price of **\$36.26/MWh in 2015** is lower than the **2000 price of \$42.28/MWh** (\$30.71/MWh nominal)

Annual Average PJM Wholesale Energy and Capacity Costs (\$/MWh)



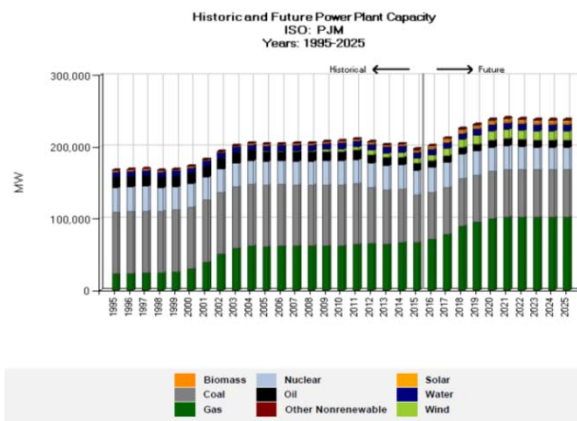
There is close correlation between natural gas price changes and PJM power price changes, and a downward price trend observed in both markets.

Natural gas hubs include: Dawn Ontario, Dominion N, Dominion S, Lebanon, Leidy, Parkway Ontario, TCO pool, TETCO M2, TETCO M3, Transco Z5, Transco Z6 non-NY.

PJM

Installed Capacity

- Between **1995 and 2015** there was a **17 percent** increase in internal installed capacity representing a net increase of **29.3 GW**.
- Some new supply (and load) related to new zone integration



Capacity additions from **1995 to 2015** in PJM came primarily from natural gas (44.2 GW), wind (6.7 GW), water/hydro (1.3 GW), and solar (1.1 GW). In addition to other resources, this represents a total of **54.1 GW of capacity entry**.

Capacity reductions from **1995 to 2015** in PJM came primarily from generation using coal (-19.5 GW), petroleum products (-4.8 GW), and nuclear (-0.4 GW). This represents about **24.7 GWs of capacity exit**.

Image courtesy of SNL Energy

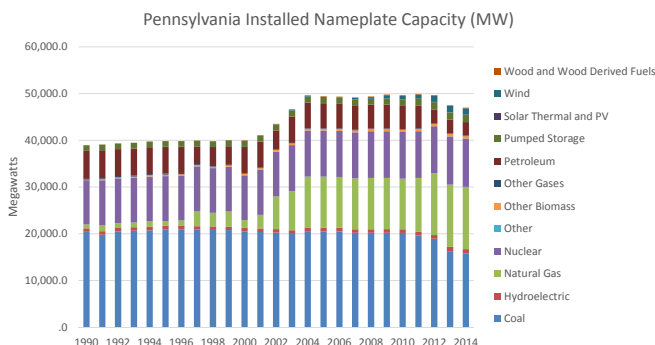


PA

Installed Capacity

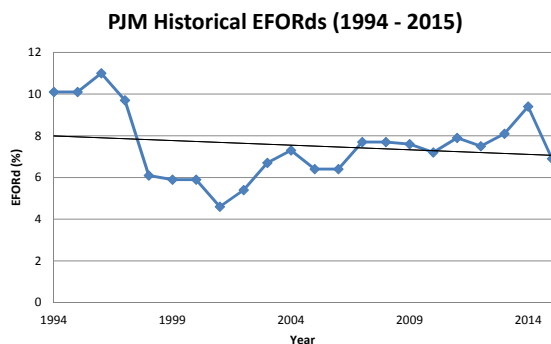
From **1996 through 2014**, installed nameplate capacity **grew by 18%**, representing **7.1 GWs**.

- Capacity increases** were realized from natural gas (12.1 GW), wind (1.3 GW), nuclear (0.6 GW) and other generation resources. Total new resource entry in Pennsylvania was **15.1 GW**.
- Capacity losses** were incurred from coal (-5.1 GW), petroleum (-2.7 GW), and other gas (-0.1 GW) generation resources. Total resource exit from Pennsylvania was **8 GW**.
- October 2015 and July 2016** – **1,811 MW** of new capacity (gas and biomass) online.
- Currently**, 9 large scale generation projects currently **under construction** representing **5,557 MW** of (gas and wind) capacity.



Operational Efficiencies

The report outlines findings from several academic studies observing operational efficiencies related to electricity restructuring – e.g. **improved thermal efficiency** and **reduced labor and non-fuel expenses** at fossil-fueled plants, and **increased operating performance** at nuclear plants.



PJM data shows a downward trend in equivalent forced outage rates when in demand (EFORds) – a metric identifying the probability a generator will fail when needed.

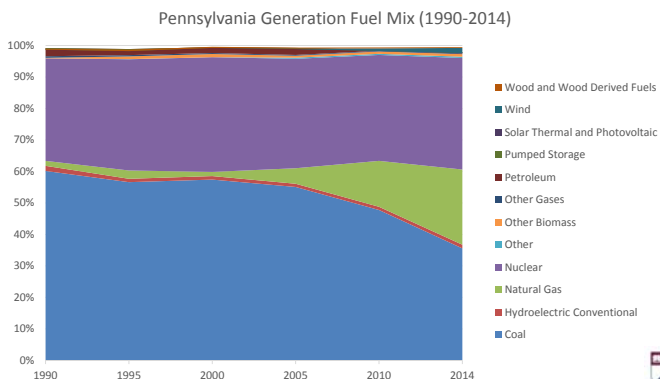
- In **1996**, the EFORd for PJM was **11 percent**.
- In **2015** the EFORd was **6.9 percent**.



PA Fuel Mix

Compared to **1996 levels** of generation, coal-fired output from Pennsylvania generators dropped **16.8 percent by 2014**, while natural gas-fired generation increased by **26 percent**.

- In 2005, **coal (55.5 percent)** was the dominant fuel for power generated in Pennsylvania, followed by **nuclear (35 percent)** and **natural gas (5 percent)**.
- By 2014, **coal (35.7 percent)** and **nuclear (35.6 percent)** were close to equally sharing the dominant fuel position, followed by **natural gas (24 percent)**.



From 1990 to 2014, total annual generation in Pennsylvania increased by 26 percent.

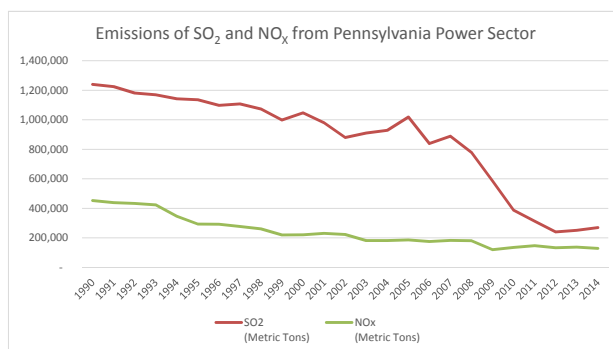
This represents a CAGR of 0.92 percent per year.



Pennsylvania Environmental Emissions

Between **2005 and 2014**

- **Carbon dioxide** emissions fell by **21%**
- **Nitrogen oxide** emissions fell by **31%**
- **Sulphur dioxide** emissions fell by **74%**



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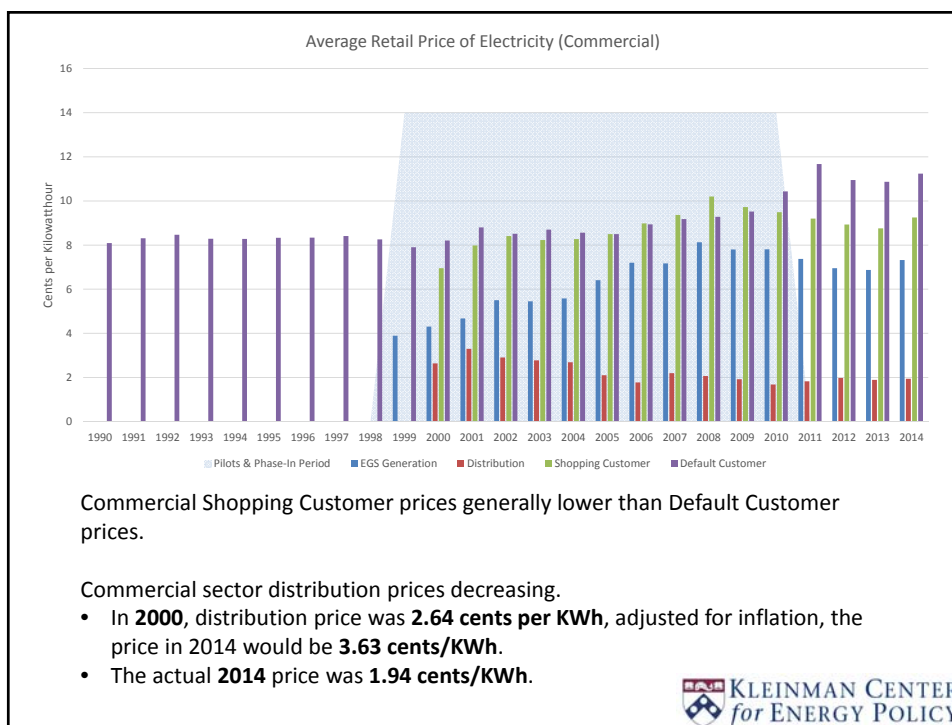
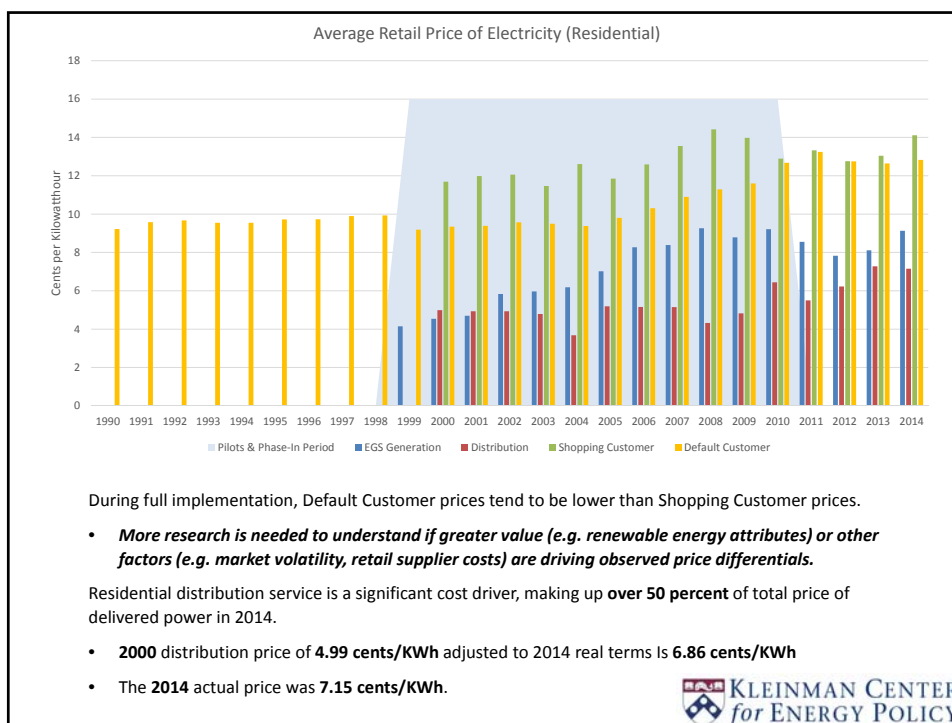
Retail Overview

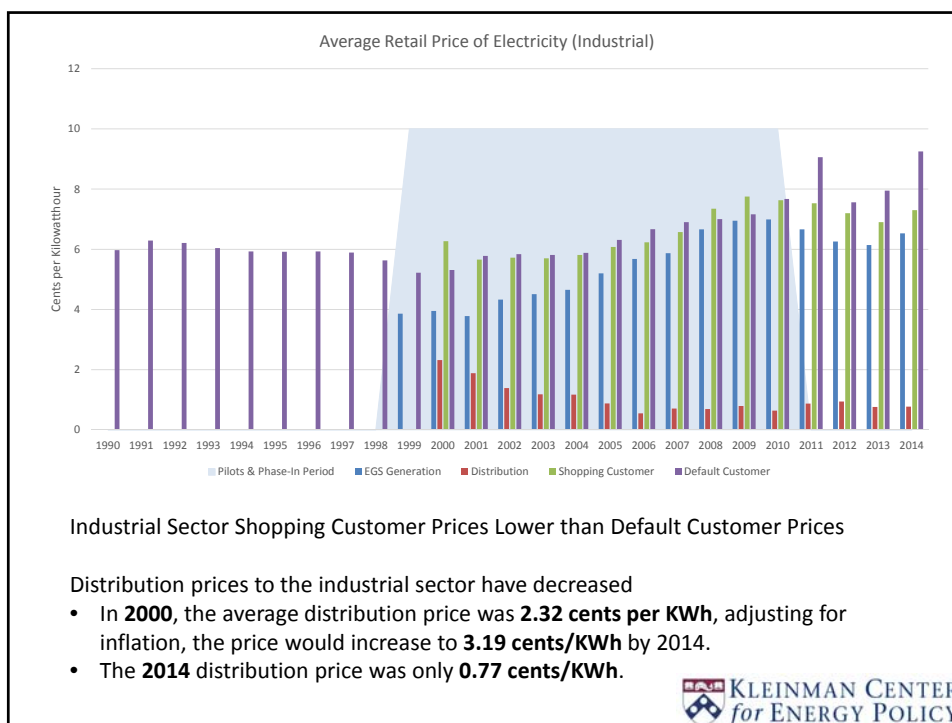
Some Data Limitations:

- Rate cap extension impacts data quality
- EIA data lacks granularity
- Effects of statewide annual averaging
- Ability to access and organize historic restructuring orders/settlements

Also, be aware of assumptions used in analysis

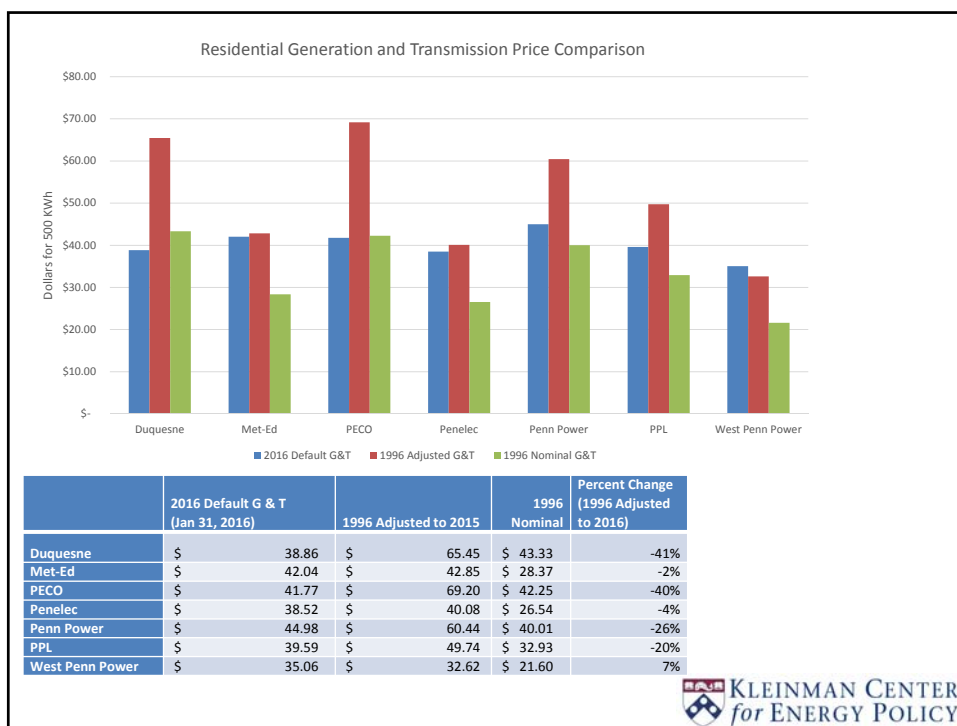
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Deeper Dive into Small Customer Impacts

- Compare 1996 inflation-adjusted G&T and Total Bundled Bill costs to today's prices
 - Customer classes based on PUC Rate Comparison Report (RCR)
 - 500 KWh/month residential
 - 1,000 KWh, 5 KW demand for small commercial
 - Default G&T price and distribution rates based on PUC RCR for January 2016
 - 1996 rates from restructuring orders and implementation plans



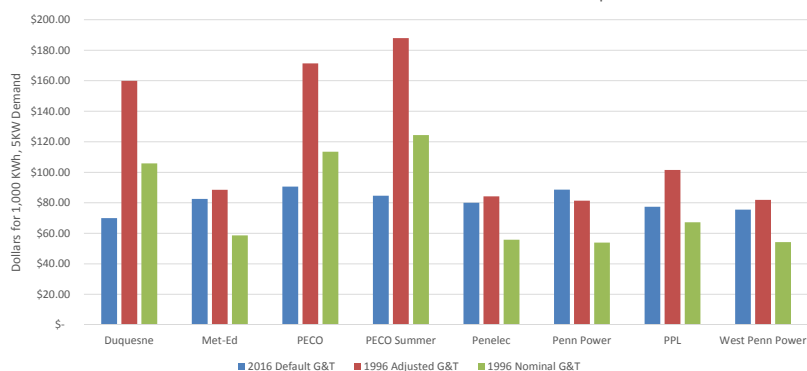
EDC Territory	Average Number of Residential Customers (2015)	2016 Default Price	1996 Adjusted to 2015 Price	Monthly Savings (Costs)
Duquesne	525,714	\$ 20,429,246	\$ 34,409,127	\$ 13,979,881
Met-Ed	492,501	\$ 20,704,742	\$ 21,101,596	\$ 396,854
PECO	1,455,425	\$ 60,793,102	\$ 100,712,537	\$ 39,919,435
Penelec	502,415	\$ 19,353,026	\$ 20,137,571	\$ 784,546
Penn Power	142,591	\$ 6,413,743	\$ 8,617,595	\$ 2,203,852
PPL	1,226,583	\$ 48,560,421	\$ 61,013,686	\$ 12,453,265
West Penn Power	622,404	\$ 21,821,484	\$ 20,302,569	\$ (1,518,916)
Monthly Total Savings				\$ 68,218,917

Projects the potential for \$818 million in savings in 2016

- Savings comes from requiring utilities to procure default service on competitive market, rather through cost of service regulation.
- Assumes all residential customers are default service customers.
- Uses January 31, 2016 G&T price for monthly savings (costs), then extrapolates for entire year.
- Recall, this is G&T only, not delivered price.

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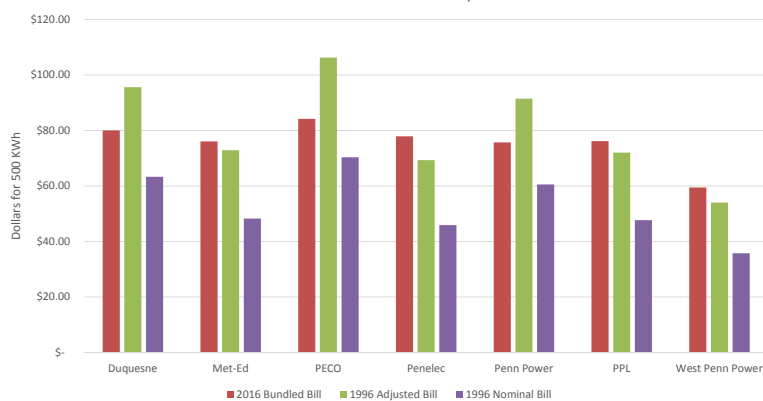
Small Commercial Generation and Transmission Price Comparison



	2016 Default G & T (Jan 31, 2016)	1996 Adjusted to 2015	1996 Nominal	Percent Change
Duquesne	\$ 69.94	\$ 159.91	\$ 105.87	-56%
Met-Ed	\$ 82.52	\$ 88.56	\$ 58.63	-6.8%
PECO	\$ 90.59	\$ 171.35	\$ 113.44	-47%
PECO Summer (July 31, 2016)	\$ 84.64	\$ 187.91	\$ 124.40	-55%
Penelec	\$ 80.00	\$ 84.24	\$ 55.77	-5%
Penn Power	\$ 88.67	\$ 81.40	\$ 53.89	9%
PPL	\$ 77.41	\$ 101.53	\$ 67.22	-24%
West Penn Power	\$ 75.47	\$ 81.96	\$ 54.26	-8%

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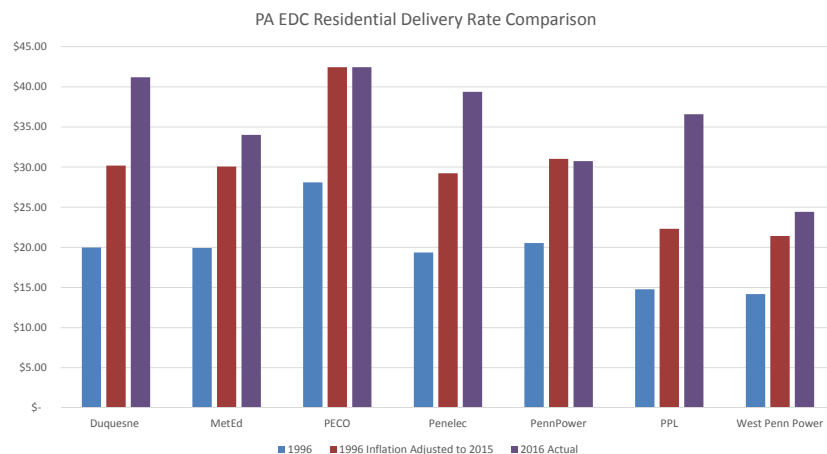
Residential Bundled Bill Comparison



	Bundled Bill (January 31, 2016)	1996 Adjusted to 2015	1996 Bundled Bill (Nominal)	Percent Change
Duquesne	\$80.06	\$95.63	\$63.31	-16%
Met-Ed	\$76.06	\$72.92	\$48.28	4%
PECO	\$84.21	\$106.26	\$70.35	-21%
Penelec	\$77.89	\$69.32	\$45.89	12%
Penn Power	\$75.72	\$91.45	\$60.55	-17%
PPL	\$76.18	\$72.05	\$47.70	6%
West Penn Power	\$59.49	\$54.04	\$35.78	10%

These data indicate that for total bills, increases in distribution prices are outstripping potential savings from generation and transmission prices.

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These data indicate that **distribution rates have increased faster than the rate of inflation** for Duquesne Light, MetEd, Penelec, PPL, and West Penn Power.

Penn Power distribution rates have **increased slower than the rate of inflation**.

For PECO, distribution rate increases have **basically kept pace with the rate of inflation**, exceeding the inflation adjusted rate by one cent.



Residential Product Offerings Snapshot

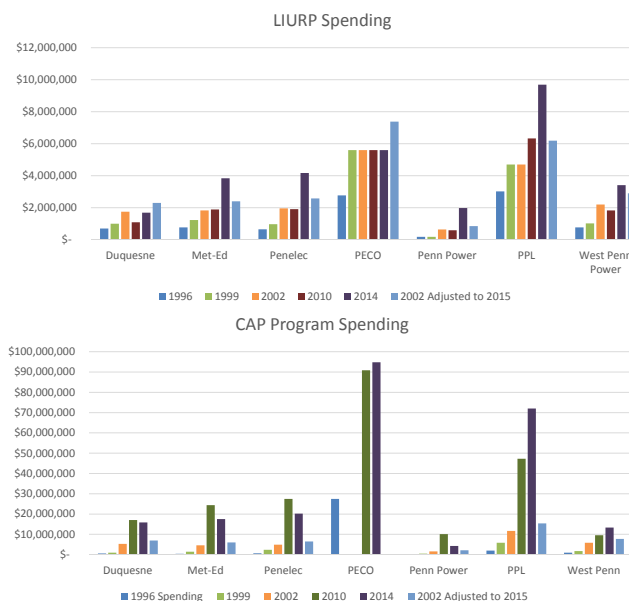
EDC	# of offerings	Variable Price	Fixed Price	3 Year Fixed	2 Year Fixed	1 Year Fixed
Duquesne	95	15	80	7	15	30
PPL	138	24	109	8	19	47
MetEd	102	18	82	7	14	35
PECO	134	23	107	9	15	46
Penelec	88	17	68	6	13	31
Penn Power	57	11	44	4	8	19
West Penn	79	15	62	6	10	25

	Innovative Rates						Innovative Products			
	# of offerings	Unlimited Usage Flat Bill	TOU	Indexed Price	Discount-Incentives	Prepaid	EE&C	Net Metering	Total RE	PA RE
Duquesne	95	0	0	0	2	0	0	3	27	4
PPL	138	1	0	0	2	0	0	4	44	9
MetEd	102	0	0	0	2	0	0	3	37	5
PECO	134	1	0	0	2	0	0	4	45	10
Penelec	88	0	0	0	2	0	0	3	29	5
Penn Power	57	0	0	0	2	0	0	0	21	0
West Penn	79	0	0	0	2	0	0	1	23	2

Snapshot analysis from
www.papowerswitch.com
 data reviewed on
August 25, 2016



Universal Service



Restructuring orders required funding increases b/t 1999 and 2002.

Comparing 2014 LIURP funding levels with 2002 inflation adjusted levels, we find **Met-Ed, Penelec, PennPower, PPL, and West Penn** program funding has increase at or above the rate of inflation, while **Duquesne Light and PECO** program funding levels have not kept pace with inflation.

For 2014 CAP program funding, we found all EDC program spending has kept pace with inflation.



Policy Overview

We Identify Issues, We Don't Advocate Positions



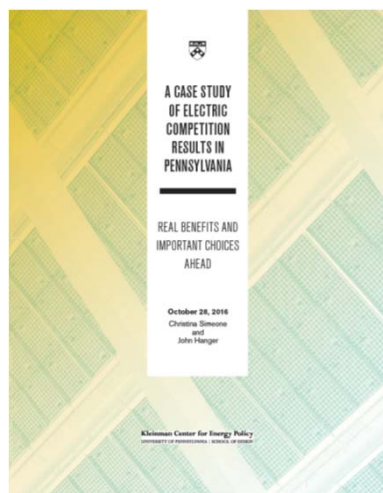
Policy Choices Ahead

Retail Policy

- Sustainable Utility Business Model for the Future
- Secure and Modernize the Distribution Grid
- Electrification of Transportation Sector
- Default Service

Wholesale Policy

- State Policy Intervention into Markets
- Capacity Market Evolutions
- Integration and Optimization of DERs for Wholesale Market



Thank you!
Full paper available at:

WWW.KLEINMANENERGY.UPENN.EDU/PAPER/ELECTRICITY-COMPETITION

