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## Electricity Customer Choice in Ohio: How Competition Has Outperformed Traditional Monopoly Regulation

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**ELECTRICITY  
CUSTOMER CHOICE  
IN OHIO: HOW  
COMPETITION HAS  
OUTPERFORMED  
TRADITIONAL  
MONOPOLY  
REGULATION**

Prepared for:  
Northeast Ohio Public  
Energy Council



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## EXECUTIVE SUMMARY

It took nearly a decade of sorting out regulatory problems, but by 2011 deregulation of the market for electricity generation in Ohio began to work exactly how economic theory projected it would. Since 2011, a robust retail market for electricity has developed in Ohio. As a result, deregulation of electricity has saved consumers an average of \$3 billion per year, for a total of \$15 billion over five years. Moreover, it is projected to continue to save consumers nearly that amount for the next five years, through 2020, totaling another \$15 billion in savings. Further, the Midwestern deregulated states (Ohio, Pennsylvania and Illinois) have, over time, outperformed their regulated Midwestern neighbors (Michigan, Indiana and Wisconsin) in terms of constraining electricity cost increases for their consumers.

This Study was undertaken to assess the effects that deregulation of electricity generation has had on electricity prices in Ohio. Deregulation has become controversial in Ohio as several of Ohio's investor-owned utilities ("IOUs") sought price supports for their uncompetitive generation facilities. The IOUs sought these supports even though Ohio had deregulated the generation side of the electricity business in 2001.

The utilities argued that the price supports were necessary because without them, major existing generation facilities would be shut down, threatening grid reliability and increasing price volatility. In short, they argued that competition in Ohio had become a problem for the IOUs, whose aging generation fleet was struggling to remain competitive. Accordingly, Ohio's IOUs sought, and received, authority from the Public Utilities Commission of Ohio (PUCO) to assess ratepayers with additional fees to subsidize the flagging generation fleets.

The Federal Regulatory Commission subsequently determined that the proposed price supports, which would have been passed through to ratepayers as a rider on the regulated distribution side of their business, were improper, finding that they were inconsistent with deregulated generating markets and threatened to undermine regional wholesale electricity markets. Consequently, the IOUs have begun to argue through media and other venues that Ohio should abandon its deregulated electricity markets in favor of the traditional fully regulated monopoly model that American utilities have followed for most of the 20<sup>th</sup> century.

Such a strategy, however, would cost Ohio's ratepayers significantly. The research contained in this Study demonstrates that Ohio consumers have realized billions of dollars in savings in each of the past five years due to the deregulation of electricity generation. The savings have been realized in part because Ohio's IOUs have begun setting their electricity generation standard service offers (SSO, also called "Price to Compare," or "PTC") through competitive auctions, and in part because over 70% of Ohio's IOU electricity load is shopped. Further, these savings are in keeping with trends seen by other states that have switched to competitive electricity generation.

These results are consistent with research that examines the effects of deregulation, which on the whole find that deregulation reduces electricity prices, or at least growth in those prices. As has

been done in other studies, this Study relied on data from the Energy Information Agency, comparing electricity price in similarly situated states in the Midwest, namely Ohio, Illinois and Pennsylvania (all deregulated their markets for power generation) against Wisconsin, Indiana and Michigan (all mostly regulated). However, the Study differed from most prior studies in two important ways. First, the Study Team used difference-in-difference statistical modeling to control for variables that would affect electricity price (e.g. time-related trends). Second, the Study Team assessed savings due to shopping.

The reason why prior studies have not sought to evaluate savings from shopping is that the data supporting such a study are not publicly available. The Study Team resolved this problem by organizing the shopping data into two sets: mercantile (greater than 700,000 kWh/year consumption) and non-mercantile (less than 700,000 kWh/year). For the non-mercantile group, the Study Team assumed a savings rate of 6% for residential shoppers and 4% for commercial shoppers off of the Price to Compare. These rate discounts have generally been available from aggregators in Ohio in the past five years. For mercantile users, the Study Team used data that were aggregated from private data banks held by local brokers who track electricity procurement by their clients.

Analysis of the pricing data demonstrates that Ohio ratepayers have avoided nearly \$15 billion in charges over the past five years as a result of competition. Of this, around \$3 billion is from shopping, four-fifths of which is from mercantile shopping, and one-fifth from non-mercantile shopping.

**Total Shopping Savings from Mercantile and Non-Mercantile Markets  
2011-2015 (millions of dollars)**

| Year         | Mercantile        | Non-Mercantile  | Total             |
|--------------|-------------------|-----------------|-------------------|
| 2011         | \$391.60          | \$105.1         | \$496.70          |
| 2012         | \$324.69          | \$118.6         | \$443.29          |
| 2013         | \$600.81          | \$143.3         | \$744.11          |
| 2014         | \$664.21          | \$160.0         | \$824.21          |
| 2015         | \$487.19          | \$157.8         | \$645.19          |
| <b>Total</b> | <b>\$2,468.50</b> | <b>\$684.80</b> | <b>\$3,153.30</b> |

In addition to shopping savings, an additional \$12 billion was saved by Ohio's ratepayers between 2011-2015 as a result of using deregulation strategies to establish the Standard Service Offer (Price to Compare). These savings inured to all customers of the IOUs, regardless of whether they shopped or not.

Total savings due to deregulation were around \$3 billion per year between 2011 and 2015.



**Total Savings Due to Deregulation in Ohio  
2011-2015 (millions of dollars)**

| Year         | Shopping          | SSO                | Total              |
|--------------|-------------------|--------------------|--------------------|
| 2011         | \$496.70          | \$2,395.00         | \$2,891.70         |
| 2012         | \$443.29          | \$2,366.00         | \$2,809.29         |
| 2013         | \$744.11          | \$2,342.00         | \$3,086.11         |
| 2014         | \$824.21          | \$2,380.00         | \$3,204.21         |
| 2015         | \$645.19          | \$2,339.00         | \$2,984.19         |
| <b>Total</b> | <b>\$3,153.30</b> | <b>\$11,822.00</b> | <b>\$14,975.30</b> |

Ohio has also seen significant price drops in the standard service offers since utilities transitioned to setting 100% of the Price to Compare by auction (as opposed to the cost-based accounting historically used by regulators to set prices). As these standard service auctions mature, we might expect that the available “headroom” (the difference between the price to compare and the price that commercial retail providers can offer) will be diminished as markets work their way toward equilibrium pricing. Accordingly, shopping savings in Ohio may not increase significantly going forward, as the standard service auction process fully matures. In 2015 shoppers saved around \$645 million off of the SSO. We assumed that 2015 savings represent the savings available from a mature auction market. Accordingly, we forecast additional savings from deregulation over the next five years by adding this amount to the savings generated through the SSO auctions.

Using the \$645 million per year savings, along with the PUCO’s long-term projections for electricity consumption to forecast savings due to the standard service offer auctions, the Study Team forecasts that Ohio’s ratepayers will save around \$2.98 billion per year for the next five years from deregulation, totaling \$14.9 billion. Projected savings, compared to a reregulated generation market, for 2016-2020 are as follows:

**Total Projected Savings Due to Deregulation in Ohio,  
2016-2020 (millions of dollars)**

| Year         | Shopping Savings | SSO Auction Savings | Total Savings   |
|--------------|------------------|---------------------|-----------------|
| 2016         | \$645            | \$2,333             | \$2,844         |
| 2017         | \$645            | \$2,338             | \$2,829         |
| 2018         | \$645            | \$2,343             | \$2,833         |
| 2019         | \$645            | \$2,349             | \$2,839         |
| 2020         | \$645            | \$2,354             | \$2,844         |
| <b>Total</b> | <b>\$3,225</b>   | <b>\$11,717</b>     | <b>\$14,942</b> |

Unfortunately, the regulated portion of electricity – called “non-bypassable costs” (distribution, transmission, and various riders) – have been trending upwards at the same time that competition in the generating market has been pushing the generation portion of the costs down. As a result, the overall cost of electricity has not fully reflected the savings achieved through deregulation.

However, reregulating the generation portion of electricity will not reverse the rising costs of distribution and other non-bypassable charges. This only makes the argument for deregulation more compelling, since deregulation is largely responsible for the relatively low cost of electricity in Ohio. There exists no public policy basis for reregulating generation in Ohio.

## I. INTRODUCTION

### A. BACKGROUND

Since the late 1990s, some 14 U.S. jurisdictions<sup>1</sup> have restructured their electricity regulations to allow for the existence of competitive, multi-state markets for electricity generation. Other states, like Michigan, have allowed limited competition. Many states, including Ohio, have allowed open competition in the generating market, but have created a partially regulated default alternative for those customers who choose not to directly shop for their electricity. In these states, as in all jurisdictions, certain other components of the cost of delivering electricity to end-users has remained largely regulated, notably transmission, distribution and non-bypassable riders.

The research contained in this Study demonstrates that Ohio consumers have realized significant savings due to the deregulation of generation. The savings have been realized in part because Ohio's utilities have begun setting their electricity generation standard service offers through competitive auctions, and in part because Ohio's consumers have been able to shop for their electricity loads. Further, these savings are in keeping with trends seen by other states that have switched to competitive electricity generation.

This Study principally examined the costs that have been avoided by Ohio's electricity users as a result of competition. The conclusion reached is that deregulation has, at a minimum, directly saved Ohio consumers \$14.98 billion between 2011 and 2015, and will likely save Ohio consumers another \$14.18 billion over the next five years (including 2016).

However, deregulating the market for electricity generation has triggered five major structural changes that have negatively affected the financial condition of some of the incumbent utilities by fundamentally disrupting their business model. These changes are:

- 1) The establishment of multi-state Regional Transmission Organizations (RTOs) that are responsible for regulating the energy generating and transmission markets;
- 2) Shift in some of the responsibility over the reliability of the supply of electricity from state regulatory bodies to the RTOs;
- 3) Flattening of demand for electricity. Demand initially dropped with the Great Recession of 2008 and did not recover its previous growth rates, despite the subsequent economic recovery, as energy efficiency and load management technologies became widely deployed. The close correlation between economic growth and the demand for electricity that existed before the Great Recession ended;
- 4) Perfection and dissemination of horizontal drilling and hydraulic fracturing technologies opened up massive and inexpensive natural gas deposits in the Appalachian Basin as a competitive fuel source for electric generation, making both coal and nuclear generation higher cost fuels for base-load electric generation;

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<sup>1</sup> The 14 deregulated jurisdictions are: CT, DC, DE, IL, MA, MD, ME, NH, NJ, NY, OH, PA, RI, and TX. A map of the regulated and deregulated states is attached hereto as Appendix 1.

- 5) Private equity support for the entry of new lower-cost suppliers into the electricity generating market. These new entrants are responding to market opportunities in base-load generation using natural gas and to consumer and regulatory demand for carbon-free power generation.

Today a single, vertically integrated, market for electricity consumption does not exist and trying to regulate the market as if all components of electricity are natural monopolies is not economically viable. Barriers to entry into the electricity generation market have crumbled. There is a regulated market for transmission from generating plants to distribution networks where barriers to entry are declining, and auction markets managed by the RTOs are allocating capacity based on demand. The local distribution networks are the last pure natural monopoly in the electricity industry.

It is best to view the electricity market as consisting of three, separate, but closely integrated submarkets: generation, transmission, and distribution. Regulation of generation and system reliability is clearly the province of the RTOs and the Federal Energy Regulatory Commission (FERC). The states retain an important watchdog role when it comes to assuring the reliability of generating resources available to their residents and businesses. Interstate transmission capacity is an RTO responsibility, and intrastate transmission capacity regulation belongs to the states unless it negatively affects the interstate grid. This places state regulators in a subordinate position on that issue. The distribution market, including the wires and infrastructure that connect homes and places of work to power, remains (for the time being) a natural monopoly that is subject to state regulation.

Changes in the regulatory and financial landscape have placed the formerly vertically integrated utilities in an awkward position. Some bet heavily on coal-fired generation as the cheapest source of base load electricity. In so doing, they stretched their financial capacities to purchase what they thought were sure wins. The PUCO recognized at the start of its deregulation of the generation market that the formerly regulated monopolies might need to recover for some stranded assets resulting from deregulation. Indeed, the PUCO did allow utilities to be compensated by their distribution customers for generating assets that had become “stranded,” or uncompetitive, as a result of deregulation.

By late 2015 deregulation had once again become controversial in Ohio as several of Ohio’s investor-owned utilities (IOUs) sought additional price supports for their uncompetitive generation facilities – despite the fact that in Ohio generation has been deregulated since 2001. The utilities argued that price supports were necessary because, without them, major existing generation facilities will be shut down, arguing that this will threaten grid reliability and increase the volatility and cost of electricity paid by end-users in Ohio. In the spring of 2016, the agency that regulates Ohio’s electric utilities, the Public Utilities Commission of Ohio (PUCO), agreed with the utilities and granted their requests for price support.<sup>2</sup> The supports the PUCO granted were

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<sup>2</sup>AEP Energy. (2016). PUCO approves AEP Ohio and First Energy PPA stipulation. Retrieved from: <http://www.aepenergy.com/puco-approves-aep-ohio-and-first-energy-ppa-stipulations/#.V9Aq04YrI2w>

to be funded through the creation and assessment of non-bypassable riders to pay for novel long-term power purchase agreements produced by non-competitive plants owned by the IOUs. However, all ratepayers, regardless of whether they actually purchased power from that utility or if they shopped for electricity on the competitive market, were required to pay for the power generated by these plants. Some selected industrial customers received, under the PUCO ruling, special price discounts and exemptions under a complicated rate structure, in what appeared to be a return for having supported the proposed power purchase agreements.<sup>3</sup>

The Federal Energy Regulatory Commission (FERC), following a recent Supreme Court ruling on a similar generation subsidy scheme in Maryland, subsequently found that the PUCO decision mandating support by Ohio consumers for certain high-cost generating assets through power purchase agreements undermined regional wholesale electricity markets and violated federal rules.<sup>4</sup> As a result, rather than acknowledge that technology, regulation and markets have changed over the decades, and retire their uncompetitive generation capacity, some of Ohio's utilities have instead turned their attention to identifying alternative strategies for offsetting the costs of the uncompetitive portions of their generation fleet.

One such strategy is for Ohio to return to full, vertical regulation of the electricity industry.<sup>5</sup> Under this scenario, the utilities would reestablish spatial monopolies within their service areas, re-monopolizing the traditional electric generating market and pre-monopolizing the emerging market for distributed and carbon-free electricity generation. Under such a reregulation strategy, utilities would be guaranteed their costs of service plus a return on their investment that is negotiated with the PUCO, but is usually around 10 percent or higher.

The results from this Study suggest such a reregulation would have a significant adverse economic impact on Ohio's electricity consumers. The Study results show that deregulation has saved and will continue to save Ohio ratepayers billions of dollars. Moreover, it is important to note that competition in the generating market has not only lowered prices, it has also improved system reliability,<sup>6</sup> stimulated technical innovation, and has resulted in capital investment and entrepreneurship. The economic development benefits from a deregulated generating market appear in the form of operating costs savings for employers, new sources of construction

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<sup>3</sup> See e.g. Thomas, A. (2015) "FirstEnergy's Latest Strategy for a Bailout is Still a Bad Idea." Crain's Cleveland Business (explaining FirstEnergy's redistributive coalition strategy). Retrieved from: <http://www.craincleveland.com/article/20150123/BLOGS05/150129906/firstenergys-latest-strategy-for-a-bailout-is-still-a-bad-idea>.

<sup>4</sup> Funk, J. (2016) FERC reject PUCO-approved FirstEnergy, AEP power deals. Retrieved from: [http://www.cleveland.com/business/index.ssf/2016/04/ferc\\_rejects\\_puco\\_approval\\_of.html](http://www.cleveland.com/business/index.ssf/2016/04/ferc_rejects_puco_approval_of.html)

<sup>5</sup> Funk, J. (2015). FirstEnergy wants Ohio to end deregulation, return to state-controlled rates. Retrieved from: [http://www.cleveland.com/business/index.ssf/2015/07/firstenergy\\_wants\\_ohio\\_to\\_end.html](http://www.cleveland.com/business/index.ssf/2015/07/firstenergy_wants_ohio_to_end.html)

<sup>6</sup> For example, total capacity reserves in the PJM have been increasing since deregulation. A higher reserve capacity leads to a more reliable system. See "2019/2020 RPM Base Residual Auction Results," PJM (2016), retrieved from: <http://www.pjm.com/~media/markets-ops/rpm/rpm-auction-info/2019-2020-base-residual-auction-report.ashx>

employment as new generation plants are built, and improved regional competitiveness as the relative price of electricity has declined.

Deregulation has also played a role in reducing consumption. Historically electricity consumption in the U.S. has been directly tied to economic growth. In the United States, this relationship changed during the recovery from the Great Recession of 2008 when electricity consumption decoupled from economic growth for the first time.<sup>7</sup> In Ohio, electricity consumption has been flat since 2008, notwithstanding a slow but steady recovery since then.<sup>8</sup> This coincides with changes in Ohio laws that furthered deregulation. Many of the programs that have developed as a result of deregulation, such as demand response and load management, have contributed to this decoupling.

The effects of the decoupling have not been measured in this Study, even though it has led to lower electricity costs, technical innovation, and investment into new generation capacity in Ohio. Instead, this Study looks only at the direct savings attributable to generation suppliers competing for customers that were ushered in through deregulation of electricity in Ohio.

## **B. ELECTRICITY MARKETS AND COMPETITION**

A prolonged bout of financial turmoil that challenged the stability and structure of the electricity industry began with the 1973 Arab Oil embargo. The embargo triggered an 18-month recession in the United States that reduced industrial demand and increased operating costs as fuel prices shot up.<sup>9</sup> Change accelerated when Consolidated Edison froze its dividend in 1974 and the value of utility stocks collapsed. Utilities were no longer considered a steady rate return “widows and orphans” stock and a safe alternative to bonds for risk-averse investors. Financial troubles haunted the industry through the 1970s as political instability in the Middle East followed the Iran revolution of 1978. Political-economical shocks that made it difficult to predict the cost of fuel, coupled with the changing assessment of risk from investing in the industry, posed a threat to the stability of electricity supplies in the United States. In response, the United States Congress enacted the *Public Utility Regulatory Policy Act* (PURPA) of 1978. The ideas of PURPA were to promote energy conservation, to stimulate greater use of domestic and renewable energy, and to increase efficiency within the generation sector.

The prospect of private market competition in electricity dawned in 1992, with the passage of the *Energy Policy Act*. This Act was fundamental to setting the U.S. down a path toward improving

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<sup>7</sup> Romm, J. (2016) U.S. economic growth decouples from both energy and electricity use. Retrieved from: <https://thinkprogress.org/u-s-economic-growth-decouples-from-both-energy-and-electricity-use-16ae78732e59#.wy153assg>

<sup>8</sup> U.S. Energy Information Administration (2016). Ohio electricity profile 2014. Retrieved from: <https://www.eia.gov/electricity/state/ohio/>

<sup>9</sup> Oil and gas prices both increased rapidly in the 1970s. The Arab oil embargo merely precipitated this rapid rise in costs, however; other factors were involved in the escalating hydrocarbon prices during the 1970s. Other factors included reserve overestimates, drilling and production costs increases and the dedication of gas reservoirs to low-priced contracts on interstate gas pipelines.

efficiency in the electric system by introducing competition into electricity generation. It led to a new class of privately owned and operated electricity generation service providers that were allowed to compete for the right to generate and sell electric power. Congress mandated that utilities provide wholesale power transmission services to these providers at cost-based rates, even if doing so might cause them to expand their transmission capacity.<sup>10</sup> This Congressional mandate created demand for a transmission line capacity market and ultimately for a wholesale electricity market.

In 1996, the FERC responded by issuing Order 888, which required utilities to provide “open access non-discriminatory transmission services” to independent generators. This separated generation capacity in power plants from transmission and distribution services, thus breaking apart the historical vertical integration of electric utilities. FERC assumed responsibility for both regulation of the interstate transmission of electricity and the rules governing wholesale power generation competition, while the States remained responsible for intrastate regulation.

Not long after this, some states began to deregulate electric power generation services with the goal of creating a competitive market for generation. Deregulation allowed generators to sell power directly to end-users and to intermediary firms that aggregated the demand of electricity users and purchased generating capacity for them. In deregulated states, wholesale power generation service providers could compete with each other to sell electricity to consumers who, all else being equal, would buy it at the lowest possible price. The creation of competitive wholesale markets also allowed investors to bring on-line new sources of generating capacity that could compete in terms of purchase price and, eventually, also in terms of their carbon and other emissions.

The main purpose of electricity deregulation was to use competition to promote operational efficiencies resulting in lower prices.<sup>11</sup> This, of course, raises the question as to whether or not this expectation was fulfilled. Published research makes clear that many factors have to be considered in answering this question, and while the findings are somewhat mixed, there is a consensus that deregulation has resulted in reduced prices.

States that have historically paid the highest electricity prices have tended to be the states that have chosen to deregulate their markets.<sup>12</sup> Ardoin and Grady (2006) established that the price of electricity per kWh was likely to play a significant role in a state’s decision to deregulate. Their finding is consistent with the findings documented in this study.

As of 2016, there are 14 competitive regulatory jurisdictions in the United States: Delaware, District of Columbia, Connecticut, Illinois, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island and the area of Texas that is within the ERCOT

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<sup>10</sup> Ardoin, P.J., & Grady, D. (2006). The Politics of Electricity Restructuring across the American States: Power Failure and Policy Failure. *State & Local Government Review*, 165-175

<sup>11</sup> P. Joskow. (2006). Markets for Power in the United States: An Interim Assessment. *The Energy Journal*, 27, 1 – 36

<sup>12</sup> Ardoin & Grady, *supra*, note 10.

regional transmission organization. Together, these jurisdictions comprise about one-third of the U.S. electricity load.<sup>13</sup> The remaining states continue to regulate their electric utilities as either a vertically integrated monopoly that links generation, transmission and distribution, or under a model that allows for highly restricted access to competitive electricity markets as is true in Michigan.<sup>14</sup>

## II. HISTORY OF DEREGULATION IN OHIO

### A. ELECTRICITY IN OHIO PRIOR TO RESTRUCTURING

Before the passage of Senate Bill 3<sup>15</sup> in 1999 (and the subsequent enactment of the law in January 2001), Ohio's electricity utilities were regulated by the Public Utilities Commission of Ohio under the traditional approach to regulation: transmission, distribution and generation were bundled together in a package by the local utility.<sup>16</sup> Under this model, a restricted geographic market became a "certified territory"<sup>17</sup> wherein the utility was granted monopoly rights to<sup>18</sup> provide a bundled package of electricity generation, transmission, and distribution, subject to regulatory oversight by the PUCO.

Prior to 2001, there were eight for-profit public utilities and 26 non-profit electric utilities in Ohio, all of which provided bundled retail electric service to customers within their respective certified territories. About 91 percent of the electricity consumed in Ohio was provided by the eight for-profit, investor-owned utilities (IOUs).<sup>19</sup> Four of these IOUs, with their respective operating companies – AEP Ohio (Columbus Southern and Ohio Power), Dayton Power & Light, Duke Energy, and FirstEnergy (Cleveland Electric Illuminating Company, Toledo Edison and Ohio Edison), generated and supplied most of the electricity consumed in Ohio.<sup>20</sup>

<sup>13</sup> Kuipers, W. & Chappelle, L. (2016). Electricity Customer Choice Out-Performs Traditional Monopoly. *Utility Dive*, retrieved from: <http://www.utilitydive.com/news/electricity-customer-choice-out-performs-traditional-monopoly-1/424986/>

<sup>14</sup> For a map of the regulated and deregulated jurisdictions, see Appendix "1" attached hereto.

<sup>15</sup> Senate Bill 3 was introduced to Ohio's 123<sup>rd</sup> General Assembly on January 20, 1999, to enact Ohio Revised Code, section 4928.01. Through the Senate and House actions it was substituted and amended several times, and finally passed by General Assembly and signed by Governor on July 6, 1999 as Am. Sub. S.B.3.

<sup>16</sup> Ohio Public Utilities Commission Docket, Case No. 12-3151-EL-COI, entry of Commission's findings setting forth investigation into Ohio's retail market, at 1 (December 12, 2012); found at: <http://dis.puc.state.oh.us/TiffToPdf/A1001001A12L12B14210G58737.pdf>

<sup>17</sup> Ohio Code, Title 49. XLIX Public Utilities, Chapter 4933: Companies – Gas; Electric; Water; Others, 4933.81. Certified territories for electric suppliers definition: <http://codes.ohio.gov/orc/4933>.

<sup>18</sup> Ohio Legislative Service Commission, Final Analysis. Am. Sub. S.B. 3 (Ohio Legislative Service Commission, 1999).

<sup>19</sup> The IOU portion of the Ohio total load can be determined by comparing the total load in 2015 (145,500,000 MWhs) to the total IOU load in 2015 (132,922,251 MWhs). See Report by the Staff of the PUCO – Ohio Long Term Forecast of Energy Requirements, July 22, 2015, page 41, found at:

<http://www.puco.ohio.gov/puco/index.cfm/industry-information/statistical-reports/ohio-long-term-energy-forecast/ohio-ltfr-2014-2033/> and at <http://www.puco.ohio.gov/puco/index.cfm/industry-information/statistical-reports/electric-customer-choice-switch-rates-and-aggregation-activity/electric-switch-rates-by-sales/sales-2015>

<sup>20</sup> Snitchler, T. "The Emerging Ohio Market," presented at 21<sup>st</sup> Century Manufacturing Task Force (November 26, 2012). "IOUs" and "EDUs" are often used interchangeably, but the restructuring of the electricity markets brought



Under Ohio’s electricity regulation regime that existed prior to 2001 the IOUs were required to petition the PUCO for approval of their electric rates. Approved electricity rates included the cost of operation reported by the utilities, typically accounting for 80 percent of the utilities’ revenue, plus a rate of return on that part of the utilities’ capital investment that was determined to be “used and useful” in all three phases of the business—generation, transmission, and distribution.<sup>21</sup> Under this traditional method of determining the electricity rate, consumers bore the risk of all operations, from generation to transmission to distribution, so long as those operations were deemed to be “useful” to the process of delivering power to the consumers. The determination of “usefulness” was made by the PUCO on the basis of information provided to them by the utilities, thus raising issues and potential problems associated with information asymmetries and regulatory capture. However, the return on capital investment portion of the electricity rate could only include those investments made into infrastructure currently in use by utilities for electricity generation and delivery.

Like a number of states in the Northeast and the Upper Midwest, electricity rates in Ohio began to rise in the 1990s. Further, prices were considerably higher in Ohio than in some competing states, especially those in the Southeastern portion of the nation, where lower electricity prices invited continued migration of manufacturing investment out of Ohio. Higher prices in Ohio were largely attributable to factors such as the fuel mix used for generation within the state, fuel prices, real yield on utility debt, as well as the age and condition of the electric transmission and distribution grid.<sup>22</sup> Northern Ohio consumers, especially, experienced high prices that can be attributed to the pass-through of nuclear power cost overruns.<sup>23</sup>

### **B. RESTRUCTURING OF ELECTRICITY MARKETS AND SENATE BILL 3**

Since the late 1990s 24 states, including Ohio, restructured their electric power markets. The Ohio Electric Restructuring Act (SB 3) in 1999 authorized the 2001 deregulation of the electric power industry by encouraging the development of a competitive market for electric power generation in Ohio.

The restructuring required electric utilities to separate or “unbundle” their services and charges for electricity generation, transmission, and distribution and to allow retail customers to choose their electric retail suppliers.<sup>24</sup> Under SB 3, competitive retail services included electric generation, aggregation, power marketing and brokering. Additionally, metering, billing, and collection services could be performed as part of providing competitive retail services. However,

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about a clearer distinction. EDUs are generally in the business of electricity distribution, while the IOUs are in the business of electricity more generally.

<sup>21</sup> Shapiro, S. & Tomain, J. (2003) *Regulatory Law and Policy: Cases and Materials* (3), 109

<sup>22</sup> Joskow, P. (2006). Markets for Power in the United States: An Interim Assessment. *The Energy Journal* (27), 1 – 36.

<sup>23</sup> See e.g. Kiesling, L.L. (2009). Deregulation, Innovation and Market Liberalization: Electricity Regulation in a Continually Evolving Environment. *Rutledge Studies in Business Organizations and Networks*, 24-25.

<sup>24</sup> Ohio Public Utilities Commission Docket, Case No. 12-3151-EL-COI, *supra*, at 1. The utilities received consideration for separating. For instance, FirstEnergy received \$7 billion for “stranded costs” associated with the transition. <http://www.eia.gov/electricity/policies/restructuring/ohio.html>.

SB 3 ensured that the IOUs retained their spatial monopoly status for electric transmission and distribution services within their respective regions – meaning that intrastate transmission and retail distribution remained under the PUCO’s regulatory authority under a cost-based (cost plus a rate of return, or “cost plus”) regulatory scheme.<sup>25</sup>

Beginning on January 1, 2001, SB 3 enabled electricity customers to have the choice of competitive retail service providers for their electric energy. The Senate bill also established a market development period through December 31, 2005, which was designed to serve as a transition period from regulated to deregulated electric generating markets. During this development period, the IOUs submitted “Electric Transition Plans,”<sup>26</sup> to the PUCO. At that point then-current electric rates were frozen pending the development of a competitive wholesale market.

It is also important to note what SB 3 did not require. The IOUs were not required to sell their electric generation assets to third parties. Further, while they were required to place their generation assets into separately operated subsidiaries, the statute did not set dates by when separation needed to be completed. Further, the PUCO did not seek to enforce full separation immediately. Such a separation would have isolated the competitive portion of an IOU (generation) from the regulated portions of the companies (intrastate transmission and distribution) and made cross-subsidization from one to the other more difficult. Only FirstEnergy immediately separated its generating plants into a wholly owned subsidiary. The PUCO did not order AEP Ohio to do so until 2013, while by the fall of 2016, DP&L had still not separated.<sup>27</sup> Competitive electricity markets failed to emerge during the 2000s, as no competitive retail electric service (CRES) providers were bidding on loads under these conditions.<sup>28</sup>

In an attempt to lower barriers to the market to provide electricity to customers, the PUCO, together with Ohio’s electric utilities, established plans to minimize market uncertainty and to provide customers a gradual transition to market-based rates with stable and predictable rates. This “Rate Stabilization Period” took place for FirstEnergy, Duke Energy Ohio, Dayton Power and Light, and American Electric Power from 2006 through 2008.<sup>29</sup> However, these rate stabilization plans did not result in competitive electricity markets. Even the government aggregation programs – described by one author as the “jewel of deregulation” – were not working.<sup>30</sup> In northeast Ohio,

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<sup>25</sup> Ohio Legislative Service Commission, *supra*. For instance, PUCO approved a 9.46 percent rate of return for Duke Energy on November 22, 2010 (p.41, PUCO, 2013). For each of FirstEnergy’s operating companies, PUCO approved an 8.48 percent return rate.

<sup>26</sup> Littlechild, S. (2007) Municipal Aggregation and Retail Aggregation in the Ohio Sector. Retrieved from: <http://www.eprg.group.cam.ac.uk/wp-content/uploads/2008/11/eprg0715.pdf>.

<sup>27</sup> See “AEP Receives All Necessary Approvals to Complete Separation of its Ohio Assets,” December 26, 2013, retrieved from: <http://www.aep.com/newsroom/newsreleases/?ID=1851>. As of November 2016, only DP&L has not separated. It was ordered to do so by January 1, 2017, however DP&L has argued that its electric security plan approved by the PUCO was vacated by the Federal Energy Regulatory Commission, therefore the order to do so was also vacated. See <http://www.supremecourt.ohio.gov/rod/docs/pdf/0/2016/2016-Ohio-7535.pdf>

<sup>28</sup> Public Utilities Commission of Ohio. (2007) Electric Rate Stabilization Plans: Ensuring Rate Certainty in Ohio. Retrieved from: <http://www.getpureenergy.com/states/forms/Electric%20Rate%20Stabilization.pdf>.

<sup>29</sup> *Id.* See Figure 1 for specific dates for each IOU.

<sup>30</sup> Littlechild. Municipal Aggregation 3, *supra* (quoting Ohio Consumer’s Counsel).

residential users were essentially paying standard service offer rates from the IOUs, which were the retail electric rates established by the PUCO after engaging in traditional regulatory bargaining with each utility.<sup>31</sup> By 2007, then-Governor Ted Strickland determined that deregulation in Ohio “was not working.”<sup>32</sup> As a result, the Governor presented a new strategy to help develop electricity markets to the Ohio General Assembly.

It is important to remember that Ohio’s electricity industry is only partially deregulated. The intent of SB 3 was not to fully deregulate Ohio’s electricity industry. Ohio’s approach to electricity deregulation has recognized that the changes in federal regulation and the creation of multi-state regional transmission organizations produced a multi-state competitive market for electricity generation and a partially regulated market for interstate electricity transmission. The state’s intent was to deregulate the electricity generation portion of the service while maintaining regulation on intrastate transmission and distribution.

Deregulation of the generation market allows users of large volumes of electricity to purchase power directly from generating companies and have that power delivered through the multistate, regional, transmission grid. Smaller users were expected to purchase their power from a competitive group of companies that would aggregate electricity users and purchase power on their behalf. These “aggregators” were envisioned to be either traditional electric utilities (IOUs, municipal utilities, or cooperatives), municipalities or groups of municipalities, and competitive providers that were expected to enter the retail market.

When SB 3 unbundled the services and charges of electric utilities, it effectively unbundled the electric user’s electric bill. Understanding this unbundling is required to recognize what portion of an electric bill became competitive and what portions remain subject to regulation. An electric bill in partially deregulated Ohio states the cost of generation that is part of a service offer, and then separately provides the costs of transmission, distribution, and various riders or quasi-taxes that the PUCO assesses to specific electric ratepayers to support industrial discounts given to promote economic development, weatherization, and other redistributive actions that are under the review of the PUCO.

### **C. TAKE TWO: SENATE BILL 221 AND REVISIONS TO RESTRUCTURING**

In August 2007, then-Governor Strickland announced a new energy plan, entitled “Energy, Jobs, and Progress Plan.” The Governor’s energy proposal included four major goals: (1) stable and predictable electricity rates, (2) the development of advanced and renewable energy technologies, (3) an increase of energy efficiency, and (4) the modernization of Ohio’s electric infrastructure. Ohio’s General Assembly passed Senate Bill 221 in May 2008 largely incorporating the Governor’s proposal (SB 221 passed the Ohio Senate 32-0 and the Ohio House on a 93-1 vote). The plan was most notable for its enactment of a renewable energy portfolio, as well as energy efficiency mandates. However, the plan also revisited and revised Ohio’s strategies for restructuring the electricity generating market. SB 221 changed the regulatory framework for all

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<sup>31</sup> *Id.*

<sup>32</sup> *Id.*

utilities engaged in the retail distribution of electric power, which includes the power delivered through their subsidiary electric distribution utilities (EDUs).<sup>33</sup>

SB 221 required Ohio's electric utilities to implement a "hybrid approach" to setting electric rates for default service (i.e. when a customer does not actively choose an alternative retail supplier).<sup>34</sup> Instead of fully relying on the competitive market approach for this default service, SB 221 requires each of Ohio's EDUs to develop a standard service offer (SSO) for its retail service within a certified distribution territory.<sup>35</sup> SB 221 redefined a utility's SSO as "an offer of all competitive retail electric services necessary to maintain essential electric service to consumers, including a firm supply of electric generation service, and be offered on a comparable and nondiscriminatory basis."<sup>36</sup>

The SSO, under the SB 221, must be set either as part of an electric security plan (ESP)<sup>37</sup> or through a market rate offer (MRO).<sup>38</sup> The ESP is a traditional rate plan based on a cost-of-service proposal from the electric utilities (which can include a blend of electricity that is from the utility's captive generating capacity and purchased power). The MRO is a market-based pricing system that sets retail rates through a competitive bidding process where the EDU seeks bids from wholesale suppliers of power. To stabilize electricity prices, SB 221 authorized the PUCO to establish rules and test utilities' rate plans to determine whether the plans were "fair and equitable" to consumers, and to determine if utilities were generating excessive earnings from their rates.

While SB 221 preserved SB 3's requirement that the SSO from each utility be the default service for its customers, the bill amended the PUCO's approval process and enabled the EDUs to choose either the rate set in the ESP or the MRO to establish the generation portion of the SSO (the "Price to Compare," or PTC). To date, only ESPs have been used and filed with the PUCO by Ohio's utilities. However, the ESPs have included aspects of the market rate option by using market-based supply auctions to establish the cost of generation under the SSO.

It is important to note that SB 221 provided the utilities with an important concession: it allowed their EDUs to place "riders" into their non-bypassable costs through the ESPs. Riders are

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<sup>33</sup> SB221 changed the regulatory framework that applies to EDUs. An electric utility was defined as "an electric light company that has a certified territory and is engaged on a for-profit basis either in the business of supplying noncompetitive retail electric service in this state or in the business of supplying both a noncompetitive and a competitive retail electric services in this state." SB 221 further defined an EDU as "an electric utility that supplies at least retail electric distribution service." See Thompson Hines: PUCO Finalizes SB 221 Electricity Pricing Rules, *Energy Update* (October 2008); <http://www.thompsonhine.com/publications/energy-update-puco-finalizes-sb-221-electricity-pricing-rules>.

<sup>34</sup> Caplan, E. & Brobeck, S.(2012), Have Restructured Wholesale Electricity Markets Benefitted Consumers? *Electricity Policy.com*. Retrieved from: [https://www.publicpower.org/files/PDFs/CFA\\_APPA\\_RTO\\_Article\\_12\\_12\\_12.pdf](https://www.publicpower.org/files/PDFs/CFA_APPA_RTO_Article_12_12_12.pdf)

<sup>35</sup> The term "Standard Service Offer" is also called the "Provider of Last Resort" offer – in other words the default service when the consumer fails to choose a provider. EPSCA Electricity Primer at 4. [www.esps.org](http://www.esps.org).

<sup>36</sup> Legislative Service Commission. (2008). Am. Sub. SB 221.,13. Retrieved from: <http://www.lsc.state.oh.us/analyses127/08-sb221-127.pdf>

<sup>37</sup> Ohio Rev. Code Section 4928.143. See <http://codes.ohio.gov/orc/4928>.

<sup>38</sup> Ohio Rev. Code Section 4928.142.

additional charges imposed by the utilities to reimburse them for costs they incur in providing distribution services or to pay for social programs. Some, such as compliance with energy efficiency mandates, are non-bypassable. As a result, SB 221 effectively *invites utilities to try to make up losses incurred from competition by expanding their non-bypassable riders*. The utilities predictably deploy many riders. FirstEnergy's EDU Cleveland Electric Illuminating Company (CEI), for instance, has some 41 non-bypassable riders, of which as many as 35 are applicable depending upon the rate class of a customer.<sup>39</sup> The most troubling are the "automatic adjustment" riders – those that can go up each year with no regulatory review. The concern is that utilities may use increases in these riders to capture some of the losses attributable to competition in the generation markets, offsetting savings otherwise available for consumers.

At this same time, the PUCO also furthered the deregulation process by requiring corporate separation of non-competitive retail electric service (distribution) from competitive electric service.<sup>40</sup> As of August 2016, there are seven regulated EDUs (excluding transmission subsidiaries) that are operating in Ohio:<sup>41</sup>

- Cleveland Electric Illuminating Company (FirstEnergy)
- Ohio Edison (FirstEnergy)
- Toledo Edison (FirstEnergy)
- Columbus Southern Power (American Electric Power)
- Ohio Power Company (American Electric Power)
- AES Corporation (Also known as Dayton Power & Light)
- Duke Energy Ohio

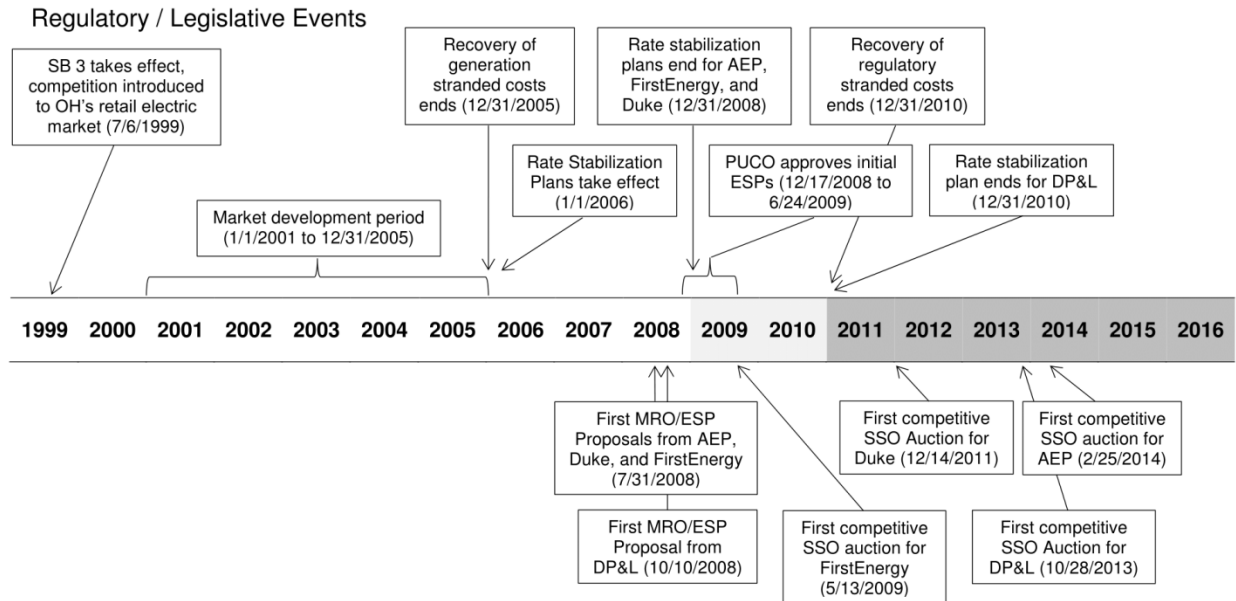
Figure 1 sets forth the time line of the key regulatory decisions in Ohio made since deregulation was initially passed in 1999. The medium shaded region represents the time-period after SB 221 was passed, which is the period when Ohio first began to attract commercial retail electricity service companies into its electricity markets. The darker shade represents the period after which the rate stabilization period ended, and when the deregulated markets began in earnest.

<sup>39</sup> FirstEnergy Tariff Sheets 2016 (sheet 80). Residential consumers have 33 non-bypassable riders in CEI's service territory.

<sup>40</sup> PUCO Case Number 12-3151-EL-COI, Entry Order from PUCO, dated 12/12/2012 at 1.

<sup>41</sup> See e.g. "The Players in the Ohio Energy Market." Direct Energy. Retrieved from: <https://www.directenergy.com/learning-center/energy-choice/ohio-players-electric-market>. See also: <http://www.puco.ohio.gov/puco/index.cfm/docketing/regulated-company-list?InId=25>

**Figure 1. Ohio Electric Market Restructuring Process**  
**Timeline of Major Events in Ohio Electric Restructuring**



Source: Noah Dormady, et al, Ohio State University (2016)

**D. OHIO’S COMPETITIVE LANDSCAPE SINCE 2009**

Nearly all of the electricity consumed in Ohio from the start of deregulation in 2001 through 2008 was provided by IOUs and their market affiliates—the EDUs. Attracting competitive retail electricity providers to bid on providing power to end users in Ohio was, and continues to be, critical to the success of injecting competitive market forces into the state’s economy.<sup>42</sup> Since 2009 Ohio has been successful in attracting a number of significant CRES providers. FirstEnergy Solutions continues to be the largest CRES provider in Ohio; however, as can be seen by the following table, its market share has dropped considerably from 2011 to 2015:

<sup>42</sup> The PUCO recognizes two types of competitive retail electric service (CRES) providers: (1) competitive retail electric suppliers, and (2) government aggregators. As of August 2016, there were 1141 electric providers registered in Ohio, of which 342 were government aggregators, and 799 were competitive retail electric suppliers (CRES) providers. The PUCO also recognizes multiple forms of CRES providers, including brokers/nongovernment aggregators, generators, and marketers. See Public Utility Commission of Ohio at: <http://www.puco.ohio.gov/puco/index.cfm/docketing/regulating-company-list/>. Many CRES providers list themselves in multiple categories, making it appear that there are more registered CRES providers than there actually are.

**Table 1. Sale Amount Generated by Commercial Electric Suppliers (MWH)**

| <b>MWH</b>                 | <b>2011</b> | <b>2013</b>      | <b>2015</b>      |
|----------------------------|-------------|------------------|------------------|
| FirstEnergy Solutions Corp | 41,223,219  | 49,437,270       | 27,160,820       |
| AEP Energy                 | 1,513,656   | 7,554,206        | 9,390,908        |
| Others                     | 21,308,010  | 34,452,631       | 60,049,598       |
| Total <sup>43</sup>        | 64,044,885  | 91,444,107       | 96,601,326       |
| <b>Percent Change</b>      |             | <b>2011-2013</b> | <b>2013-2015</b> |
| FirstEnergy Solutions Corp |             | 19.9%            | -45.1%           |
| AEP Energy                 |             | 399.1%           | 24.3%            |
| Others                     |             | 61.7%            | 74.3%            |
| Total                      |             | 42.8%            | 5.6%             |

Source: PUCO Annual Reports<sup>44</sup>

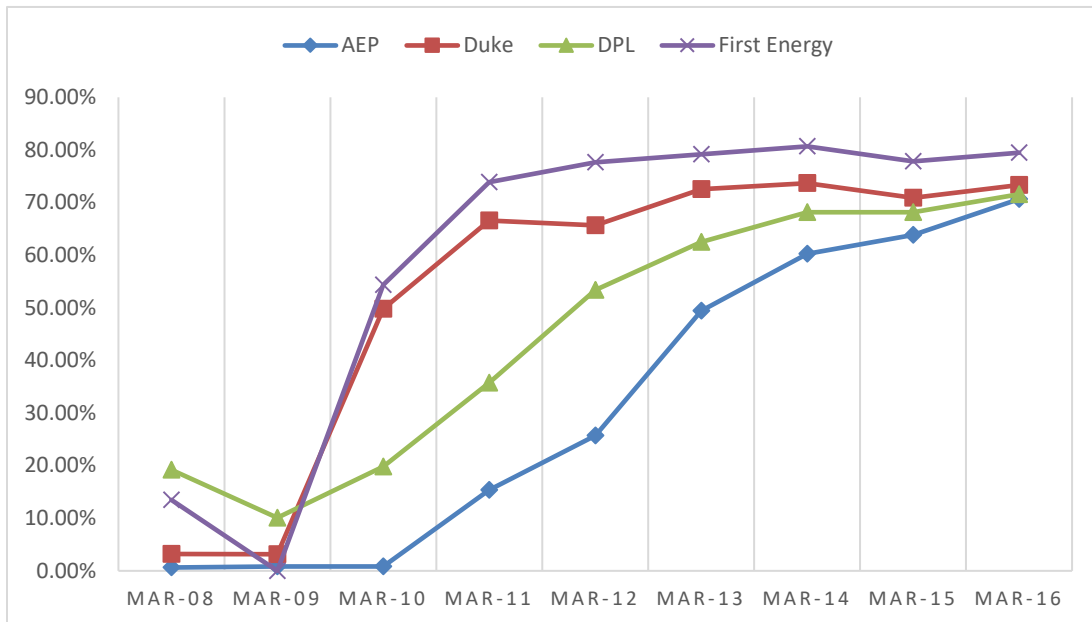
Major CRES providers (as opposed to Ohio IOUs) have made considerable market gains since 2011. Direct Energy, in particular, had achieved a 14 percent share of the electricity shopping market. Other non-incumbent companies that were able to obtain at least 5 percent of market share in Ohio between 2013 and 2015 include Noble Americas, GDF Suez (now Engie) and Constellation.

Since 2008 the amount of retail electricity shopping has also seen a marked increase. As seen in Figure 2, over the last eight years the percentage of energy that is sold through shopping has grown from an average of 9.13% to an average of 73.75%. Additional information on switching rates can be found in Appendix 2.

<sup>43</sup> Public Utilities Commission of Ohio. (2016) Summary of switch rates from EDU to CRES providers in terms of sales. Retrieved from: <http://www.puco.ohio.gov/puco/index.cfm/industry-information/statistical-reports/electric-customer-choice-switch-rates-and-aggregation-activity/electric-switch-rates-by-sales/sales-2q2016/>

<sup>44</sup> PUCO Annual Reports, 2011-2015. Other CRES providers include, but are not limited to, Duke Energy Retail, Dynegy, Dayton Power & Light Energy Resources, Constellation New Energy Inc., Champion Energy Services, Noble Americas Energy Solutions LLC, Direct Energy Services LLC, MP2 Energy, MidAmerican Energy and GDF Suez Energy Solutions LLC.

Figure 2. Percentage of Ohio Energy Sold to Shoppers, 2008-2016



Source: PUCO (2016)<sup>45</sup>

## E. STANDARD SERVICE OFFERS

Standard Service Offers in Ohio have been set by a mixture of cost-based and auction-based accounting practices. By the fall of 2016, however, all of the utilities in Ohio had transitioned to using 100 percent auction-based accounting to determine their SSO prices. FirstEnergy has been using auctions to determine the SSO price since 2009. In 2012 Duke transitioned to 100 percent auction, and in 2015 AEP also transitioned to 100 percent auction. DP&L transitioned to a 100 percent auction in January 2014.

Electricity consumers in Ohio can use the “Price to Compare” in selecting their electricity supplier. To electricity users, the PTC represents that portion of the cost of electricity that consumers can avoid by selecting an offer other than the SSO from the traditional utility (this selection process is called “shopping”). CRES providers think of the PTC as the price that they have to beat to win business and to gain market share. The terms “PTC” and “SSO” are used interchangeably in the electricity business.

The SSO auctions are conducted in compliance with electric stability plans approved by the PUCO. Typically they are undertaken in tranches, with each tranche representing a target purchase of electricity 12, 24 and 36 months in advance of delivery.<sup>46</sup> The electricity generating companies that sell power at these auctions are usually obligated to supply whatever volume of electricity may be required to fulfill their pro-rata share of the tranche. In the recent auction conducted by

<sup>45</sup> *Id.*

<sup>46</sup> FirstEnergy (2016). FirstEnergy Ohio Utilities’ CBP SSO Auctions. Retrieved from: <http://www.firstenergycbp.com/FAQ.aspx>



FirstEnergy, the auction cleared at \$48.46, \$49.36 and \$50.49 per MWh for the 1, 2 and 3-year products.<sup>47</sup>

Auction bids contain more than the cost of generating the required power: they also include capacity costs, which have become an increasingly large part of the Price to Compare. For a typical 24-month bid into an SSO auction, energy and capacity together comprise 88 percent of the total bid. An example of the breakdown of the build out for a competitive supplier bidding on an auction is in Table 2:

**Table 2. Supplier Cost Build Out Example for SSO Auction**

|                                     | <b>24-Month</b> |
|-------------------------------------|-----------------|
| Energy                              | 61%             |
| Capacity                            | 27%             |
| Risks, Additional Costs, and Margin | 12%             |
|                                     | 100%            |

Source: Industry Interviews (2016)<sup>48</sup>

An analysis of how the SSOs were affected by the change from cost-plus accounting to auctions is presented in Section IV, *infra*. It is important for consumers to remember, however, that even if they choose to not shop and to accept the PTC, this is still only a portion of the total cost of electricity that is reflected in the bills they receive. Distribution, transmission and non-bypassable riders comprise nearly a third of the total cost (*see* Figure 4 below in Section IV, *infra*.)

### III. LITERATURE REVIEW

In addition to Ardoin and Grady, a number of researchers have sought to understand if deregulation of electricity has reduced costs. The bulk of the peer-reviewed research indicates that deregulation reduces electricity prices. Joskow (2006) examined the impacts of wholesale and retail market reforms on average retail residential and industrial price in different states using data from 1970 to 2003 and from 1981 to 2003 and found that competition has been associated with lower retail prices overall, although less so for small customers.<sup>49</sup> Su’s (2014) analysis of the impact of deregulation on electricity price for the period from 1990 to 2011 concluded that deregulation lead to a reduction in residential electricity prices, but that the reduction occurred

<sup>47</sup> Kaften, C. (2016). *Energy Manager Today*. Retrieved from: <http://www.energymanagertoday.com/puco-accepts-results-of-firstenergy-auction-0123575/>

<sup>48</sup> Private communication with CRES providers and brokers. “Energy” as used here means the generation of electricity. This is a common method that retail companies use to differentiate the cost of generation from the cost of electricity, which term usually encompasses the entire cost, including distribution, transmission and other non-bypassable costs.

<sup>49</sup> Joskow, P.L. (2006). *Markets for Power in the United States: An Interim Assessment*. AEI-Brookings Joint Center Working Paper, 05-20.

during the first five years after deregulation.<sup>50</sup> Carlson and Loomis (2008) examined residential electricity prices in five states (IL, IN, IA, KY, MO, and WI) between 1997 and 2007 and concluded that both nominal and real electricity prices fell in deregulated states during the time-period studied.<sup>51</sup>

Joskow (1997) also found that retail competition lowered both residential and industrial electricity prices in Texas.<sup>52</sup> Swadley and Yucel (2011) analyzed retail electricity prices in the residential sector in 16 states (CA, CT, DE, IL, MA, MD, ME, MI, NH, NJ, NY, OH, PA, RI, TX, and VA) and the District of Columbia, finding that retail competition lowered the markup of retail prices over wholesale costs, and that deregulation generally appeared to lower prices more in states with a higher proportion of customers participating in retail choice.<sup>53</sup> Fabrizio et al. (2007) found evidence of reduced fuel and nonfuel expenses in fossil-fueled plants in states that restructured their wholesale markets to accommodate competition in electricity generating markets.<sup>54</sup> Ros (2016) found that competition in electricity markets was associated with lower electricity prices with the mean total impact being price decreases of -4.2 percent, -8.5 percent and -11.6 percent for residential, commercial, and industrial customers during the period 1972 to 2009.<sup>55</sup>

Another recent study ranked price increases between 2008-2015 for the 49 contiguous electricity jurisdictions in the United States. In this study, Kuipers and Chappelle (2016) found that since the recession of 2008, electricity customer choice has “routinely outperforming traditional monopolies in terms of price.”<sup>56</sup> By comparing “all-sector,” all-in prices between 2008 and 2015, Kuipers and Chappelle found that “competitive choice states cluster toward the low end” of rate increases. Further, half of the 14 choice states showed price decreases, while only 3 of 35 monopoly states showed a decrease.<sup>57</sup> Ohio, according to Kuipers and Chappelle, was the weakest performing among the deregulated states, with nearly a 20 percent average price increase:

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<sup>50</sup> Su, X. (2014). Have Customers Benefited from Electricity Retail Competition? *Journal of Regulatory Economics*, 47(2), 146-182.

<sup>51</sup> Carlson, J.L., and Loomis, D., (2008) An Assessment of the Impact of Deregulation on the Relative Price of Electricity in Illinois. *The Electricity Journal*, 21(6), 60-70.

<sup>52</sup> Joskow, P.L., (1997. Restructuring Competition and Regulatory Reform in the US Electricity Sector. *The Journal of Economic Perspectives*, 11(3), 119-138.

<sup>53</sup> Swadley, A. and Yucel, M., (2007) Did Residential Electricity Rates Fall after Retail Competition? A Dynamic Panel Analysis. *Energy Policy*, 39(12), 7702-7711. For this Study we used a different group of states, although they were mostly the same. See Section I, *supra*, note 1. Michigan, for instance, was deregulated in 2006, but later re-regulated, so was considered a regulated jurisdiction for this Study.

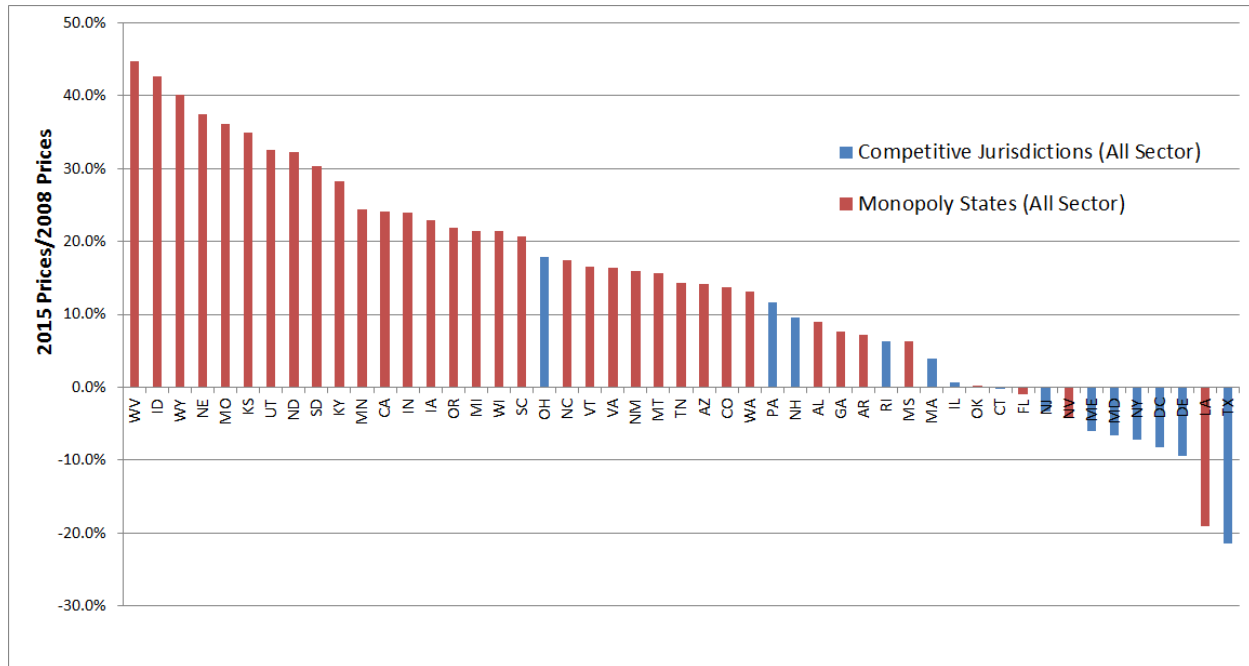
<sup>54</sup> Fabrizio, Kira R., Rose, Nancy R., and Wolfram, Catherine D.(2007). Do Markets Reduce Cost? Assessing the Impact of Regulatory Restructuring on U.S. Electric Generation Efficiency. *The American Economic Review*, 97(4), 1250-1277.

<sup>55</sup> Ros, A. (2016). An Econometric Assessment of Electricity Demand in the United States Using Utility-Specific Panel Data and the Impact of Retail Competition on Prices. *The Energy Journal*, 38(4).

<sup>56</sup> Kuipers, W. & Chappelle, L. (2016). Electricity Customer Choice Out-Performs Traditional Monopoly. *Utility Dive* retrieved from: <http://www.utilitydive.com/news/electricity-customer-choice-out-performs-traditional-monopoly-1/424986/>

<sup>57</sup> *Id.* This Study used the same 14 jurisdictions identified as deregulated by Kuipers & Chappelle.

**Figure 3. Comparison of Change in All-In Electricity Prices Between 2008 and 2015 in 49 US Regulatory Jurisdictions**



Source: Electricity Choice Now (2016)<sup>58</sup>

Kuipers and Chapelle argued that the reason why regulated states have performed poorly compared to deregulated states is that “traditional monopoly needs to push consumer prices higher as sales volumes stagnate. In contrast, in the Choice states, overall prices are suppressed by flat demand.”<sup>59</sup> It should be noted, however, that notwithstanding Ohio’s weaker overall performance than other deregulated states, Ohio still outperformed Michigan and other neighboring states that have not yet deregulated. This is especially true with West Virginia, which had the worst performance of any of the 49 jurisdictions. Further, as will be explained in Section IV, *infra*, the reasons for Ohio’s relatively weak performance relates to the regulated portion of the consumer’s cost of electricity rather than the portion of the final bill that is associated with deregulated generation costs.

In October of 2016, the Kleinman Center for Energy Policy at the University of Pennsylvania published a study that demonstrated similar results to those found in the other studies identified herein. The authors concluded that overall, the statewide average “all-sector retail price of electricity in Pennsylvania was 0.1 percent below the national average, compared to 15 percent above the national average before restructuring.”<sup>60</sup> Using EIA data to determine the savings, the

<sup>58</sup> Energy Choice Now. (2016). Retrieved from: <http://ecnmichigan.com/>

<sup>59</sup> *Id.*

<sup>60</sup> Hanger, J. & Simeone, C. (2016) A Case Study of Electric Competition Results in Pennsylvania. Kleinman Center for Energy Policy, 24. Retrieved from: [http://kleinmanenergy.upenn.edu/sites/default/files/proceedingsreports/A%20Case%20Study%20of%20Electric%20Competition%20Results%20in%20Pennsylvania\\_0.pdf](http://kleinmanenergy.upenn.edu/sites/default/files/proceedingsreports/A%20Case%20Study%20of%20Electric%20Competition%20Results%20in%20Pennsylvania_0.pdf)

authors further concluded that residential ratepayers in Pennsylvania saved around \$819 million in 2016 as a result of deregulation.<sup>61</sup>

On balance, the research literature establishes that deregulation tends to decrease overall electricity prices, although exactly how, and to what extent, depends on specific market and regulatory conditions that are extremely difficult to fully capture with highly aggregated statistical models. Indeed, as will be seen from the following discussion, when the data are unbundled and examined, it is apparent that Ohio’s consumers have benefited greatly from deregulation. Further, this trend will likely continue, as long as utilities are regulated in a manner that prevents them from making up the revenue they lose due to competition by increasing the charges they can impose on the regulated side of the business.

## IV. ANALYSIS OF THE EFFECTS OF DEREGULATION ON ELECTRICITY PRICES IN OHIO

### A. REGULATED AND DEREGULATED COMPONENTS OF ELECTRICITY PRICE

One of the challenges of analyzing the impact of deregulation comes from the complex composition of electricity prices. The retail price that a consumer pays has multiple components that are difficult to disentangle and understand. Compounding the difficulty is the fact that only portions of the delivered cost of electricity have been deregulated. The major cost components of the retail price of electricity for a typical commercial Ohio customer are presented in Figure 4 and described below:

- **Energy (deregulated).** The energy charge refers to the actual cost of generating electricity by the generating company. The industry commonly uses the term “energy” price to describe this charge to differentiate it from the “electricity” price, which is used in the industry to describe the “all in” retail price paid for by the consumer. This charge makes up the single largest share of the total price. Purchases of electricity from generators constituted 48 percent of the end user’s electric bill in 2015 (Figure 4).
- **Capacity (deregulated).** The Regional Transmission Organization (RTO)<sup>62</sup> that regulates and manages Ohio’s electricity generation and interstate transmission markets is PJM Interconnect. PJM states that the capacity market is designed to “meet the demand for the future.”<sup>63</sup> Its purpose is to ensure long-term grid reliability, where reliability is primarily established through a three-year-ahead electricity generation auction that it conducts. PJM also states that capacity represents “the commitment of resources to

<sup>61</sup> *Id.*

<sup>62</sup> Regional Transmission Organizations have been created by the Federal Energy Regulatory Commission to manage the wholesale markets and transmission for the deregulated states. There are 10 RTOs in North America, and Ohio’s RTO, PJM Interconnect, is the largest in North America in terms of total electricity generation. See: <http://www.eia.gov/todayinenergy/detail.cfm?id=790>. It includes, among other states, Pennsylvania, New Jersey and Maryland (hence, PJM).

<sup>63</sup> PJM. (2016). Capacity Market. PJM Learning Center. Retrieved from: <https://learn.pjm.com/three-priorities/buying-and-selling-energy/capacity-markets.aspx>.

deliver [electricity] when needed, particularly in case a grid emergency.” Under this definition, “capacity” consists of dedicated generation reserves.<sup>64</sup> PJM likens this to a big box store that builds extra parking spots for Black Friday, even though it may need those spots on only one day a year.<sup>65</sup> Because capacity relates to generation, it is on the deregulated side of pricing and is usually passed through to consumers by the commercial retail electric service company as an RTO charge. Capacity charges are approximately 12 percent of the retail cost of electricity (Figure 4).

- Ancillary Charges (deregulated). Ancillary Services describes an assortment of charges incurred by PJM for managing the grid. There are two general categories of ancillary services: regulation services and operating reserves. Regulation services provide the short-term adjustments needed to maintain system frequency. Operating reserves provide back-up power in the event of emergencies. These charges are around 2 percent of the total cost of electricity (Figure 4).
- Line Losses (deregulated). Line loss charges account for the energy that is lost while transmitting electricity along transmission and distribution lines. The loss rate is a percentage of the total energy consumed and is set by the local operating companies for the IOUs (also called EDUs). Line losses represent approximately 3 percent of final electricity charges (Figure 4).
- Transmission (regulated). Transmission charges enable utilities to recover the cost of transporting high voltage electricity from generating facilities to distribution systems, along with the costs associated with maintaining the grid. Until 2015, some Ohio utilities delegated recovery of transmission costs to the CRES provider through an accounting provided by the RTO. However, all Ohio utilities now recover transmission charges as a non-bypassable cost through their EDU. Transmission charges contribute around 8 percent of final electricity costs (Figure 4).
- Distribution (regulated). Low voltage transportation and delivery costs are called distribution charges and are set by state regulators through tariffs collected by the EDU. Distribution charges are responsible for about 3 percent of the electricity users’ bill (Figure 4).
- Non-bypassable riders (regulated). Non-bypassable riders are charges that cannot be avoided through shopping. They are assessed to all electricity users in an EDU’s service territory no matter which company they contract with to provide their electricity. Non-bypassable riders are regulated costs that are assessed with the approval of the PUCO for items such as deferred fuel costs, storm damage, transmission costs and discounted electricity purchases for economic development. The cost of non-bypassable riders have been rapidly rising, and as a result, have become controversial, especially when they are used to support deregulated activities, such as power generation. These riders now

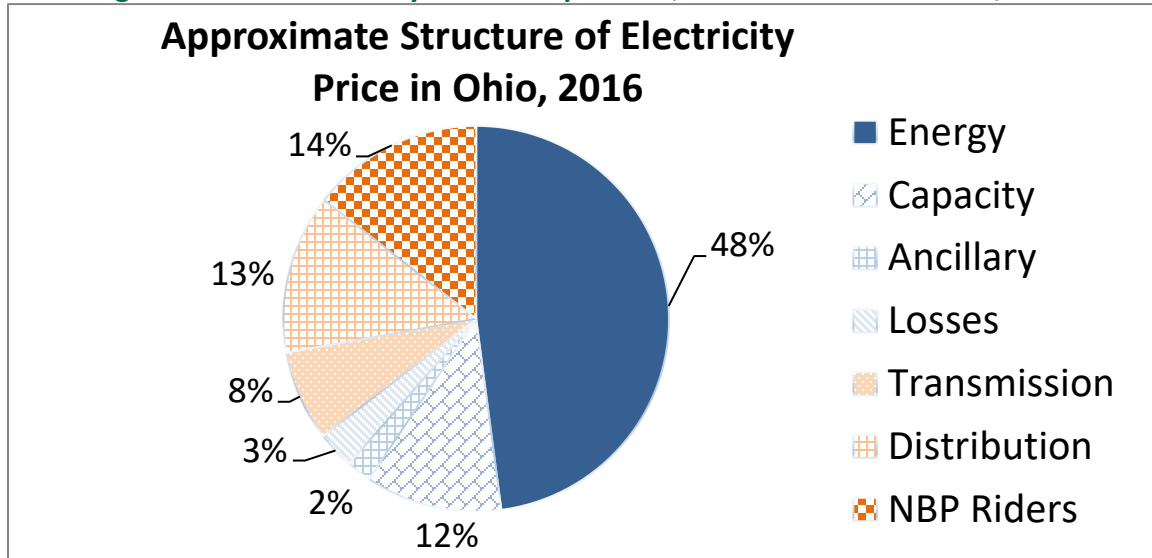
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<sup>64</sup> PJM sets forth initially that the purpose of capacity is to encourage the building of new generation. Elsewhere, however, it defines capacity as a form of standby power – as described by the parking lot analogy. Further confusing these definitions is that there are also elements of standby power in ancillary charges, such as blackstart, spinning reserves, etc. Presumably the difference is that the latter are considered emergency standby reserves. See *Id.*

<sup>65</sup> *Id.*

represent approximately 14 percent of a consumer's cost of electricity usage. (See Figure 4)

**Figure 4. Ohio Electricity Price Components, Commercial Customers, 2016**



Source: Scioto Energy (2016). Blue represents deregulated; orange regulated costs. Assumes a commercial customer with a 47 percent load factor.

One of the challenges to analyzing the effects of deregulation on the final price consumers' pay is to separate the regulated portions of the price from the deregulated portions. Unfortunately, due to the way the data are reported, some of these costs, in particular capacity, line losses and ancillary charges, are not always easy to untangle from the regulated costs. Two additional factors complicate efforts to isolate the impact of deregulated generation markets from the other portions of the bill customers' pay: (1) Regulated utilities do not commonly break down their costs and report them publicly in a way that enables direct comparison across states and EDU territories; and, (2) state regulatory agencies have idiosyncratically deregulated their territories, often using different terminology to describe similar activities or costs.

The result of this lack of transparency is that most studies looking at the effects of deregulation have used the "all-in" or "bundled" retail prices. The reason why they do so is that bundled price data are available from the Energy Information Agency (EIA),<sup>66</sup> and unbundled data are not. Unbundled electricity prices can only be obtained by surveying each state's regulatory agency and each regional transmission organization and hope for both cooperation and standard definitions of customers and charges. Also, the portion of the final bill that comes from regulated costs varies between states, between EDU territories within states, and across time.

In the end, the EIA's data are the most accessible and complete source of pricing data over time. This is why most studies use this data to evaluate the effects of restructured electricity markets.

<sup>66</sup> The EIA obtains its information from its EIA form 861 obtained annually from its electric power industry survey.

The analytical cost of using these data, however, is that the true impact of deregulation on price is less clear due to the significant fraction of the final bill that remains regulated.

Importantly, *the retail price that EIA uses for deregulated states is likely to be higher than that paid by consumers who shop for their electricity.* The EIA price is based upon the “all-in” price paid by those *who do not shop* – the standard service offers. As a result, the EIA price misses a significant portion of the savings generated by competition, especially in a state like Ohio where some 70 percent of the load that can be shopped is shopped.<sup>67</sup> If the state uses an auction to set the default, or SSO rates, then these rates may in part reflect competition. However as demonstrated in section IV below, even in those jurisdictions where the standard service offer is set wholly by a competitive auction, the SSO or default price still significantly underestimates the savings experienced by customers from deregulation.

Statistical and other techniques were used in this study to obtain the best and most accurate estimates of the impact of deregulation on electricity prices possible, given the way the data are collected and reported. See Section V below. Additionally, the Study Team supplemented the EIA data by gathering information from private sources for larger “mercantile” sales of electricity (i.e. sales to customers that use more than 700,000 kWh a year). The effects of deregulation on smaller “non-mercantile” consumers in Ohio were considered by assuming that the discount rates negotiated by a municipal government aggregator, Northeast Ohio Public Energy Council (NOPEC), for its customers is a representative discount for Ohio’s non-mercantile consumers.<sup>68</sup> NOPEC is the largest aggregator in the State of Ohio, serving nearly 500,000 customers in northern Ohio, and is one of the largest in the nation. As a result, its discount rate should be comparable to what many non-mercantile consumers who shop are able to get.<sup>69</sup> During the time-period relevant to this study, NOPEC has offered its residential customers 6 percent off of the SSO, and its commercial customers have received 4 percent off of the SSO. Accordingly, for purposes of this study, we assume that the NOPEC savings are representative of savings offered to non-mercantile shoppers throughout Ohio.<sup>70</sup>

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<sup>67</sup> See Section II(D), *supra*.

<sup>68</sup> A typical commercial restaurant uses around 500,000 kWhs per year. For this study, we modeled the PTC each January and June using the average commercial mercantile and non-mercantile load for each electric distribution utility to estimate total savings from shopping. We then used the NOPEC discount rate to calculate the savings for the non-mercantile load. See Section VII, *infra*. This savings estimate is both the most transparent available, and the easiest to use. However, commercial non-mercantile consumers can, and do, shop and CRES providers also compete with aggregators for this load, as they do for residential loads.

<sup>69</sup> The amount that an aggregator can negotiate off of the SSO will depend upon the size of its load (total aggregation), as well as other factors, such as the load capacity and how much “headroom” exists between the SSO and the private party retail price available for such a load.

<sup>70</sup> In addition to the 6 percent and 4 percent discount, NOPEC has also typically credited an additional 1 percent discount to its customers. See <https://www.nopecinfo.org/energy-solutions/electric-solutions/electric-pricing/>. That additional discount was not included in this analysis by the Study Team.

For mercantile customers, the Study Team used data that were aggregated from individual customer records provided by members of the Energy Professionals of Ohio.<sup>71</sup> These data were aggregated to maintain individual confidentiality, and include information on retail electric sales in the seven different electric distribution utility territories owned by the four investment owned utilities in Ohio: FirstEnergy, AEP Ohio, Duke Energy, and Dayton Power & Light. The sales data begin in 2011, which is when true competition began in Ohio.<sup>72</sup> These data can be used to benchmark the PTC for each EDU, as well as distribution, transmission and other non-bypassable charges (e.g. economic development and other riders). The all-in prices for consumers who shopped for electricity in Ohio were also determined.

Rate class average load factors and rate class average electricity consumption per year were used to model electricity prices and make consistent comparisons between each rate class's PTC and the privately contracted cost of generated electricity. Both of these calculations are consistent with the practices of the Public Utilities Commission of Ohio.<sup>73</sup> The average load factor assumed for the mercantile primary rate class was 67 percent with an average annual consumption, or usage, of 3 million kWhs. The average load factor assumed for the mercantile secondary rate class was 47 percent, with annual usage of 1 million kWhs. For the non-mercantile rate class, we assumed a discount tied to the PTC, as is commonly offered by aggregating companies to their customers.<sup>74</sup>

Sales data were broken down into secondary and primary users for each EDU. Secondary users typically consume lesser amounts of electricity, and take lower-voltage power, while primary users are generally large industrial consumers that consume large amounts of power and take high voltage electricity. Primary users are usually mercantile customers as defined by the PUCO, while secondary users can be either mercantile or non-mercantile customers, depending upon their yearly loads. Dividing the electricity users into rate class groups is required because differences in voltage level, electricity load size or usage, and peak load demand significantly influence the PTC and the purchase price of electricity from CRES providers.

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<sup>71</sup> Energy Professionals of Ohio is a trade association of brokers and consultants who work in the Ohio retail electricity and natural gas business. Aggregated customer data does not include data from Ohio IOU affiliated marketers. For a description of EPO, see: <http://www.energyprofessionalsofohio.com/>

<sup>72</sup> Commercial electricity sales are typically executed with multi-year contracts, or power purchase agreements (PPAs), that are based on generating prices at the time contracts are signed. As a result, these yearly contract rates do not compare directly with Standard Service Offer rates, which are set through auctions undertaken over several years, and from which the generating costs are blended. However, the differences between these two rates accurately portray differences in the cost of electricity in the generating market. Therefore, the savings identified accurately represent avoided costs, or savings, that accrue to electricity users by being able to shop for electricity generation. This is why the PUCO calls the SSO the "Price to Compare."

<sup>73</sup> Public Utilities Commission of Ohio. (2013). In The Matter of the Commission's Review of Customer Rate Impacts from Ohio Power Company's Transition to Market Based Rates. PUCO Case Number 13-1530-EL-UNC, Attachment 1A. Retrieved from: <https://dis.puc.state.oh.us/CaseRecord.aspx?CaseNo=13-1530>.

<sup>74</sup> Non-mercantile consumers can also shop among CRES providers. However, because aggregators represent most of this market and because their retail prices are readily available, the Study Team assumed in its analysis that all shopping non-mercantile users were able to secure the discount offered by NOPEC.



Further complicating the analysis of generating costs is the fact that the definitions for rate classes vary not only among states but also among EDUs within a state. The structure of an EDU's rate classes is demonstrated by FirstEnergy's CEI region:

**Table 3. FirstEnergy CEI Rate Classes**

| Rate Category | Description                                   |
|---------------|---|
| CE-RSF        | Residential Full Service                      |
| CE-RSD        | Residential Shopper                           |
| CE-GFS        | General Service-Secondary Full Service        |
| CE-GSD        | General Service-Secondary Shopper             |
| CE-GPF        | General Service-Primary Full Service          |
| CE-GPD        | General Service-Primary Shopper               |
| CE-GSUF       | General Service-Sub Transmission Full Service |
| CE-GSUD       | General Service-Sub Transmission Shopper      |
| CE-GTF        | General Service-Transmission Full Service     |
| CE-GTD        | General Service-Transmission Shopper          |
| CE-STLF       | Street Lighting Full Service                  |
| CE-STLD       | Street Lighting Shopper                       |
| CE-TRFF       | Traffic Lighting Full Service                 |
| CE-TRFD       | Traffic Lighting Shopper                      |
| CE-POLSF      | Private Outdoor Lighting Full Service         |
| CE-POLSD      | Private Outdoor Lighting Shopper              |

Source: North Shore Energy (2016)

## B. TRENDS IN RETAIL ELECTRICITY PRICING IN OHIO

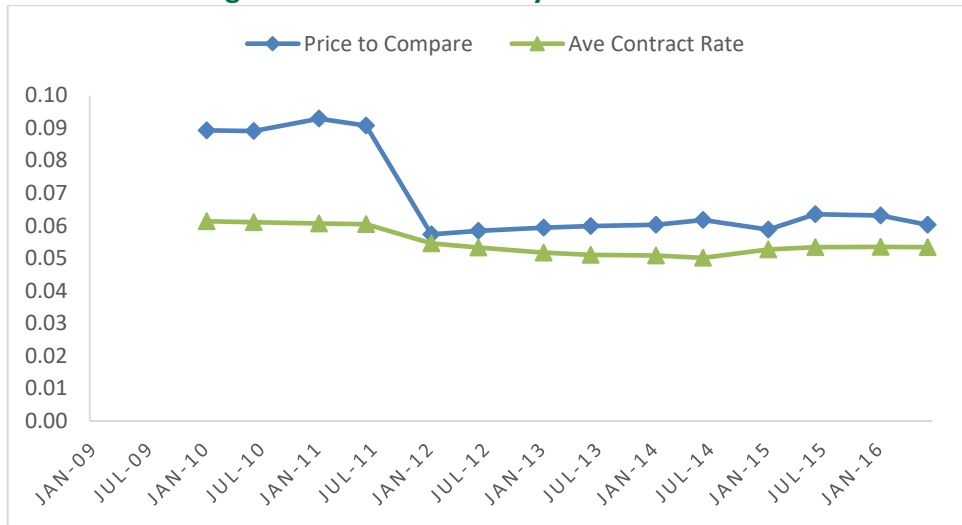
### 1. SSO Trends

Utilities in Ohio have used a mixture of auctions and cost-based generation (cost-of-service plus a guaranteed return on investment, sometimes referred to herein as the "cost-plus" method) approaches to arrive at their PTC. As utilities have phased in the use of generation auctions to determine their PTCs, they have introduced the benefits from competition into that price. The effect of introducing competition into the PTC calculation is apparent in the experiences of Duke Energy and AEP Ohio. In January 2012 Duke Energy switched from using a 100 percent "cost-plus" method of determining its PTC to a 100 percent "auction" method. In so doing, Duke's PTC for secondary mercantile consumers dropped by 37 percent, from \$0.090 to \$0.057 per kWh in the first quarter of 2012. See Figure 5 below.

AEP Ohio's Electric Distribution Utility Columbus Southern Power had a similar experience when it changed its cost of electricity acquisition from a cost-plus PTC to an auction-based PTC. AEP chose to phase in its auction pricing more slowly than Duke, fully transitioning from a 100 percent cost-plus PTC to a 100 percent auction-based PTC within a 12-month period. In June of 2014, the majority of AEP's PTC was based upon cost-plus accounting. At that time, Columbus Southern's

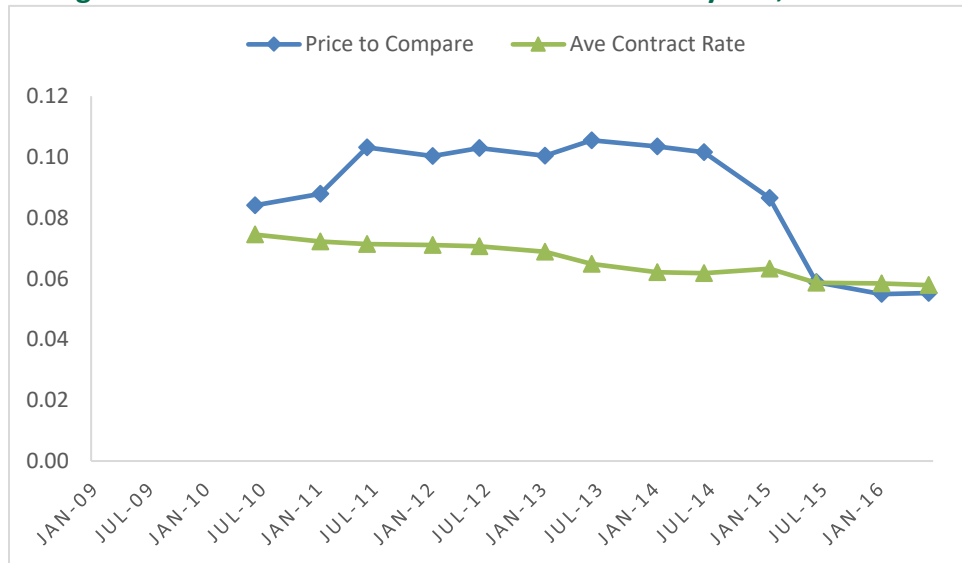
PTC for a secondary mercantile user was over \$0.10 per kWh (from 10 percent auction basis and 90 percent cost-based basis). By January of 2015, however, AEP had transitioned to 100 percent auction pricing, and the price dropped to \$0.0865 per kWh. By June of 2015, the price had fallen further to \$0.0549, totaling a 32 percent fall in one year. See Figure 6, below.

**Figure 5. Duke Secondary PTC 2010 to 2016**



Source: Scioto Energy (2016)

**Figure 6. AEP Ohio Columbus Southern Secondary PTC, 2010-2016**



Source: Scioto Energy (2016)

The data displayed in the Figures 5 and 6 show that Ohio’s transition to auction-based accounting allowed the PTC rate to become more competitive with private contract rates. These data show that competitive electric generation markets work to reduce the difference between the PTC and private contract rates and lower costs to consumers, which was a goal of deregulating electricity-generating markets. Further proof lies in the reduction of available avoided costs from shopping.

The difference between the PTC rate and the private contract rate has all but disappeared in some utility service areas in Ohio. The difference between the PTC and average private contract rate fell from \$.0444/kWh in January 2014 to \$0.0037/kWh in June 2015 in the case of AEP's Columbus Southern Power. Duke Energy's avoided costs dropped from \$0.0321/kWh in January 2011 to \$.00689 in June 2016.

As auction prices reduce the PTC, it inevitably makes for an increasingly challenging environment for aggregators and CRES providers to compete. However, it is important to remember that the competitive contract prices include legacy prices from prior generation auctions and their resulting contracts; these lags influence competitive prices for a 2 to 3-year time-period. Aggregators and CRES providers will be looking for new supplies and possibly new suppliers when competing with the PTC. Those new supplies are likely to also be lower cost, allowing savings to continue to be gained through shopping.

The drop in the PTC is not, however, solely attributable to the introduction of competition into the generation market. In both the Duke and AEP cases, transmission costs moved from PJM pass-through charges into EDU non-bypassable charges. When transmission charges convert into EDU non-bypassable charges, they drop out of the PTC and move over into the PUCO regulated portion of a customer's electric bill. However, the movement of the transmission charge into the non-bypassable charge appears to have had a much greater effect on the AEP Ohio's PTC than it did on the Duke PTC.

In the case of AEP Ohio, the typical transmission charge for mercantile users passed through to its customers by PJM via their CRES provider in the AEP Ohio territory was around \$0.007/kWh in January of 2015.<sup>75</sup> Yet AEP Ohio Columbus Southern Power's price fall between January and June 2015 was over 2.5 cents/kWh between January and June 2015. In other words, moving transmission charges into non-bypassable charges only accounted for 28 percent of the reported drop in PTC. The move in transmission costs was a minority component to the drop in the PTC.

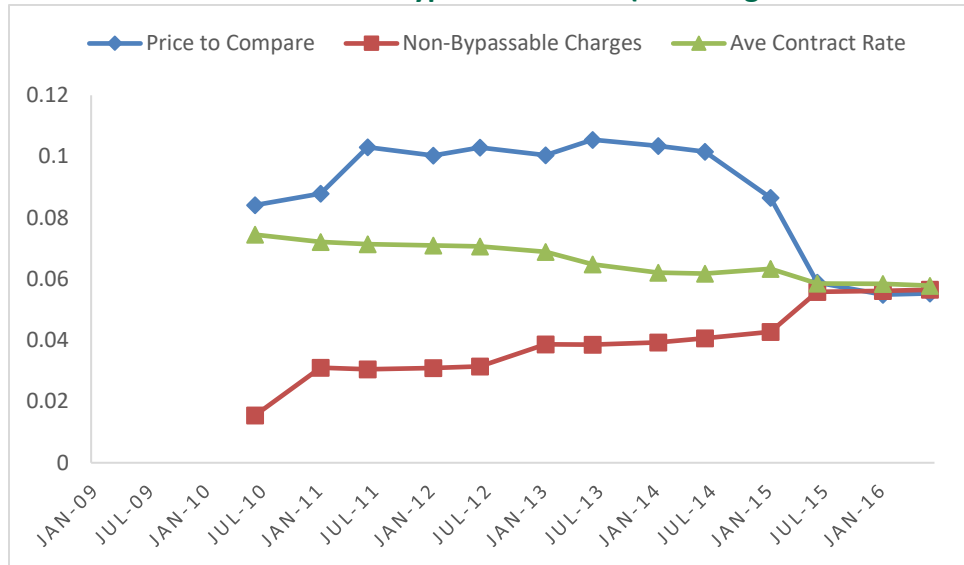
The transmission charge that AEP Ohio folded into the non-bypassable charges that was concurrent with the removal of PJM's pass-through transmission charge was nearly double the PJM pass through transmission charge. It appears that AEP Ohio used a formula to derive the cost of transmission that differed from that used by PJM.<sup>76</sup> It is beyond the scope of this Study to determine what lies behind the transmission charges that were approved by regulators, but this difference raises an important issue relating to competition: *Utilities that are experiencing the squeeze from lost profit margins from their generating assets have an incentive to try to make up those losses by shifting costs and assets into their regulated distribution subsidiary companies—the EDUs.* Figure 7 shows how non-bypassable charges spiked between January and June 2015, which is when the PTC dropped.

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<sup>75</sup> This number is based upon EPO broker calculations.

<sup>76</sup> Transmission costs by AEP are collected through the Basic Transmission Cost Rider.

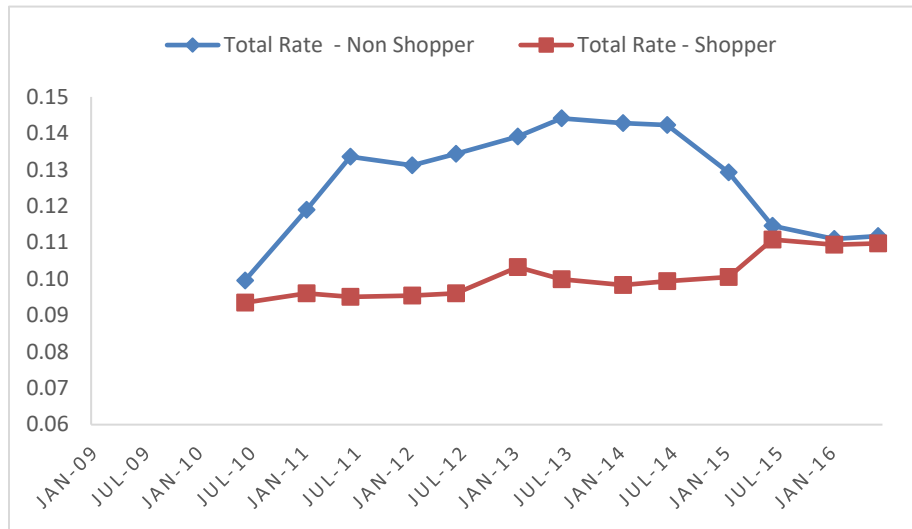
**Figure 7. AEP Columbus Southern Secondary Mercantile PTC Charges Compared to Average Private Contract Price and Non-Bypassable Costs (Including Distribution costs)**



Source: Scioto Energy (2016)

Indeed it is clear that for AEP Ohio Columbus Southern Power, since 2011 private contract prices have steadily decreased from 6.5 to 5.3 cents/kWh mainly due to the falling wholesale energy generating markets; however, non-bypassable costs have steadily increased by more than this amount (from 3.1 to 5.65 cents/kWh). The increase in non-bypassable charges has essentially erased the benefits consumers derived from falling wholesale energy prices for the past few years. Indeed, for this particular rate class, in this particular EDU, total electricity costs exceed 11 cents per kWh; half of the total cost is from non-bypassable charges. These increases in AEP Ohio's non-bypassable charges also partially explain why Ohio lags other deregulated states in the competitiveness of its total electricity rates, as documented by Kuipers and Chapelle (Figure 4, *supra*).

**Figure 8. AEP Columbus Southern Secondary Mercantile Total Charges for Shoppers Compared to Total Charges for Non-Shoppers**



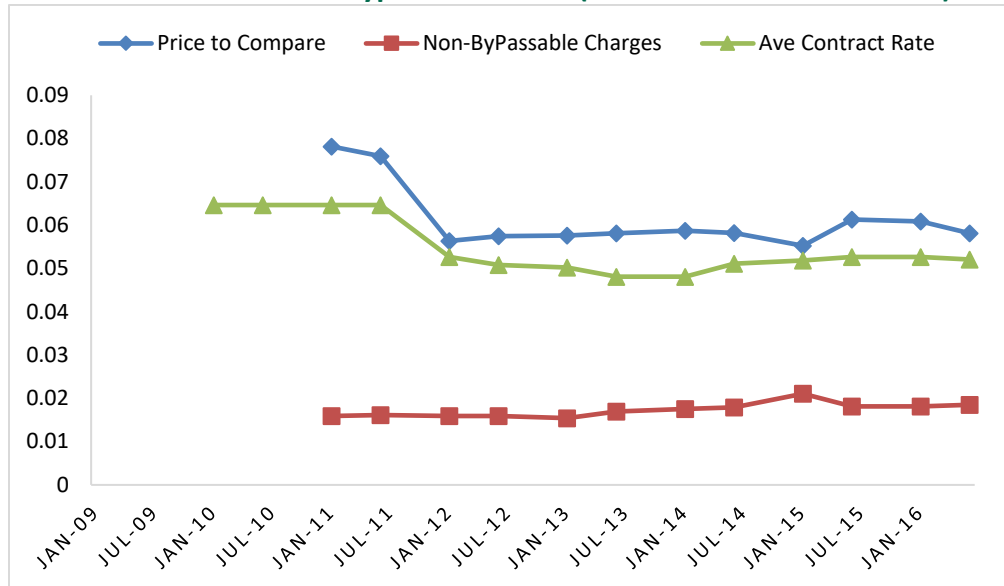
Source: Scioto Energy (2016)

Duke Energy also removed transmission charges from its PTC; however, this shift did not result in a large contemporaneous rise in its non-bypassable charges, as it did for AEP’s EDU subsidiaries.

The contrast in Duke Energy and AEP Ohio’s Columbus Southern Power non-bypassable charges raises an important regulatory question: Is it sufficient for utilities to merely separate their generation and EDU businesses, setting up “Chinese Walls” between their sister subsidiary companies, for electricity users to realize the full benefit from competition in the electricity generating market? Senate Bill 221 mandated that all utilities completely separate their deregulated and regulated businesses, but did not require that the generation assets be sold to third parties. Duke Energy, which saw no dramatic rise in its non-bypassable charges when it transitioned to PTCs based solely on the outcomes from generation auctions, had previously sold all of its generation assets to a third-party. AEP, on the other hand, retained its generation fleet as a subsidiary.<sup>77</sup>

<sup>77</sup> Howland, E. (2014). AEP Ohio spins off power plants into unregulated genco. Retrieved from: <http://www.utilitydive.com/news/aep-ohio-spins-off-power-plants-into-unregulated-genco/210312/>. See also: PR Newswire (2015). Duke Energy completes sale of its non-regulated Midwest generation business to Dynegy. Retrieved from: <http://www.prnewswire.com/news-releases/duke-energy-completes-sale-of-its-non-regulated-midwest-generation-business-to-dynegy-300060392.html>

**Figure 9. Duke Energy's Secondary Mercantile PTC Charges Compared to Average Private Contract Price and Non-Bypassable Costs (Includes Distribution Costs)**



Source: Scioto Energy (2016)

Other EDU regions in Ohio also are experiencing increases in non-bypassable charges. For instance, non-bypassable charges in CEI's secondary mercantile market have gone from \$0.039 in January of 2012 to \$0.058 in January of 2016. *Rising non-bypassable charges in Ohio have had the effect of offsetting some, or all, of the savings obtained from falling energy prices on the PTC or from shopping.* Graphs for all the EDUs and their mercantile and non-mercantile prices from 2009-2016 can be found in Appendix 4.

## 2. Avoided Cost and Headroom

Standard Service Offers that are determined by competitive auctions will inevitably lead to falling PTCs, until the most economically efficient possible outcome is reached. Inevitably this leads to the potential for shrinking avoided costs for consumers. It also leads to shrinking "headroom" – which is a concept similar to avoided cost, but with important distinctions. Headroom is the difference between the PTC and *current* contract prices. Avoided cost is the difference between PTC and the price paid under previous contracts, which typically lag by a year or two. A consumer may, for instance, beat the PTC one year in its contract, but not the next, and still come out well ahead over the span of the two years.

In a mature deregulated market, where electricity generation auctions are used to determine SSOs, there will be less headroom. This is exactly the case in Ohio in 2016, where auctions have been bringing down the PTC. For instance, in July 2016 Direct Energy saw Ohio's headroom drop to below \$20.00 per megawatt hour (MWh) for most of its July 2016 Ohio markets, and some are below \$10/MWh.<sup>78</sup> It remains to be seen whether sufficient headroom exists in the marketplace to continue to entice aggregators and CRES providers to compete to expand their share of Ohio's

<sup>78</sup> Communication with Direct Energy.

retail electricity markets as their cost differential with PTCs is eroded. It is important to remember, however, that headroom establishes the difference between private contract retail prices and the PTC, and as such it includes a profit margin for the CRES providers

Even while auction-based SSO, or default, rates trend toward the average shopping price, CRES providers and aggregators still have ample opportunity to find savings for their customers. One way they can do this is by targeting customers in rate classes that have more headroom. Additionally, bigger electricity consumers can find savings through competition even when headroom is negative. This is because competitive markets allow for targeting specific customer load factors, or for the consumer to use load management practices that they could not employ in regulated markets. Moreover, there will likely always be some headroom: companies that bid into the standard service auction must undertake full-requirements obligations. This means that the party bidding generation into an auction needs to include an element of volume risk into its auction bid that CRES providers negotiating with shopping customers may not have to include.<sup>79</sup> CRES providers negotiating with end users can include contractual load bandwidths in their contracts, or use other techniques to constrain volume risk. These contractual techniques give CRES providers knowledge about the expected distribution of volumes demanded by their customers, thereby reducing volume risk.

Customers are motivated to enter contracts by avoided cost (or money saved) against the PTC. Table 4 displays our estimates of the costs secondary mercantile customers of Ohio's CRES providers in Ohio avoided from 2011 to 2016, expressed in terms of avoided costs as a percent of the Price to Compare. For most EDUs, avoided costs were very high when competition began in earnest around 2010. This was attributable to the fact that some of Ohio's utilities had not completely phased in auction pricing as the basis for their PTC. FirstEnergy's distribution utilities, which used 100 percent auction pricing from the early stages of deregulation, started with a smaller avoided cost for shoppers than did the EDUs of the other IOUs. AEP Ohio, for example, experienced a significant drop in avoided costs once its transition to auction-based pricing was completed (from January 2015 to June 2015).

As of June 2016, avoided costs for secondary mercantile users had dropped to below 10 percent in most markets, indicating that competitive auction pricing has driven down the Price to Compare. The largest users of electricity, the primary users, have experienced similar trends in avoided costs since the start of deregulation in the generating market. Avoided costs for primary customers in both the Duke and AEP Ohio Power territories have leveled off to around 10 percent for the past few years.

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<sup>79</sup> One of DTE Energy's arguments against deregulation in Michigan is that the 10 percent of Michigan shoppers are free to come back at any time to the SSO should the headroom disappear. This forces the 90 percent that are not allowed to shop to keep and pay for standby power in case the liberated 10 percent return. This scenario of course would be a disaster in Ohio, since around 70 percent of Ohio consumers shop. However, most shoppers in Ohio are contractually bound, and cannot abandon their contracts without consequences.

**Table 4. Average Avoided Costs as Percent off PTC for the Secondary Mercantile Market**

|                           | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 <sup>80</sup> |
|---------------------------|------|------|------|------|------|--------------------|
| AEP <sup>81</sup>         | 20%  | 24%  | 29%  | 30%  | 18%  | 4%                 |
| Duke                      | 34%  | 7%   | 14%  | 17%  | 13%  | 13%                |
| DPL                       | 19%  | 15%  | 16%  | 20%  | 19%  | 7%                 |
| FirstEnergy <sup>82</sup> | 16%  | 15%  | 13%  | 24%  | 21%  | 7%                 |
| Average                   | 22%  | 15%  | 18%  | 23%  | 18%  | 8%                 |

Source: Scioto Energy (2016)

The central point to take away from Table 4 is that competition in the electric generating market is working: PTCs are decreasing, however, CRES providers still provide a cost advantage over the IOUs, even after the market equilibrium has been established.

## V. COMPARING TOTAL RETAIL ELECTRICITY COSTS IN MIDWESTERN DEREGULATED STATES TO MIDWESTERN REGULATED STATES

As discussed earlier, the EIA data fail to account for the full impact of deregulation of the market for electricity generation because the agency reports the “all-in” price of electricity to end-users using the standard service offers published by the utilities. As a result, the data do not reflect savings due to shopping, and analyses based upon these data underestimate the total savings attributable to deregulation. Nevertheless, to obtain the best feasible estimates of the impact of deregulation without considering shopping, we conducted three different statistical tests using the data available. The idea was to determine if the deregulation of electricity generation markets was of benefit to consumers:

- In the first section comparisons of means and regression analyses were used to demonstrate the price differences between regulated and deregulated states and to determine that these price differences were not attributable to other variables other than the regulated vs. deregulated status of the states.
- Two-way Analysis of Variance (ANOVA) was used in section b to test if there was a difference in the relative price of electricity in the three deregulated Midwestern states (Illinois, Ohio, and Pennsylvania) and the three regulated Midwestern states (Indiana, Michigan, and Wisconsin)
- Section c presents a graphic showing the trends in mean Midwestern state electricity prices before and after deregulation
- Section d contains a difference-in-difference regression model. This analysis examined differences over time in the price of electricity (this is the first difference) and between regulated and deregulated states (which is the second difference). The difference-in-difference regression equations isolated the impact of deregulation among the states on

<sup>80</sup> Through June of 2016.

<sup>81</sup> Average of GS2 Secondary and GS3 Primary for both Columbus Southern Power and Ohio Power.

<sup>82</sup> Includes secondary rate classes for Ohio Edison, Toledo Edison and Cleveland Electric Illuminating Company.

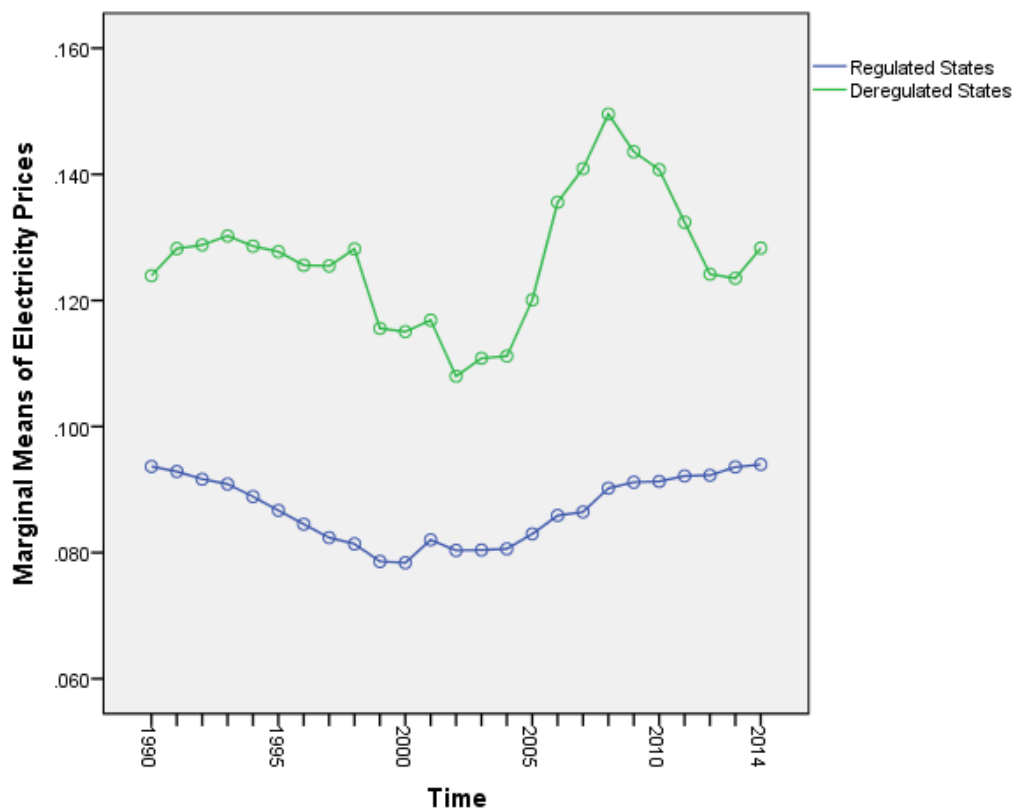


price movements in electricity over time. The results from this model indicate that deregulation tends to decrease the prices paid by electric consumers.

### A. THE UNITED STATES OVERALL

Energy Information Administration data on electricity prices paid by consumers were examined for forty-eight of the fifty states and the District of Columbia from 1990 to 2014.<sup>83</sup> Figure 10 gives the mean electricity prices in regulated vs. deregulated states for the period from 1990 to 2014, demonstrating that prices were consistently higher in the deregulated states.

**Figure 10. Mean Electricity Prices in Regulated vs. Deregulated States, 1990 – 2014**



Note: <sup>1</sup>Data were from the Form EIA-861 Annual Electric Power Industry Report. All prices given in 2014 dollars  
Source: the Authors (2016)

To determine whether this observed difference in mean prices between regulated and deregulated states is an independent effect and not an artifact of a set of other variables omitted from the analysis, we performed a regression analysis designed to control for other variables suspected to influence electricity prices. The details of this analysis are reported in Appendix 5. The results indicate that even when controlling for other variables that affect electricity prices, those found in deregulated states were higher than those found in regulated states. This is shown

<sup>83</sup> Alaska and Hawaii were omitted due to their geographical isolation and unique electricity markets.

by the positive and statistically significant coefficient on the regulation/deregulation variable ( $\beta=.01438$ ,  $t = 9.04$ ). More specifically, the model shows that over 75% of the variation in state electricity prices may be accounted for by the status of regulation/deregulation, generation capacity, fuel mix, and fuel prices. Additionally, Joskow (2006) found that utility debt is a significant predictor of electricity prices.<sup>84</sup> Moreover, when all of these other variables are statistically held constant, the price of electricity in deregulated states was about \$0.014 higher than in regulated states.<sup>85</sup> *Thus the regulatory status of a state is a statistically significant independent predictor of that state's electricity price.*

The fact that the overall price of electricity had been consistently higher in the states that embraced deregulation helps to understand why the deregulated states chose to deregulate in the first place. Deregulation was intended to lower prices, or to at least dampen growth in prices, by introducing competition into electricity markets. But the regression reported in this section contains no meaningful information about the effects of such choices on electricity price *before* regulation occurred relative to prices *after* deregulation occurred. Nor does the regression contain information specifically about the Midwestern industrial states, including Ohio. This is done in the following section.

## B. SIX MIDWESTERN STATES

The best group of states to use a comparison group for Ohio are its neighboring states because they share similar economies and energy systems. Accordingly, our analysis shifted to a comparison of the three deregulated midwestern states (Illinois, Ohio, and Pennsylvania) in relation to the three regulated ones (Indiana, Michigan, Wisconsin). Appendix 5 presents the mean Midwestern electricity prices in the regulated and deregulated states for 1990 to 2014, all in real 2014 dollars. O'Connor and O'Connell-Diaz (2015)<sup>86</sup> argued that 2003 marks the year when deregulation in generation markets began to take hold in the Midwestern states.

The two-way Analysis of Variance (ANOVA) test reported in Table 5 shows that the effect of deregulation on the price of electricity in the deregulated states relative to the regulated states was favorable at the 99 percent level of confidence.<sup>87</sup> In other words, on average, the relative price of electricity in the deregulated states declined. After 2003 the mean price of electricity in the deregulated states remained higher, on average, than in the regulated states. However, the mean price (adjusted for inflation) of electricity *increased* from 8.6 to 9.3 cents per kilowatt-hour in the regulated states, while it *decreased* from 10.5 to 9.6 cents per kWh in the deregulated states.

<sup>84</sup> Joskow's finding is especially notable in Ohio given the 13 July 2016 report by UBS Securities entitled, "First Energy Corporation: How Much Debt can the Utilities Support?" <https://neo.ubs.com/shared/d1zYlfYrdo/>

<sup>85</sup> Technically, the binary variable was coded with unity (1) for deregulated states and zero (0) for regulated states.

<sup>86</sup> O'Connor, P. & O'Connell-Diaz, E. (2015). Evolution of the Revolution: The sustained success of retail electricity competition. COMPETE. Retrieved from: [http://www.competecoalition.com/files/COMPETE%20White%20Paper\\_Evolution%20of%20Revolution\\_Final.pdf](http://www.competecoalition.com/files/COMPETE%20White%20Paper_Evolution%20of%20Revolution_Final.pdf)

<sup>87</sup> Technically, the p-value on the interaction term between the two variables (a) before-after and (b) deregulated state or not in the two-way analysis of variance was significant at  $p < .001$ .

**Table 5. Effects of Deregulation on Midwest Electricity Prices in All Sectors Combined  
1990 - 2014**

|                       | Deregulated vs. Regulated States |                                |
|-----------------------|----------------------------------|--------------------------------|
|                       | Deregulated States<br>OH, IL, PA | Regulated States<br>IN, MI, WI |
|                       | Mean (se)                        | Mean (se)                      |
| Before<br>(1990-2002) | 0.1049 (0.0022)                  | 0.0859 (0.0022)                |
| After<br>(2003-2014)  | 0.0957 (0.0014)                  | 0.0930 (0.0023)                |

\*\*\* Statistically significant at the  $p < 0.001$  level.

Real 2014 dollars

Source: the Authors (2016)

Table 6 shows a two-way ANOVA result for electricity prices in the residential sector. The result in this table is similar in structure to that in Table 5. These data show that in the six Midwest states examined, deregulation has delivered on its promise to cut electricity prices. On average, residential electricity prices went *up* from 10.6 to 11.8 cents per kWh in the regulated states, while they dropped from 13.0 to 11.9 cents per kWh over the same time-period in the deregulated states. It should be born in mind that these results reflect the EIA prices, which reflect SSO prices in deregulated jurisdictions. For the reasons set forth earlier, the SSO price has been consistently higher than the price available to shoppers in deregulated markets; accordingly, the changes in relative EIA price data are a conservative indicator of the effect of deregulation. These results are also consistent with the findings in the O'Connor and O'Connell-Diaz study.

**Table 6. Effects of Deregulation on Midwest Electricity Prices in the Residential Sector  
1990 – 2014**

|                       | Deregulated vs. Regulated States |                                |
|-----------------------|----------------------------------|--------------------------------|
|                       | Deregulated States<br>OH, IL, PA | Regulated States<br>IN, MI, WI |
|                       | Mean (se)                        | Mean (se)                      |
| Before<br>(1990-2002) | .1304 (0.0030)                   | .1060 (.0018)                  |
| After<br>(2003-2014)  | .1186 (.0018)                    | .1178 (.0298)                  |

Values are in real 2014 dollars

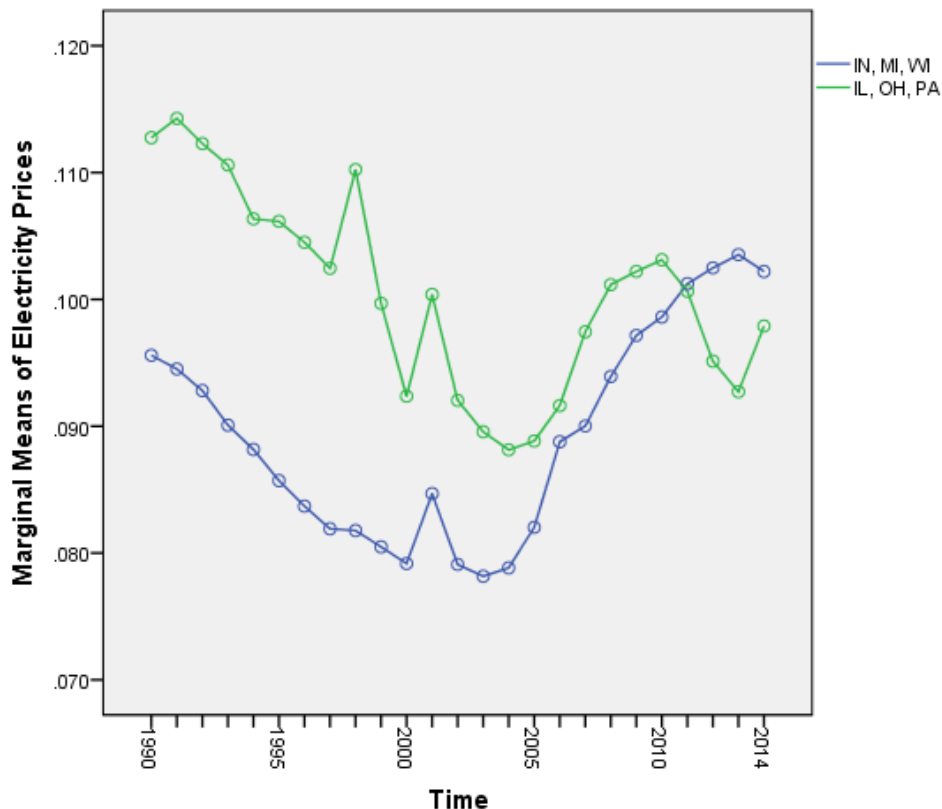
Source: The Authors (2016)

Tables 5 and 6 have provided empirical evidence that the average price of electricity has, since deregulation, increased in the regulated Midwestern states while going down in the deregulated states. This evidence paints the big picture of the impact of deregulating electricity generation markets on consumers. But the tables omit consideration of path dependencies, and so in the following section the results of another statistical analysis are provided, both of which were conducted to consider and control for path dependencies.

### C. THE OBSERVED TRENDS IN MEAN MIDWESTERN STATE ELECTRICITY PRICES

Figure 11 shows, by year, the mean electricity price of the three states in each of the two groups, regulated and deregulated states. The data cover the years 1990 to 2014. From 1990 to 2010, the average price of electricity in the regulated states was below that of the deregulated states. However, once deregulation entered the Midwest from 2001 to 2003 the relationship between these two lines began to change. Prior to the introduction of deregulation, the average price in Illinois, Ohio and Pennsylvania was above the average of Indiana, Michigan, and Wisconsin. After 2003 the average prices begin to converge, with the percentage increase in the average price increasing much more quickly in the deregulated states than in the regulated states. Finally, between 2010 and 2011 the average price in the deregulated status begins to trend down and drops below that of the average of the regulated three states. These movements in electricity prices are evidence that since 2010 Midwestern states with deregulation have tended to reduce electricity prices relative to those without deregulation.

**Figure 11. Changes in Electricity Price Means in the Combined Residential, Commercial and Industrial Sectors**



Source: the Authors (2016)

To determine whether these observed price difference trends were attributable to path dependencies, in the next section we report upon a difference in differences analysis. This form of analysis was used because cost structures and competitive positions from the past shape

operating costs and prices in the future, so the price of electricity in any given state in any given year is likely to be closely related to the price of electricity in that state in the predecessor and successor years. The difference-in-difference analysis estimated the effect of deregulation statistically and isolated it from the effects of path dependencies.

#### **D. REMOVING PATH DEPENDENCIES FROM THE MIDWESTERN STATE ESTIMATES USING DIFFERENCE-IN-DIFFERENCE ANALYSIS**

Ohio began to implement the deregulation of its electric generation markets in 2001. However, the state's IOU's did not begin to purchase their power on open markets until May 2009, when FirstEnergy engaged in its first competitive auction for power. AEP followed in December 2011 and Duke in 2014 (Figure 1). We also noted in the results from the two-way repeated measures ANOVA that an inflection point in the graph of the average electricity prices in the deregulated states did not occur until 2010 (Figure 11). This observation led us to test when the market for electricity began to reflect the influence of deregulation.<sup>88</sup> We first used the date proposed by O'Connor and O'Connell-Diaz, 2003. We then tested 2009 as the date when competition began in earnest based on when retail electric companies first began to bid on electricity generation for their Ohio customers, using the powers granted to them with the passage of SB 221.<sup>89</sup> The analysis was designed to model the effect of deregulation by estimating the difference between electricity prices before and after the time at which deregulation began for both the states that deregulated and those that did not, and then to compare the difference between the groups—hence the moniker “difference-in-differences” analysis. This approach ensures that the effect of deregulation is statistically isolated from any path dependencies within groups of regulated vs. deregulated states. Table 7, presents a DID summary table.<sup>90</sup>

The price values in Table 7 are the estimated regression coefficients from the difference-in-differences model. The “Difference” columns in the table are the differences obtained by subtracting the price estimates after deregulation from the prices before deregulation. The values obtained in the Difference in Differences row in the table were obtained by subtracting the price difference estimates for the regulated states from the price difference estimates for the deregulated states.

<sup>88</sup> Statistically significant at  $p > .001$ .

<sup>89</sup> Technically known as “difference-in-differences” analysis. Kuipers, et al also suggest that 2008 to 2009 is a better date to measure the beginning of the effectiveness of deregulation. This is also consistent with Ohio's specific experience when retail providers began to compete for customers and generated power.

<sup>90</sup> This DID model took the following general form:  $y = \beta_0 + \beta_1 D^{post} + \beta_2 D^{Tr} + \beta_3 D^{Post} D^{Tr} + Duration + \epsilon$ , where  $y$  is retail electricity price,  $D^{post}$  is a time dummy variable with 0 representing pre-deregulation and 1 representing post-deregulation,  $D^{Tr}$  is a state dummy variable with 0 representing regulated states and 1 representing deregulated states,  $Duration$  is the number of years since the beginning of the data, and  $D^{Post} D^{Tr}$  is an interaction of the post and treatment variables. The price values in this table are the estimated regression coefficients from this model.

**Table 7. Average Price per kWh under Two Assumptions about When Deregulation Began**

|                           | 2003                         |                           |            | 2009                         |                           |            |
|---------------------------|------------------------------|---------------------------|------------|------------------------------|---------------------------|------------|
|                           | Prices prior to Deregulation | Prices after Deregulation | Difference | Prices prior to Deregulation | Prices after Deregulation | Difference |
| Deregulated States        | 0.0951                       | 0.0787                    | -0.0164    | 0.1092                       | 0.0924                    | -0.0168    |
| Regulated States          | 0.0867                       | 0.0866                    | -0.0001    | 0.0939                       | 0.0947                    | 0.0008     |
| Difference in Differences |                              |                           | -0.0163    |                              |                           | -0.0176    |

Source: the Authors (2016)

On the basis of Table 7, and assuming that O'Connor and O'Connell-Diaz's 2003 date marks the beginning of truly competitive markets for electricity generation:

- (a) Electricity prices (adjusted for inflation) in the regulated states before deregulation were, on average, \$.0867/kWh;
- (b) Electricity prices in the deregulated states before deregulation were, on average, \$.0951/kWh;
- (c) Electricity prices in the deregulated states after deregulation were \$.0787 per kWh; and
- (d) Electricity prices in the regulated states were, on average, also \$.0866 per kWh.

Our estimate of the independent effect of regulation is that it saved \$.0163 per kWh, on average, in the combined industrial, commercial and residential sectors, in the three deregulated Midwestern states.

Alternatively, also based upon Table 7, and assuming that the most suitable year to represent deregulation is 2009, the results indicate that:

- (a) Electricity prices in the regulated states before deregulation were, on average, \$.0939/kWh;
- (b) Electricity prices in the deregulated states before deregulation were, on average, \$.1092/kWh;
- (c) Electricity prices in the deregulated states after deregulation were \$.0924 per kWh; and
- (d) Electricity prices in the regulated states were, on average, also \$.0947 per kWh.

Because wholesale markets did not begin to develop in Ohio until 2009, following the passing of SB 221, we deemed 2009 as the most appropriate year deregulation began in the Midwest region. Using this year as the marker, we determined *that the independent effect of deregulation saved approximately \$.0176 per kWh in the combined industrial, commercial and residential sectors of the three deregulated states.*<sup>91</sup>

<sup>91</sup> Statistically significant at  $p > 0.001$ . Using 2003 as the date deregulation began would have diminished estimated savings from deregulation by about 7.4% or between \$169M and \$175M per year.

## VI. OTHER VALUE AND CONSIDERATIONS FOR DEREGULATION

### A. DEMAND RESPONSE AND OTHER PROGRAMS

In deregulated generation markets, regional transmission organizations can use demand response and energy efficiency programs to reduce peak load requirements. PJM, the regional transmission organization that covers Ohio, for instance, sponsors a demand response program designed to reduce power consumption during times of exceptionally high peak usage. This tends to reduce the amount of electricity demanded and supplied by the state's utilities during their highest price periods, and therefore to reduce their profits. The purpose of the program is to mitigate the need to build expensive new peaking generation plants. PJM, upon recognizing an event requiring a system-wide response, issues a notice to customers and demand response providers to curtail consumption. Those who participate in the program are paid on a per MWh basis for their curtailment. This results in savings for all consumers in the regional transmission organization footprint because less generation, transmission, and distribution is required to meet peak demand. Such energy-savings are incentivized under deregulated markets, but not under traditional cost-plus regulation.

Other new programs have been introduced that also provide savings. These include, among others, economic load, capacity market, synchronized reserve and frequency regulation demand response.<sup>92</sup> In addition to these programs, in deregulated areas energy efficiency can be bid into capacity markets to reduce costs. Ascertaining the savings realized in Ohio from these sorts of programs was beyond the scope of this project. But one study that was done by ACEEE in 2013 to assess the value created by Ohio's energy efficiency program projected around \$5 billion in savings by 2020, of which \$880 million was from the program effects on prices due to reduced demand.<sup>93</sup> The value derived from demand response and similar programs available in deregulated markets is similar: these programs reduce the need to build new generation capacity and grid; they lead to improved system reliability; and they reduce demand generally resulting in suppliers being pressured to lower prices and control costs.

### B. LOAD MANAGEMENT AND OTHER CUSTOMER STRATEGIES

Deregulation also allows customers with larger loads to manage their electricity use in a manner that saves money. The most common contract for smaller users is a "fixed price" contract, where the energy portion of the bill is fixed at a contractual rate over the term of the contract. Larger electricity users, however, commonly use a "block and index" strategy for procuring power, where a portion of the load is fixed, and portion acquired on a variable price index. These customers can manage their loads and can curtail use when price indices are high. Large consumers with a predictable load also favor this strategy, since they can lock in the block at lower prices when it is convenient to do so.

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<sup>92</sup> These generally fall into the classification of "ancillary services" by PJM. Costs for these services can be constrained through demand response programs. See, e.g., <https://learn.pjm.com/three-priorities/buying-and-selling-energy/ancillary-services-market.aspx>

<sup>93</sup> Neubauber, M. et al. (2013). Ohio's Energy Resource Standard: Impacts on the Ohio Wholesale Electricity Market and Benefits to the State, retrieved from: <http://aceee.org/research-report/e138>

Other load management strategies available include Locational Marginal Pricing (LMP) index pricing (based on hourly clearing price on the LMP market), heat rate pricing (based upon natural gas prices), tranche pricing and hedging. These sorts of load management strategies are normally not available in regulated markets. Their aggregate value may be substantial.

## VII. ESTIMATED SAVINGS CREATED BY DEREGULATION IN OHIO

### A. SAVINGS CREATED BY DEREGULATION, 2011-2016

#### 1. Avoided Costs from Shopping

The total cost that Ohio consumers avoided due to shopping can be calculated for the mercantile and non-mercantile classes by multiplying the average avoided cost in each year for each rate class by the amount of electricity that was consumed by shoppers. In the following estimates, industrial users are assumed to be mercantile and residential consumers are assumed to be non-mercantile. Commercial customers, on the other hand, could be either. Unfortunately, the PUCO does not report the volume of electricity consumed by mercantile or non-mercantile customers. Instead, the PUCO reports the information based on industrial, commercial and residential loads.<sup>94</sup>

Accordingly, some assumptions were made to approximate the savings to mercantile and non-mercantile customers. The Study Team assumed that primary (i.e. high voltage) users are approximately equivalent to the industrial load. Likewise, we have assumed that all residential users are non-mercantile. Data obtained from Scioto Energy on the distribution of mercantile and non-mercantile secondary commercial electricity usage from June 2014 to June 2015 (Table 8) suggest that slightly more than half the total commercial load is non-mercantile. This is because there are many commercial users in Ohio that have relatively small loads. Table 8 sets forth the approximate percentage of commercial loads in Ohio that were non-mercantile between 2014-2015.

For purposes of estimating the total savings garnered by Ohio's electricity users from shopping, the Study Team assumed the percentages listed in Table 8 to be the mercantile commercial loads for each EDU territory, and the remainder to be non-mercantile. Total savings from shopping, by utility and year, for the mercantile markets are listed in Tables 9 and 10.

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<sup>94</sup> Public Utilities Commission of Ohio. Completed Annual Reports 2011-2015. Retrieved from: <http://www.puco.ohio.gov/apps/directorylister/annualreports.cfm>



**Table 8. Percent of Secondary Commercial Loads in Ohio That Were Mercantile  
June 2014-June 2015**

| EDU          | MWh        |
|--------------|------------|
| Duke         | 61%        |
| FE OE        | 32%        |
| FE CEI       | 50%        |
| FE TE        | 33%        |
| AEP OP       | 44%        |
| AEP CS       | 54%        |
| DPL          | 41%        |
| <b>Total</b> | <b>47%</b> |

Source: Scioto Energy (2016)

**Table 9. Total Savings through Shopping, by Utility, Mercantile Markets  
2011- 2015 (millions of dollars)**

| EDU          | Savings        |
|--------------|----------------|
| AEP          | \$975.9        |
| Duke         | \$401.6        |
| DPL          | \$143.3        |
| First Energy | \$947.4        |
| <b>Total</b> | <b>\$2,468</b> |

Source: Scioto Energy (2016) (Assumes all industrial and a fraction of commercial loads)<sup>95</sup>**Table 10. Total Savings through Shopping, Mercantile Markets  
2011- 2015 (millions of dollars)**

| Year         | Savings        |
|--------------|----------------|
| 2011         | \$391.5        |
| 2012         | \$324.6        |
| 2013         | \$600.8        |
| 2014         | \$664.2        |
| 2015         | \$487.1        |
| <b>Total</b> | <b>\$2,468</b> |

Source: Scioto Energy (2016) (Assumes all industrial and a fraction of commercial loads)<sup>96</sup>

Calculating the total avoided costs in Ohio for non-mercantile consumers, then, requires the addition of the remaining fraction of the commercial market, plus the residential market. Our estimates of the savings realized by non-mercantile customers were derived by applying the NOPEC savings rate to all commercial customers (4 percent) and to all residential customers (6 percent). These savings are listed by year in Table 11.

<sup>95</sup> The formula used to determine these numbers is:  $(PTC - \text{Average Contract Rate}) * (\text{Mercantile Shopping Volume})$ <sup>96</sup> *Id.*

**Table 11. Total Savings Through Shopping for Non-Mercantile Markets  
2011-2015 (millions of dollars)**

| Year         | Savings        |
|--------------|----------------|
| 2011         | \$105.1        |
| 2012         | \$118.6        |
| 2013         | \$143.3        |
| 2014         | \$160.0        |
| 2015         | \$157.8        |
| <b>Total</b> | <b>\$684.8</b> |

Source: Authors (2016).

The total avoided cost from 2011 to 2015 for shopping customers by IOU is presented in Table 12.

**Table 12. Total Savings Through Shopping for Non-Mercantile Markets, by Utility  
2011-2015 (millions of dollars)**

| Utility      | Savings        |
|--------------|----------------|
| FE           | \$371.7        |
| AEP          | \$150.1        |
| DPL          | \$65.3         |
| Duke         | \$97.7         |
| <b>Total</b> | <b>\$684.8</b> |

Source: Scioto Energy (2016)

Adding up all the savings between 2011 and 2015, we estimate that the total avoided cost for Ohio consumers who chose to shop was approximately \$3.15 billion, for an average annual savings of \$630 million. See Table 13 below. However, as noted before, *this is only the savings that occurred through shopping*. A more detailed breakdown of shopping savings for each EDU can be found in Appendix 3.

**Table 13. Total Shopping Savings from Mercantile and Non-Mercantile Markets  
2011-2015 (millions of dollars)**

| Year         | Mercantile        | Non-Mercantile  | Total             |
|--------------|-------------------|-----------------|-------------------|
| 2011         | \$391.60          | \$105.1         | \$496.70          |
| 2012         | \$324.69          | \$118.6         | \$443.29          |
| 2013         | \$600.81          | \$143.3         | \$744.11          |
| 2014         | \$664.21          | \$160.0         | \$824.21          |
| 2015         | \$487.19          | \$157.8         | \$645.19          |
| <b>Total</b> | <b>\$2,468.50</b> | <b>\$684.80</b> | <b>\$3,153.30</b> |

Source: Scioto Energy (2016)

These savings must be distinguished from those achieved through use of a deregulated standard service offer. The savings from deregulated SSOs – discussed and quantified below – are passed through to *all* EDU electricity consumers in Ohio, regardless of whether they shop or not.

## 2. Savings Resulting from Standard Service Offers

Having power generation costs set through a deregulated SSO provides significant value to all consumers in Ohio who obtain their power through an investor-owned utility, regardless of whether they shop or not. As discussed earlier, this has been especially so since the EDUs began to use 100% auction-based SSOs, rather than cost-based accounting.

The best way to estimate the savings is to use the average savings demonstrated by the statistical models developed from comparing the two sets of Midwestern states as presented in Section V, *supra*. The estimated cost difference between the regulated and deregulated all-in electricity prices for Midwestern states after 2009 (the year Ohio markets began) was around \$0.0176 per kWh consumed.

Accordingly, the Study Team multiplied \$0.0176/kWh times the number of IOU delivered hours each year to estimate savings generated through deregulation, without shopping. As demonstrated earlier, Ohio experienced an average 36% drop in price in the SSO price in the Duke Energy and AEP Ohio jurisdictions as a result of the switch from cost-based accounting to market-based auctions. Arguably this is the essence of deregulation – going from cost-based accounting to market-based auctions. The \$0.0176 in savings represents the average savings for all SSOs during the study period, regardless of whether they were auction based, cost-based or a mixture of both. This number represents a much smaller percent off of the average price than 36%. Nevertheless, we concluded that a savings of \$0.0176/kWh is appropriate. It is conservative, especially if shopping savings are added to this, since shopping savings are likely to be diminished as 100 percent auction-based SSOs are introduced.<sup>97</sup>

The savings estimates developed with the difference-in-difference model suggest that we can multiply \$0.0176 per kWh savings by total kWh consumption from all IOU ratepayers from 2011 to 2015. Based upon this estimate, we conclude that Ohio's electricity users saved an additional \$11.82 billion during this timeframe as a result of the change to market-based auctions. The annual savings are listed in Table 14.

Total savings from deregulated SSOs and the savings realized by shopping from 2011-2015 can be determined by adding Tables 10 and 12 (\$3.15 and \$11.82 billion, respectively), for a total savings of \$14.975 billion over five years (Table 15 below). This suggests that over the past five years, Ohio has realized an average total annual savings of around \$3 billion for its IOU consumers as a result of deregulation

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<sup>97</sup> This savings number is also consistent with the number arrived at by the Pennsylvania University team, which concluded that Pennsylvania's all-sector EIA (based upon SSO prices) went from 15 percent above national average to 1 percent below the national average as a result of deregulation. See Simeone & Hanger, *supra*, at 24.

**Table 14. Savings from Deregulated SSO in Ohio, Not Including Shopping  
2011-2015 (millions of dollars)**

| Year         | Savings         |
|--------------|-----------------|
| 2011         | \$2,395         |
| 2012         | \$2,366         |
| 2013         | \$2,342         |
| 2014         | \$2,380         |
| 2015         | \$2,339         |
| <b>Total</b> | <b>\$11,822</b> |

Source: the Authors (2016)

**Table 15. Total Savings Due to Deregulation in Ohio  
2011-2015 (millions of dollars)**

| Year         | Shopping          | SSO                | Total              |
|--------------|-------------------|--------------------|--------------------|
| 2011         | \$496.70          | \$2,395.00         | \$2,891.70         |
| 2012         | \$443.29          | \$2,366.00         | \$2,809.29         |
| 2013         | \$744.11          | \$2,342.00         | \$3,086.11         |
| 2014         | \$824.21          | \$2,380.00         | \$3,204.21         |
| 2015         | \$645.19          | \$2,339.00         | \$2,984.19         |
| <b>Total</b> | <b>\$3,153.30</b> | <b>\$11,822.00</b> | <b>\$14,975.30</b> |

Source: the Authors (2016)

## B. PROJECTED SAVINGS GOING FORWARD

### 1. For Shopping Customers Against SSO

As deregulated markets that use standard service offers mature, we can expect that the amount of avoided cost will be lower over time. That has certainly been the case for Ohio since its EDUs started to use auctions to set the SSO. Accordingly, we can reasonably assume the 2015 savings for shopping will be comparable to what we can expect for the years 2016 to 2020. Using this number, we can estimate that the total savings for shopping over the next five years will be \$3.225 billion.<sup>98</sup>

### 2. For Auction-Based SSO Against Regulation

We can use the same statistical approach that gave us past savings compared to the alternative model of regulation to project savings going forward, assuming that Ohio continues to stay deregulated, continues to use a standard service offer, and continues to use an auction-based strategy for setting the Price to Compare.<sup>99</sup> To calculate the projected savings, the Study Team

<sup>98</sup> We might expect that the headroom will continue to become tighter as SSO auctions mature (as has been the trend in the first half of 2016), but we can also expect that shopping will increase as its benefits become better known. For this reason, the last full year of shopping savings – 2015 – was used to project savings from shopping going forward.

<sup>99</sup> Texas is the only jurisdiction in 2016 that does not use an SSO. Default markets are set in that state by placement into a commercial retail supplier through a different mechanism.

used the 2015 PUCO Long Term Forecast of Energy Requirements, and then assumed that 91 percent of Ohio’s load would be provided by IOU electric distribution companies (i.e. subject to the IOU standard service offers). We also assumed the \$0.0176 per kWh savings found from the models.

Accordingly, the anticipated savings for Ohio due to the SSO auction for the five-year period, from 2016 to 2020 is \$11.717 billion dollars. Adding these savings to the anticipated savings from shopping, Ohio consumers will save an estimated \$14.942 billion dollars over the next five years, for an average of \$2.988 billion dollars per year.

**Table 16. Total Projected Savings Due to Deregulation in Ohio, Including Shopping 2016-2020 (millions of dollars)**

| Year         | Shopping Savings | SSO Auction Savings | Total Savings   |
|--------------|------------------|---------------------|-----------------|
| 2016         | \$645            | \$2,333             | \$2,844         |
| 2017         | \$645            | \$2,338             | \$2,829         |
| 2018         | \$645            | \$2,343             | \$2,833         |
| 2019         | \$645            | \$2,349             | \$2,839         |
| 2020         | \$645            | \$2,354             | \$2,844         |
| <b>Total</b> | <b>\$3,225</b>   | <b>\$11,717</b>     | <b>\$14,942</b> |

Source: the Authors (2016). Source of usage projections: Public Utilities Commission of Ohio, Ohio Long Term Forecast of Energy Requirements, July 22, 2015.

## VIII. CONCLUSIONS

This study was designed to assess the effects of deregulation of electricity generation on electricity prices in Ohio. This has recently become a source of controversy in Ohio as a result of several of Ohio’s IOUs having sought financial support for their uncompetitive electricity generation plants. After a decision by FERC that blocked those efforts, some of Ohio’s IOUs have begun lobbying for Ohio to return to reregulation of the entire electricity industry.

Based on the results of this study, such reregulation would cost Ohio’s ratepayers several billion dollars a year. The electric utility industry’s traditional business model of a state-regulated vertical monopoly that encompasses generation, transmission and distribution, based on a fixed tariff applied to the volume of consumption, is no longer viable in Ohio. This is due to a combination of technological progress, the development of regional wholesale electricity markets due to federal legislation and deregulation, and flat demand growth.

Reregulation might benefit the incumbent utilities in Ohio, but would not be conducive to industry flexibility, innovation, or adaptation to local social, technological and environmental change. It would have a material and deleterious effect on industrial users and manufacturing. It would also unnecessarily increase the cost of electricity to Ohio’s residential and commercial ratepayers, and as our analysis shows, do so in a significant and substantial way.

But more than disruptive innovation is driving the need for electric-utility business and regulatory models to change. Persistent demand for reliable, affordable electric service; reduced consumption through efficiency, conservation and demand response; increased grid efficiency based on networked smart grids that allow for local and distributed power generation; and reduced carbon emissions through a switch from fossil fuels to renewable and advanced energy technologies are all also significant contributing factors. Of course, this all causes problems for electric utilities vested heavily in uncompetitive fuel sources and outmoded plants, wires and equipment. These problems are especially weighty for utility companies that rely almost exclusively on huge, fossil-fuel fired centralized plants, rather than more efficient distributed technologies.

The problems currently faced by Ohio IOUs will not be solved by reregulation. To reregulate would simply be to return to a system of centrally regulated monopoly that is more or less the same as it was when the electric system was initially set up in the early 20<sup>th</sup> century. Huge coal-or nuclear-generated power plants would generate electricity and distribute it to consumers through a grid owned and operated by the utilities. As technology is changing, more and more electricity will be generated by cleaner, cheaper, distributed sources, and grids will become smarter and localized. The problem with reregulation of electricity generation (aside from the substantially increased costs it would bring to consumers) is that the technologies around which industry and society are organized, and which increasingly shape the U.S. electric system, will continue to evolve quickly. From micro-grids to distributed power generation and new forms of power storage, it is becoming apparent that a new kind of electric generation, distribution, and regulation system and business model is inevitable. The electric utility industry of the future cannot and will not look like the one of the past or the one of the present. Neither can related policy and regulatory practices.

There is no reason for Ohio to return now to the 20<sup>th</sup>-century command and control model of a vertically integrated utility. A strategy of reregulation would be shortsighted because of its failure to recognize the inevitability of technological advances and its blindness to regulatory and institutional changes. Reregulation would cost Ohio's ratepayers billions of dollars per year, threaten Ohio's manufacturing base, and cripple Ohio's efforts to attract new industry. The research contained in this Study demonstrates that Ohio consumers have realized billions of dollars in savings due to the deregulation of electricity generation. These savings are in keeping with the trends seen by other states that have switched to competitive electricity generation. These results are also consistent with the expectation and economic theory that was in place at the time deregulation began.

# ACKNOWLEDGMENTS

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## About the Energy Policy Center at Cleveland State University

The Energy Policy Center (EPC) is housed within the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. The mission of the EPC is to help overcome social and

institutional barriers to the implementation of solutions to energy challenges by providing an objective channel for the free exchange of ideas, the dissemination of knowledge, and the support of energy-related research in the areas of public policy, economics, business and social science. For more information on the Energy Policy Center, use the following link:

<http://levin.urban.csuohio.edu/epc/>.

### **Additional Research Support Team**

The Authors would like to thank the following for their significant contributions to this study. Without their support, much of the research undertaken would not have been possible.

#### **Northeast Ohio Public Energy Council, Solon, Ohio.**

The Northeast Ohio Public Energy Council (NOPEC) is the largest public retail aggregation in the United States. Our members are communities (residential and small businesses) throughout Northeast Ohio. Currently, we serve more than 200 communities in 13 counties.

For 15 years we have saved our communities and members more than a quarter of a billion dollars in cumulative electric savings and have provided more than \$16 million in NOPEC community energy efficiency grants. For more information about NOPEC, visit us at [nopecinfo.org](http://nopecinfo.org).

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#### **Energy Professionals of Ohio, Columbus, Ohio.**

EPO is an organization of aggregators and professional licensed energy brokers and consultants located in Ohio. Its mission includes educating its members, public decision makers and the general public about important regulatory and other considerations for energy markets in Ohio. EPO provided data collection and financial support for this study. For more information:

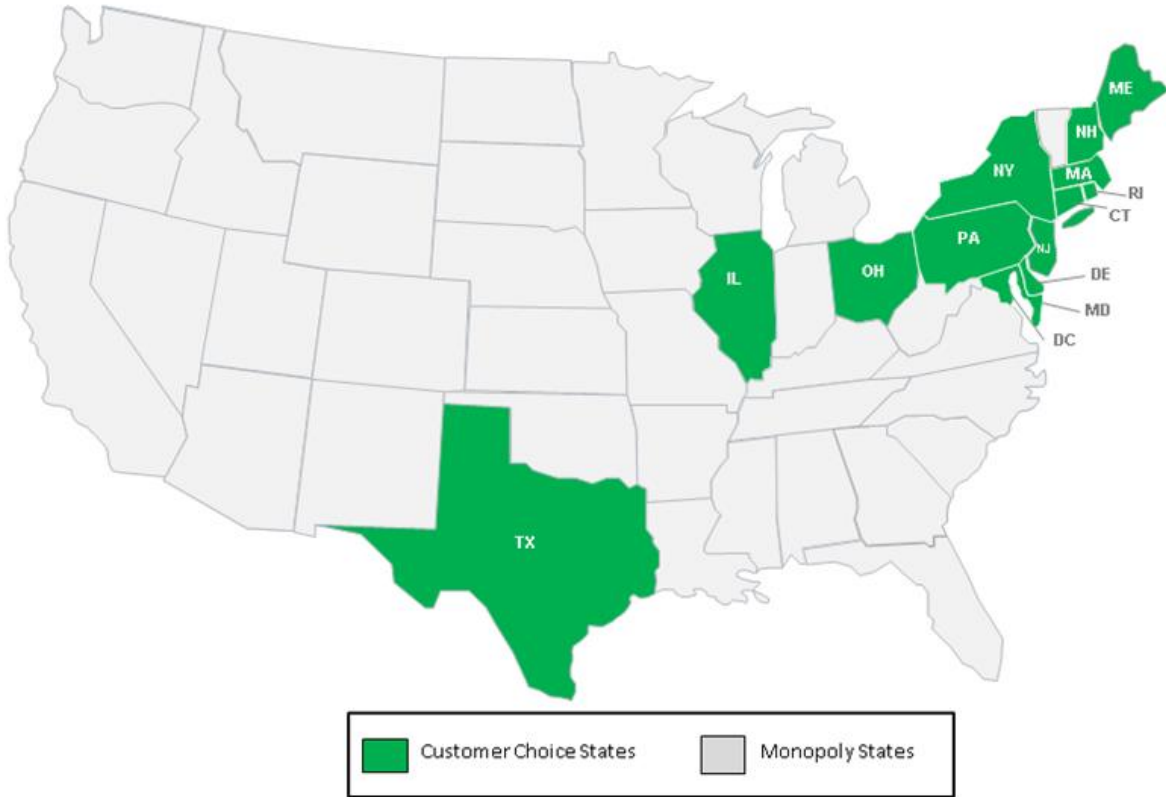
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## APPENDICES

### APPENDIX 1.

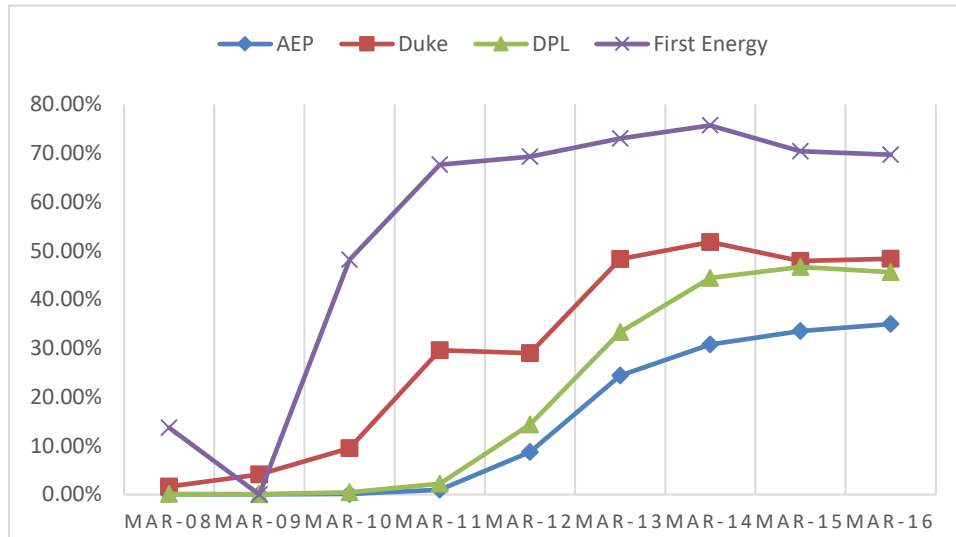
#### Map of States with Deregulated Electricity Generation Markets<sup>100</sup>



<sup>100</sup> Kuipers, W. & Chappelle, L. (2016). Electricity Customer Choice Out-Performs Traditional Monopoly. Utility Dive. Retrieved from: <http://www.utilitydive.com/news/electricity-customer-choice-out-performs-traditional-monopoly-1/424986/>

**APPENDIX 2.**

**Percentage of Customer Base that Shops for Energy in Ohio, 2008-2016**



Source: PUCO (2016)<sup>101</sup>

**Switching Rate by Percent of Total Energy Sold to Shopping Customers**

| Sales %     | Mar-08 | Mar-09 | Mar-10 | Mar-11 | Mar-12 | Mar-13 | Mar-14 | Mar-15 | Mar-16 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| AEP         | 0.63%  | 0.82%  | 0.83%  | 15.36% | 25.70% | 49.43% | 60.25% | 63.83% | 70.65% |
| Duke        | 3.20%  | 3.16%  | 49.78% | 66.56% | 65.68% | 72.54% | 73.67% | 70.90% | 73.32% |
| DPL         | 19.22% | 10.09% | 19.80% | 35.75% | 53.35% | 62.51% | 68.17% | 68.17% | 71.57% |
| FirstEnergy | 13.47% | 0.00%  | 54.33% | 73.89% | 77.66% | 79.17% | 80.67% | 77.85% | 79.45% |

**Switching Rate by Percent of Customers Shopping for Energy**

| Customer %  | Mar-08 | Mar-09 | Mar-10 | Mar-11 | Mar-12 | Mar-13 | Mar-14 | Mar-15 | Mar-16 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| AEP         | 0.05%  | 0.05%  | 0.11%  | 0.97%  | 8.69%  | 24.39% | 30.79% | 33.52% | 34.96% |
| Duke        | 1.65%  | 4.10%  | 9.51%  | 29.58% | 28.99% | 48.26% | 51.77% | 47.86% | 48.36% |
| DPL         | 0.16%  | 0.09%  | 0.44%  | 2.21%  | 14.35% | 33.32% | 44.40% | 46.66% | 45.58% |
| FirstEnergy | 13.73% | 0.00%  | 48.16% | 67.63% | 69.27% | 73.02% | 75.68% | 70.37% | 69.68% |

<sup>101</sup> Public Utilities Commission of Ohio. Electric customer choice switch rates and aggregation activity. <http://www.puco.ohio.gov/puco/index.cfm/industry-information/statistical-reports/electric-customer-choice-switch-rates-and-aggregation-activity>. Switching rates for FirstEnergy were derived from averaging the switching rates of Cleveland Illuminating Company, Ohio Edison, and Toledo Edison.

**APPENDIX 3.****Total Avoided Cost by Shoppers, by Utility, 2011-2015 (millions of dollars)**

| Utility | Class          | Savings   |
|---------|----------------|-----------|
| FE      | Mercantile     | \$947.4   |
| FE      | Non-Mercantile | \$371.7   |
| Total   | All Classes    | \$1,319.1 |

| Utility | Class          | Savings |
|---------|----------------|---------|
| AEP     | Mercantile     | \$975.9 |
| AEP     | Non-Mercantile | \$150.1 |
| Total   | All Classes    | \$1,126 |

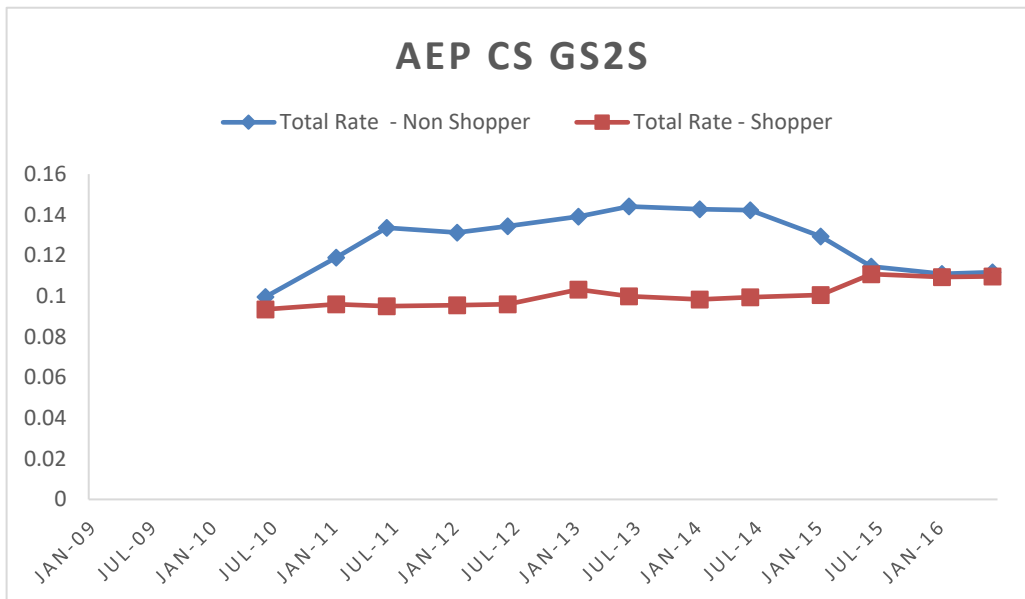
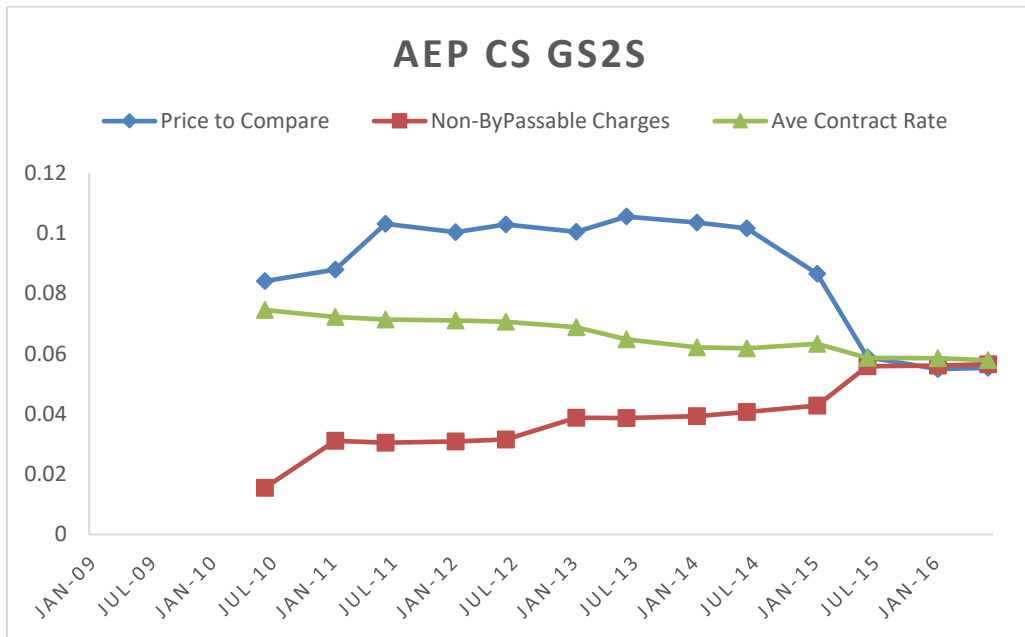
| Utility | Class          | Savings |
|---------|----------------|---------|
| DPL     | Mercantile     | \$143.3 |
| DPL     | Non-Mercantile | \$65.3  |
| Total   | All Classes    | \$208.6 |

| Utility | Class          | Savings |
|---------|----------------|---------|
| Duke    | Mercantile     | \$401.6 |
| Duke    | Non-Mercantile | \$97.7  |
| Total   | All Classes    | \$499.3 |

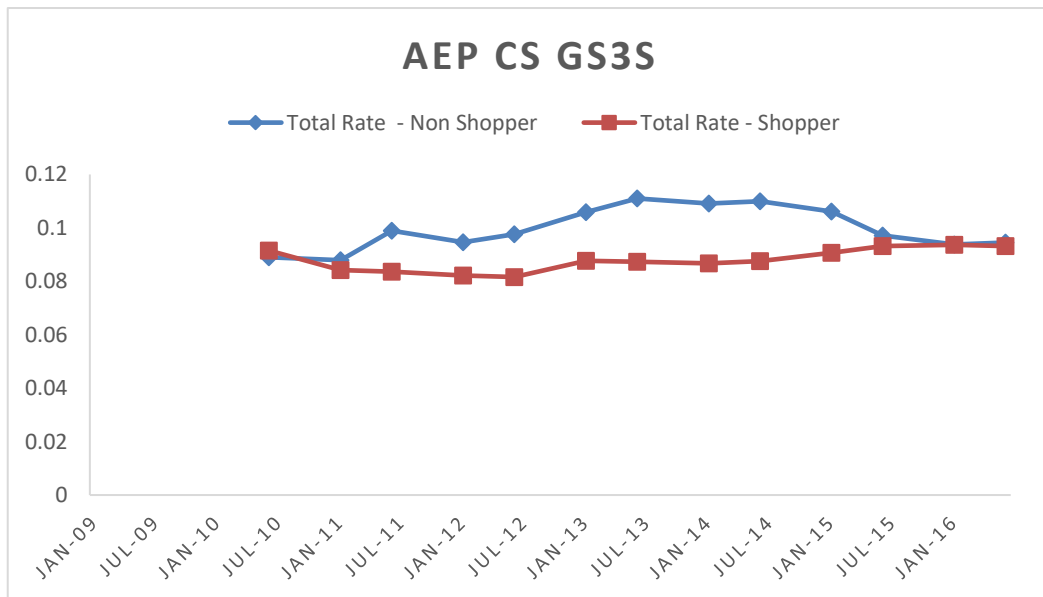
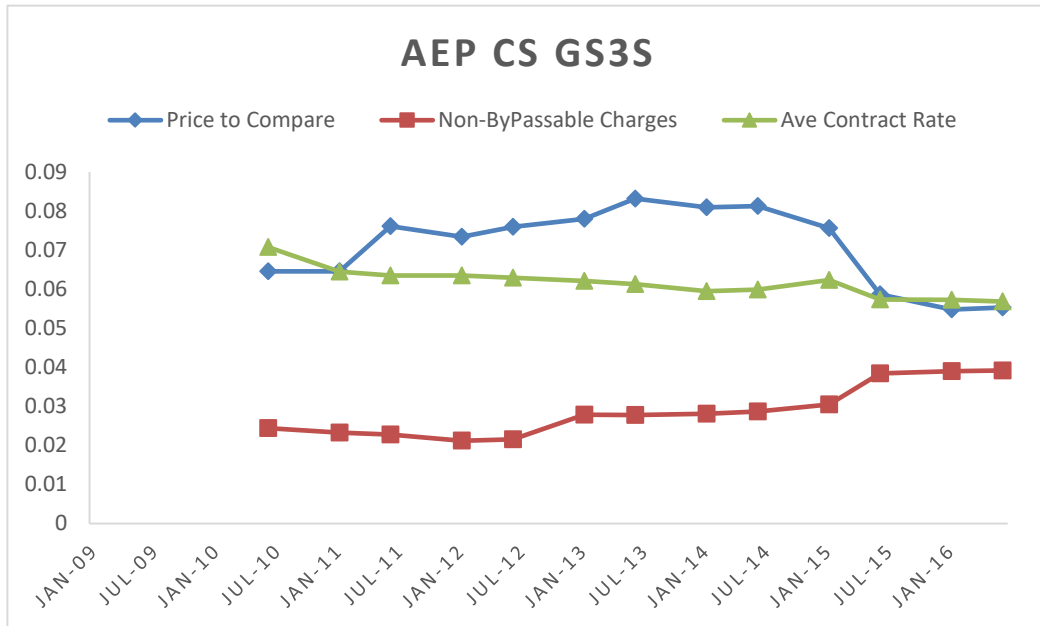
Source: the Authors (2016)

APPENDIX 4.

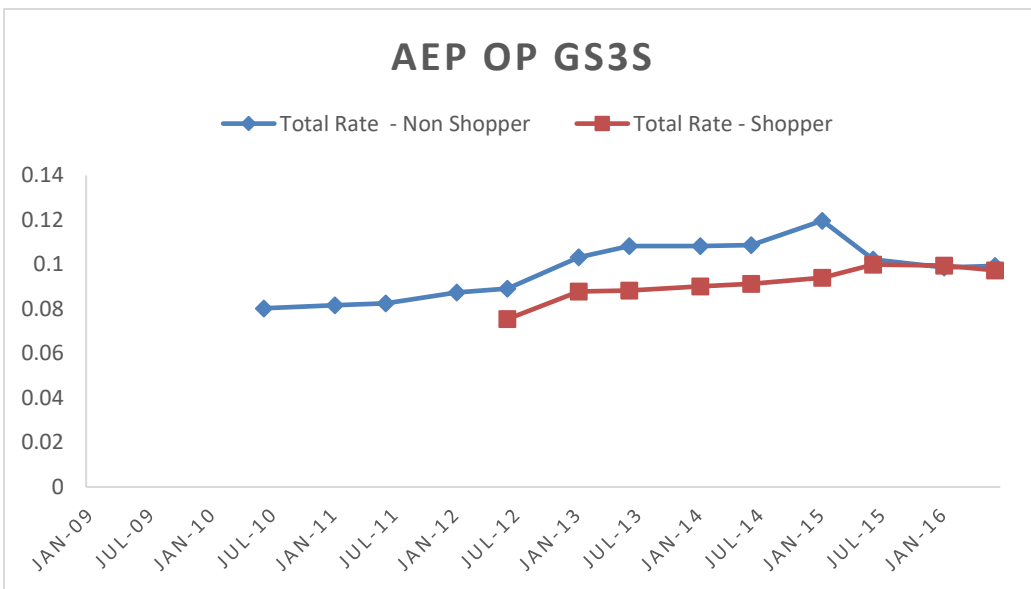
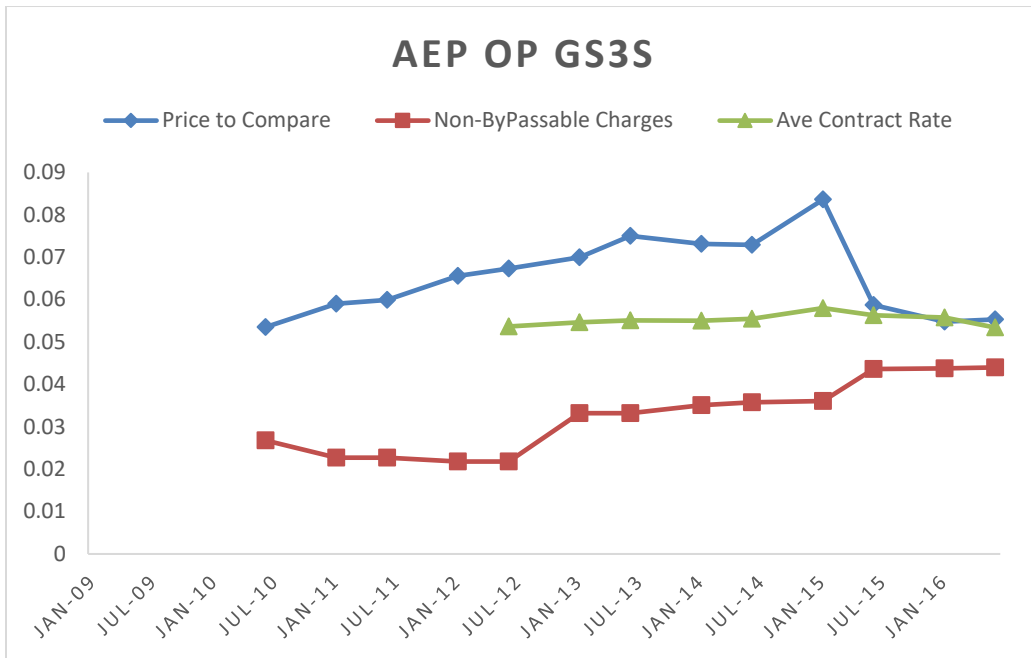
AEP Columbus Southern GS2S Rate Code Mercantile Prices



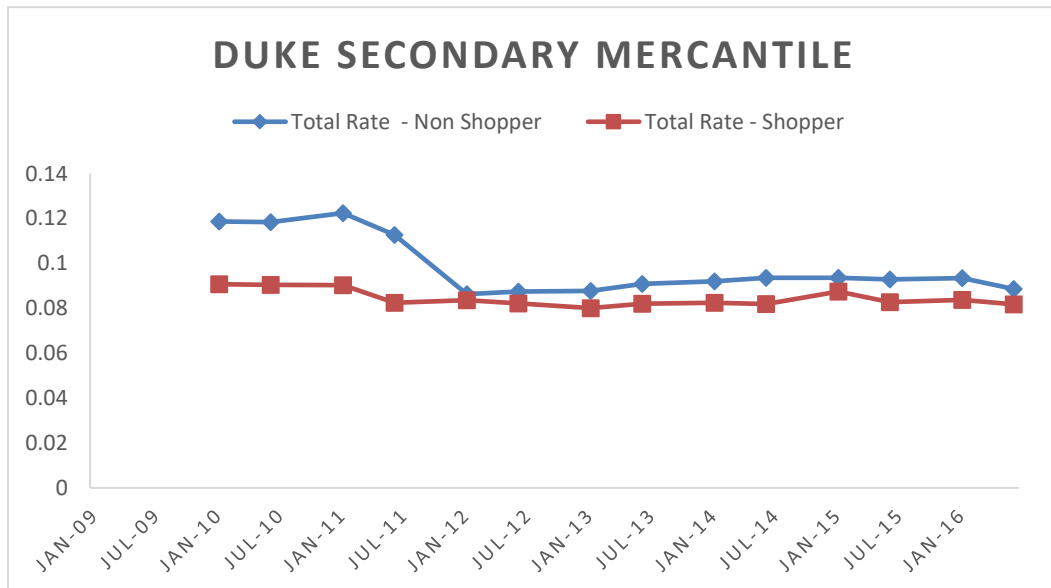
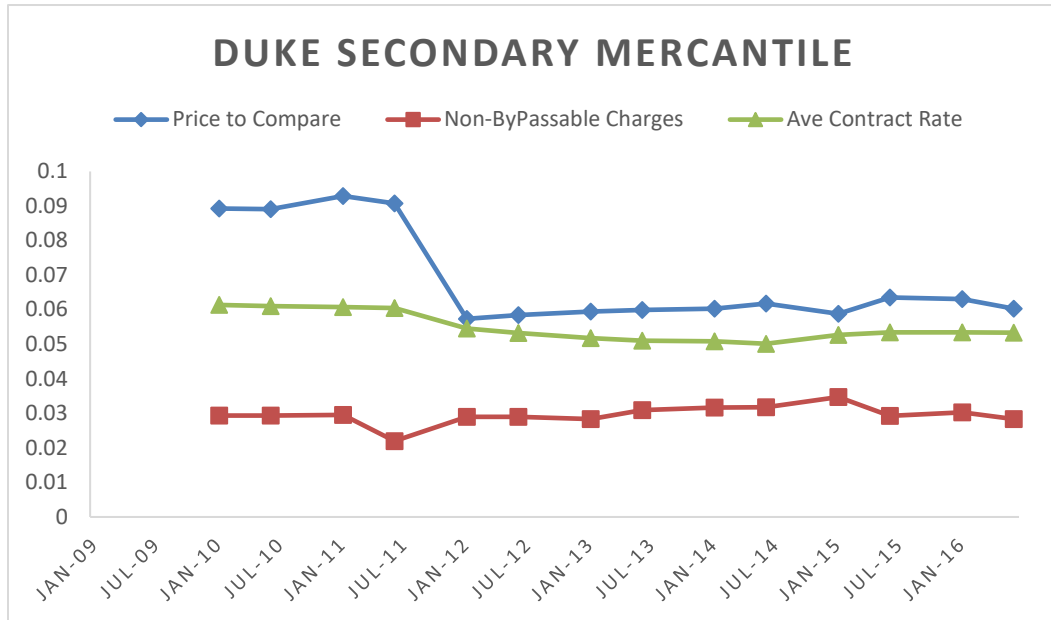
AEP Columbus Southern GS3S Rate Code Mercantile Prices



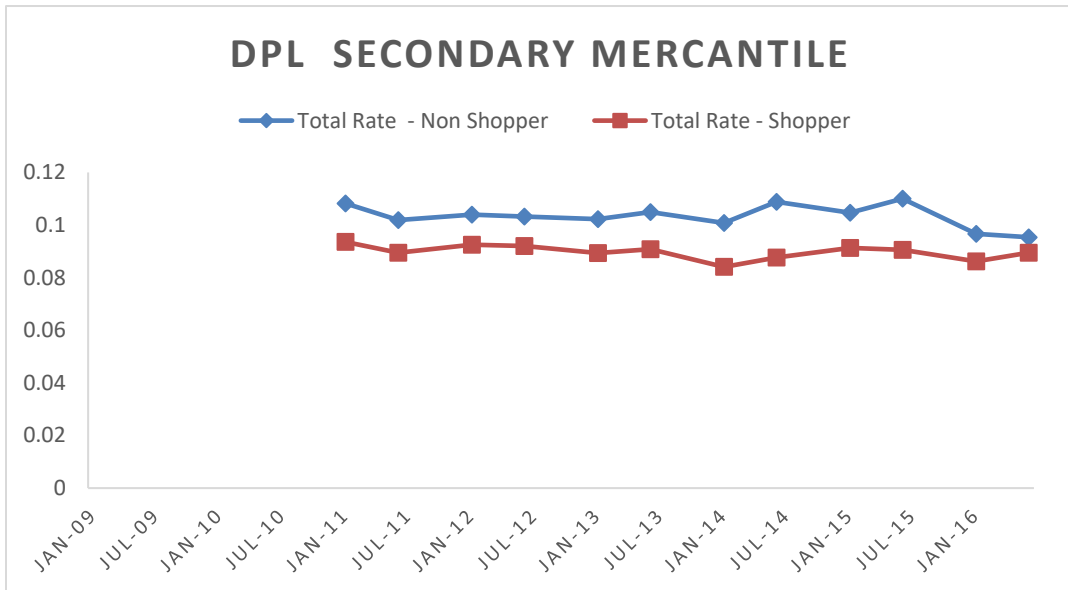
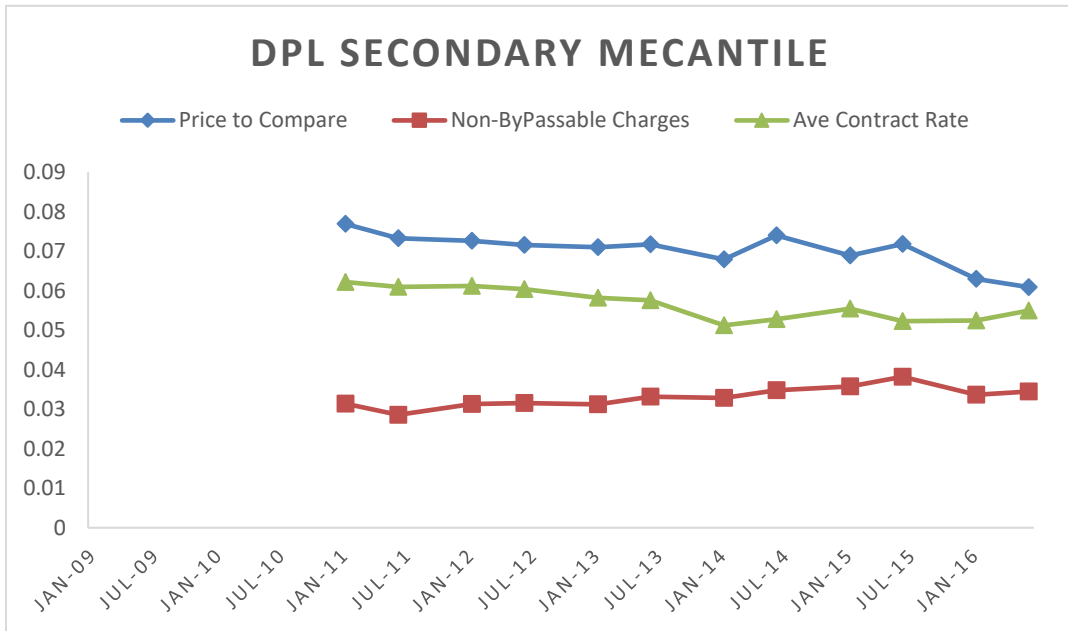
**AEP Ohio Power GS3S Rate Code Mercantile Prices**



Duke Secondary Mercantile Prices

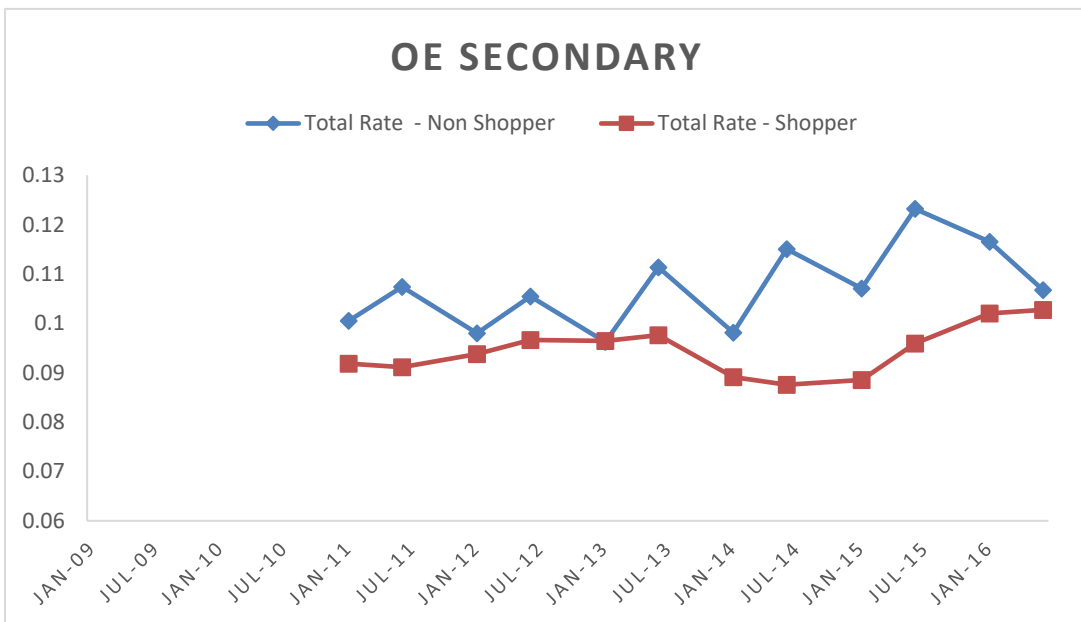
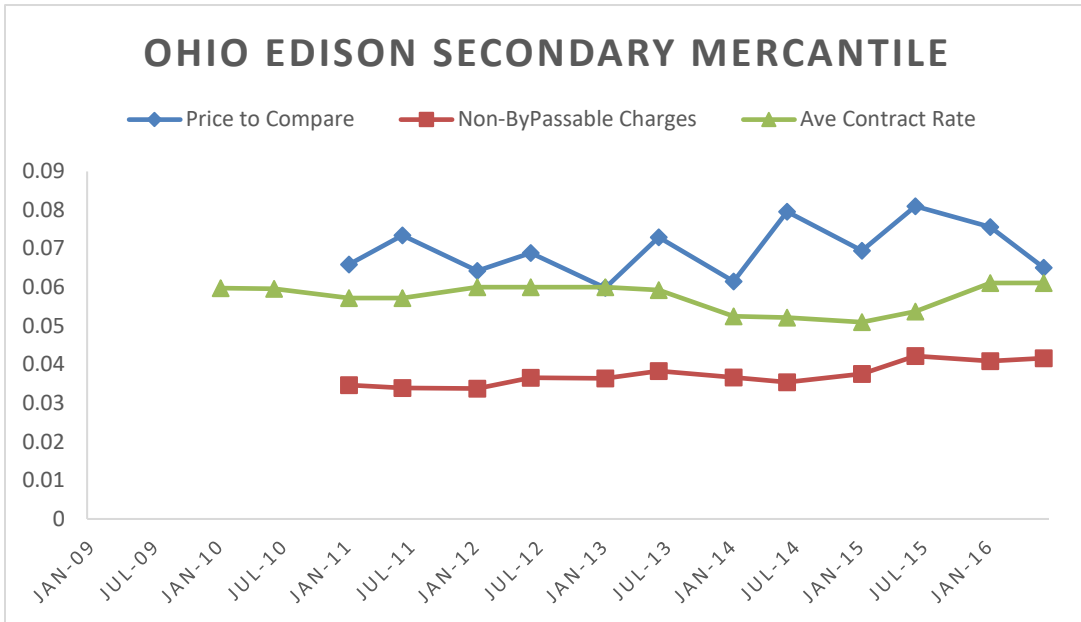


Dayton Power & Light Secondary Mercantile Prices

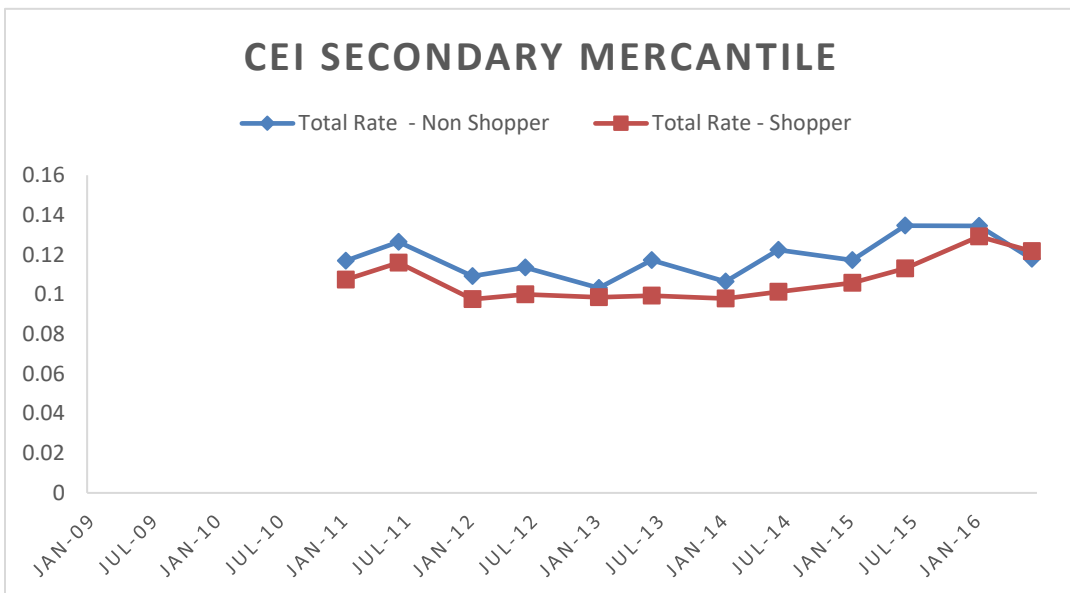
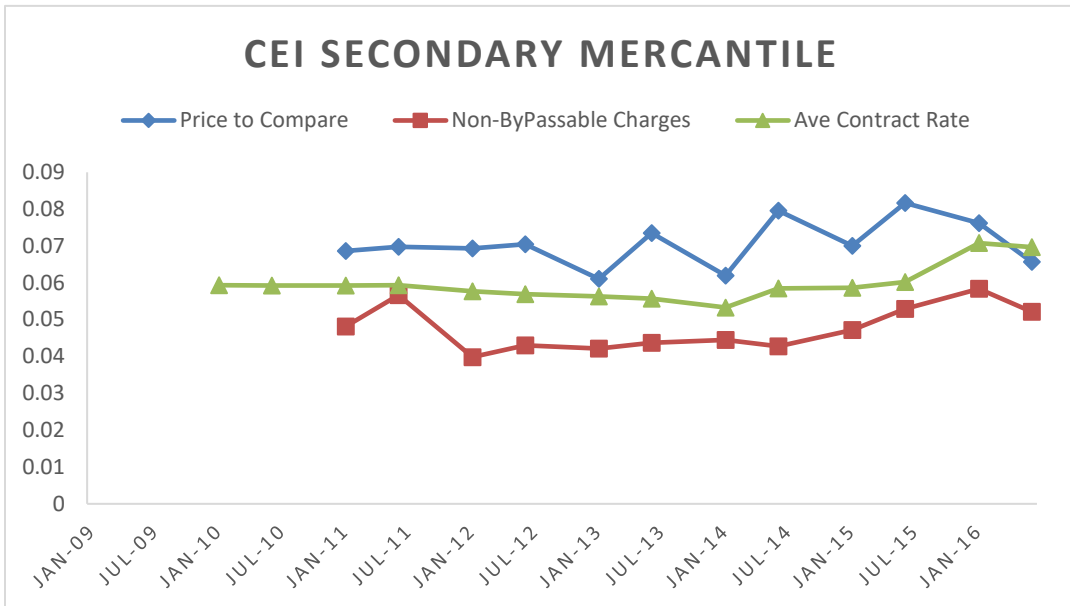




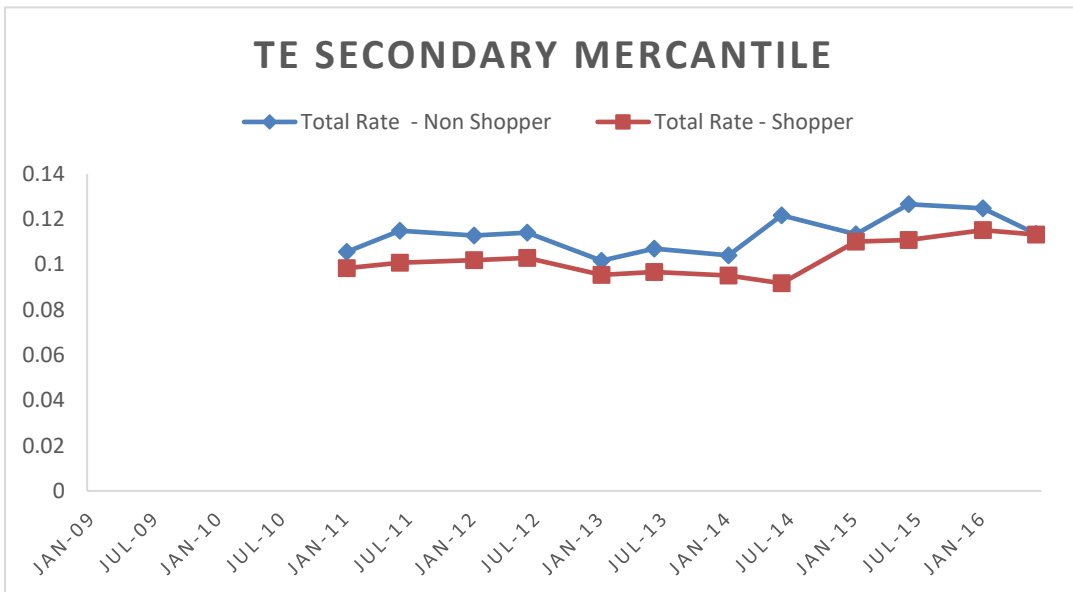
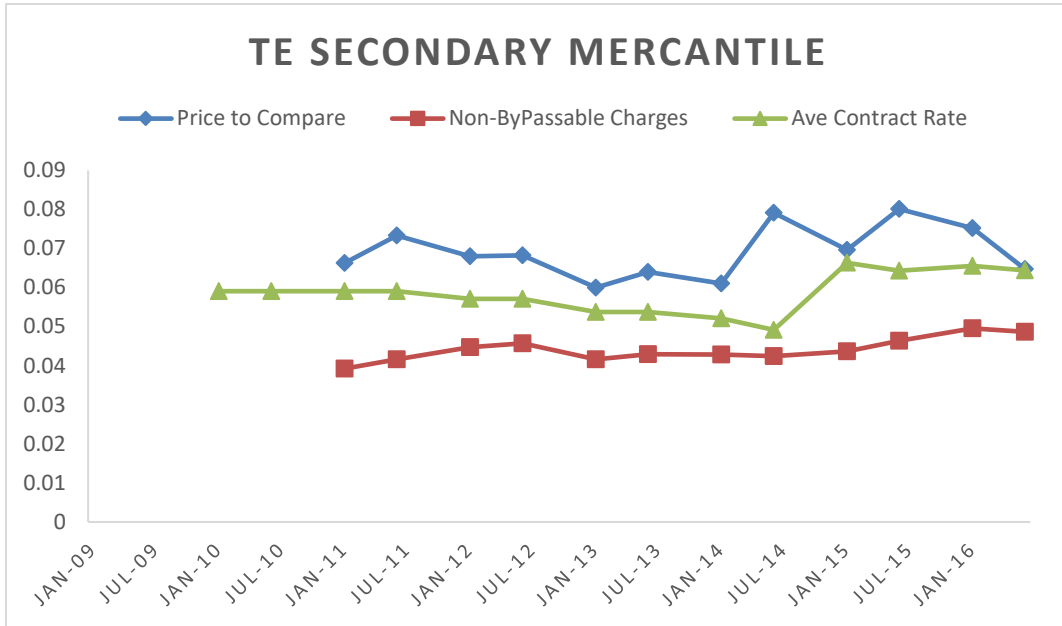
FirstEnergy Ohio Edison Secondary Mercantile Prices



FirstEnergy Cleveland Electric Illuminating Company Secondary Mercantile Prices



FirstEnergy Toledo Edison Secondary Mercantile Prices



## APPENDIX 5.

Table A. Mean Midwestern Electricity Prices in Deregulated and Regulated States, 1990 - 2014

|      | Midwestern Deregulated States | Midwestern Regulated States |
|------|-------------------------------|-----------------------------|
| 1990 | 0.113                         | 0.096                       |
| 1991 | 0.114                         | 0.950                       |
| 1992 | 0.112                         | 0.930                       |
| 1993 | 0.111                         | 0.090                       |
| 1994 | 0.106                         | 0.088                       |
| 1995 | 0.106                         | 0.086                       |
| 1996 | 0.105                         | 0.084                       |
| 1997 | 0.102                         | 0.082                       |
| 1998 | 0.110                         | 0.082                       |
| 1999 | 0.100                         | 0.080                       |
| 2000 | 0.092                         | 0.079                       |
| 2001 | 0.100                         | 0.085                       |
| 2002 | 0.092                         | 0.079                       |
| 2003 | 0.090                         | 0.078                       |
| 2004 | 0.088                         | 0.079                       |
| 2005 | 0.089                         | 0.082                       |
| 2006 | 0.092                         | 0.089                       |
| 2007 | 0.097                         | 0.090                       |
| 2008 | 0.101                         | 0.094                       |
| 2009 | 0.102                         | 0.097                       |
| 2010 | 0.103                         | 0.099                       |
| 2011 | 0.101                         | 0.101                       |
| 2012 | 0.095                         | 0.102                       |
| 2013 | 0.093                         | 0.104                       |
| 2014 | 0.098                         | 0.102                       |

Note: Values are all real dollars 2014 per kWh.

**Table B. Regression Analysis of Suspected State-Level Electricity Price Determinants**

| Source   | SS         | df  | MS         |                 |        |  |
|----------|------------|-----|------------|-----------------|--------|--|
| Model    | .707884031 | 16  | .044242752 | Number of obs = | 817    |  |
| Residual | .227939005 | 800 | .000284924 | F( 16, 800) =   | 155.28 |  |
| Total    | .935823036 | 816 | .001146842 | Prob > F =      | 0.0000 |  |
|          |            |     |            | R-squared =     | 0.7564 |  |
|          |            |     |            | Adj R-squared = | 0.7516 |  |
|          |            |     |            | Root MSE =      | .01688 |  |

| electricit~a | Coef.     | Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|--------------|-----------|-----------|--------|-------|----------------------|-----------|
| statusofde~n | .0143807  | .0015902  | 9.04   | 0.000 | .0112591             | .0175022  |
| capacityre~l | -1.79e-09 | 1.16e-10  | -15.47 | 0.000 | -2.02e-09            | -1.56e-09 |
| capacityco~l | 1.48e-09  | 1.14e-10  | 12.92  | 0.000 | 1.25e-09             | 1.70e-09  |
| capacityin~l | -3.13e-10 | 7.89e-11  | -3.96  | 0.000 | -4.67e-10            | -1.58e-10 |
| percentcoa~e | -.0006475 | .0000375  | -17.25 | 0.000 | -.0007212            | -.0005738 |
| percentnul~i | .0003791  | .0000444  | 8.55   | 0.000 | .000292              | .0004662  |
| percentren~t | -.0012127 | .0003832  | -3.16  | 0.002 | -.001965             | -.0004605 |
| percentpet~l | .0010382  | .0000996  | 10.42  | 0.000 | .0008427             | .0012337  |
| crudeoilpr~l | .0001657  | .0001311  | 1.26   | 0.207 | -.0000917            | .0004232  |
| naturalgas~l | -.0023604 | .0008864  | -2.66  | 0.008 | -.0041003            | -.0006205 |
| nuclearpri~d | -.0000188 | .0001546  | -0.12  | 0.903 | -.0003223            | .0002847  |
| coalpriced~n | .0005818  | .0002762  | 2.11   | 0.036 | .0000396             | .001124   |
| consumrene~d | 3.72e-11  | 1.08e-11  | 3.44   | 0.001 | 1.60e-11             | 5.84e-11  |
| consumeren~u | 7.22e-12  | 3.34e-12  | 2.16   | 0.031 | 6.54e-13             | 1.38e-11  |
| consumeren~l | 1.55e-10  | 1.46e-11  | 10.64  | 0.000 | 1.26e-10             | 1.83e-10  |
| conumeren~e  | -5.87e-10 | 1.09e-10  | -5.38  | 0.000 | -8.02e-10            | -3.73e-10 |
| _cons        | .1258944  | .0072093  | 17.46  | 0.000 | .1117431             | .1400457  |

In this model, the dependent variable is electricity price<sub>ij</sub> in the combined industrial, commercial and residential sectors, where *i* goes from 1 – 38 states with 13 of them deregulated and 25 regulated, and *j* goes from 1990 - 2014. The remaining states were listed in the EIA data as being in “suspended status,” and so were omitted from the analysis. The variables were defined as follows: statusofde-n was “status of deregulation,” coded with “1” for deregulated states and “0” for regulated states. The next set of variables were measures of per capita generation capacity (in megawatts): capacityre-l for the residential sector, capacityco-l for the commercial sector, and capacityin-l for the industrial sector. The set of variables after that reflected the states’ mix of resources for electricity generation. Specifically, percentcoa-e gave the percentage of total quantity consumed of coal, percentnul-i the percentage consumed of nuclear, percentren-t the percentage of renewable sources, and percentpetr-l the percentage of petroleum. The next set of variables gave the amount expended by utilities for the various fuels, specifically crudeoilpr-l gave the cost of crude oil, naturalgas-l the cost of natural gas, nuclearpri-d the cost of nuclear, and coalpriced-n the cost of coal. The final set of variables gave the fuel prices delivered to the utilities, specifically consumrene-d was the average price of crude oil delivered to electric utilities, consumeren-u the average price of natural gas, consumeren-l the average price of coal, and conumeren-e the average price of nuclear delivered to electric utilities.

Table C Gives the conceptual definition and data source for each variable reported in Table B.

**Table C. Variable Measurement and Data Sources**

| Variable  | Results searching on data availability  | Data Source  |
|---|---|--|
| Electricity Price in total sector               | Average price of electricity to ultimate customers by provider at state level (Dollars/kilowatt-hour applied real dollars value of 2014 year)   | <b>EIA-861</b><br>1990~2014  |
| Status of deregulation                          | Status of electric utility deregulation in each state <ul style="list-style-type: none"> <li>• State with deregulated electricity market (1) : 13states</li> <li>• State with regulated electricity market (0) : 25 states</li> </ul>   | <b>Each state's legislation</b>  |
| Generation Capacity                             | <ul style="list-style-type: none"> <li>• Power plant capacity from Electric Generators, Electric Utilities (Megawatt) per capita</li> <li>• Contains information on the Residential, Commercial, and Industrial sector</li> </ul>   | <b>EIA-861S</b><br>1990~2014   |
| The Mix of Resources for Electricity Generation | Percentage of total quantity consumed in each energy source for electric generation in thousands of megawatt-hours <ul style="list-style-type: none"> <li>• Coal, Nuclear, Oil, and Renewable energy Sources</li> </ul>   | <b>EIA-923:</b><br>2001~2014<br><b>EIA-906:</b><br>1990~2000<br><b>DESIRE</b>  |
| kwh Utility Fuel Cost                           | Cost expensed by utilities for use of selected energy sources <ul style="list-style-type: none"> <li>• Number multiplied between the total quantities consumed in each energy sources and the state price of each energy source.</li> <li>• Price per Megawatt hour</li> <li>• Contains information on the oil, coal, nuclear, and natural gas</li> <li>• Net generated amount ( ) * price paid by utility for fuel</li> </ul>                            | <b>EIA-923:</b><br>2001~2014<br><b>EIA-906:</b><br>1990~2000<br><b>EIA-7A</b><br>1990~2014<br><b>EIA-858</b><br>1994-2014                            |
| Fuel Prices                                     | <ul style="list-style-type: none"> <li>• Average price of coal delivered to electric utilities at the state level in dollars per short ton.</li> <li>• Price of total natural gas in nominal dollars at the state level</li> <li>• Price is collected by price of uranium purchased by owners and operators of U.S. nuclear power reactors in dollars per pound at the national level</li> <li>• Average price of crude oil at the state level</li> </ul> | <b>EIA-7A</b><br>1990~2014<br><br><b>Natural Gas Storage Report</b><br><br><b>EIA-858</b><br>1994-2014<br><br><b>Uranium Marketing Annual Report</b> |