

Exhibit A

UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

ELECTRIC POWER SUPPLY)
ASSOCIATION, DYNEGY INC.,)
EASTERN GENERATION, LLC,)
NRG ENERGY, INC., and CALPINE)
CORPORATION,)

Plaintiffs)

Case No. 17-cv-01164

v.)

Judge

ANTHONY M. STAR, in his official)
capacity as Director of the Illinois)
Power Agency, and BRIEN J.)
SHEAHAN, JOHN R. ROSALES,)
SADZI MARTHA OLIVA, MIGUEL)
DEL VALLE, and SHERINA MAYE)
EDWARDS, in their official capacities)
as Commissioners of the Illinois)
Commerce Commission,)

Magistrate

Defendants)

DECLARATION OF DAVID W. DERAMUS, PH.D.

Declaration of David W. DeRamus, Ph.D.

Table of Contents

I. Introduction and summary of conclusions	1
II. Overview of affected FERC-jurisdictional wholesale markets	4
II.A. General structure and purpose of wholesale markets	4
II.B. Energy vs. capacity markets	5
II.C. PJM energy and capacity markets	7
II.D. MISO energy and capacity markets	10
III. The ZEC price is “tethered” to wholesale markets and prices	11
III.A. ZEC program is predicated on participation in wholesale markets	11
III.B. The ZEC price is calculated based on wholesale prices	13
III.C. ZECs are easily distinguishable from RECs	17
IV. The IL ZEC program will distort FERC-jurisdictional wholesale market prices and outcomes	19
IV.A. Illinois 2015 Report	19
IV.B. Analysis of the market impact of the Illinois ZEC program	22
IV.B.1. Impact of ZEC nuclear subsidy on energy markets	22
IV.B.2. Impact of ZEC nuclear subsidy on capacity markets	26
IV.C. The IL ZEC program will distort market bidding behavior	28
V. The IL ZEC program will cause irreparable harm	31
V.A. ZEC program will harm other market participants by artificially suppressing market prices	31
V.B. ZEC program will cause market exit and reduce market entry by more efficient participants	32
V.C. ZEC program will harm ratepayers	33
V.D. ZEC program will harm ratepayers by overcompensating nuclear units relative to actual costs	35
VI. The IL ZEC program provides undue in-state preferences	37
VI.A. Statements and actions by Exelon	37
VI.B. The stated goals and findings of the FEJA	38
VI.C. Specific provisions of the FEJA	40
VI.C.1. ZEC participation is limited to nuclear facilities	40
VI.C.2. ZEC participation is limited to nuclear facilities with insufficient market revenues	41
VI.C.3. ZEC participation is effectively limited to uneconomic nuclear facilities in Illinois	42
VI.C.4. ZEC program design is uniquely applicable to Clinton and Quad Cities	43
VI.D. Legislative history of the FEJA	44
VI.E. Protectionist effects of the FEJA are exacerbated by exports	45

Declaration of David W. DeRamus, Ph.D.

I. Introduction and summary of conclusions

- (1) My name is David W. DeRamus. I am a Partner with the economic consulting firm of Bates White, LLC. I have held this position since 1999. During this time period, I have performed economic analyses related to a range of litigation, arbitration, and regulatory matters, many of which pertain to issues of competition in wholesale electricity markets. I have previously served as an economic expert in various proceedings before the Federal Energy Regulatory Commission (“FERC”), various state regulatory authorities, federal and state courts, and arbitration associations. In many of these proceedings, I have analyzed issues of market power, market manipulation, monopolization, price-fixing, mergers and acquisitions, and the design of wholesale electricity markets. I have worked on behalf of the U.S. Department of Justice, the Maryland Public Service Commission, public utilities, independent power producers, industrial and residential consumers of electricity, industry associations, and various other parties. Prior to joining Bates White, I was employed by the management consulting firm A.T. Kearney, the accounting firm KPMG Peat Marwick, and the Harvard Graduate School of Business Administration. I received a Ph.D. in Economics from the University of Massachusetts at Amherst.
- (2) I have been asked by Plaintiffs to evaluate and quantify the likely impact on wholesale electricity markets of the nuclear power plant subsidies associated with the Illinois Zero Emissions Credits (ZECs), resulting from the Illinois Future Energy Jobs Act (FEJA).¹ I have also been asked to assess whether the impact of the Illinois ZEC program on wholesale electricity markets is likely to cause irreparable harm to wholesale market participants and/or to consumers. Finally, I have been asked to evaluate whether the FEJA effectively limits participation in the Illinois ZEC program to uneconomic nuclear generating units located within Illinois – all of which are owned by Exelon² – and effectively excludes other non-emitting electricity resources outside Illinois from participating in the program.
- (3) If the ZEC program is allowed to take effect, it will have a major, long-term disruptive effect on U.S. wholesale electricity markets. The wholesale electricity markets that will be primarily affected by this program are those administered by PJM Interconnection, L.L.C. (PJM) and the Midcontinent Independent System Operator, Inc. (MISO). PJM is a regional transmission organization (RTO) operating across 13 states and the District of Columbia. MISO is an RTO operating across 15 states and the Canadian Province of Manitoba. Illinois is served in part by PJM (in and around Chicago) and in part by MISO. Because of the interconnected nature of electricity systems and markets, the

¹ The FEJA amends the Illinois Power Agency Act (IPAA), 20 ILCS 3855, effective June 1, 2017.

² Of the seven nuclear generating facilities in Illinois, Exelon owns 100% of six of these units and 75% of the Quad Cities facility. MidAmerican Energy owns the remaining 25% of the Quad Cities facility. MidAmerican, however, is fully compensated for the costs of its 25% share of Quad Cities, since its retail ratepayers take service from MidAmerican at cost-of-service rates. It does not appear that MidAmerican intends or would be eligible to participate in the ZEC program with its share of the Quad Cities facility. See: “Exelon Bill Won’t Raise MidAmerican Rates,” *Dispatch/Argus*, December 2, 2016, available at http://www.qconline.com/news/local/exelon-bill-won-t-raise-midamerican-rates/article_31c06e9f-f10c-5f3b-bb19-a7bcba95562.html, accessed March 27, 2017.

Declaration of David W. DeRamus, Ph.D.

disruptive effects of the ZEC program will extend to neighboring wholesale markets in the Eastern Interconnection as well.

- (4) The volume of commerce affected by the PJM and MISO markets is substantial. If allowed to proceed, the Illinois ZEC program will provide one company, Exelon, with out-of-market subsidies of approximately \$235 million annually on average for the next 10 years – although the costs of the program may be as high as \$340 million annually in the near term. The ZEC subsidies will be paid to support two uneconomic nuclear generating facilities in Illinois: Exelon’s Clinton and Quad Cities nuclear generating facilities.³ The purpose and effect of these subsidies is to ensure that these two uneconomic Illinois nuclear generating facilities, with 2,900 MW of capacity, will continue to operate and participate in the PJM and MISO wholesale electricity markets for at least the next 10 years, notwithstanding Exelon’s stated intention – prior to the passage of the FEJA – to shutter these plants in 2017 and 2018.
- (5) The Illinois ZEC program directly “tethers” the subsidies to the continued wholesale market participation and revenues earned by the selected nuclear generating units. This “tethering” occurs both from the *de facto* requirement that the nuclear units continue to participate in wholesale markets (for the 10-year duration of the program) in order to receive the ZEC subsidies; and from the specific formula specified in the FEJA. The ZEC formula establishes a “price collar” that substantially reduces the risks to Exelon of changes in wholesale market prices. This “price collar” will eliminate any deficiency in Exelon’s wholesale market revenues relative to the selected units’ costs (up to a cap of \$16.50/MWh). The ZEC program is easily distinguishable from other state environmental programs: its purpose is to prevent the retirement of uneconomic units of a mature technology, not to stimulate new investment or the development of novel technologies; it relies on a non-market mechanism, restricting participation to a single owner of a single technology in a single state, who can demonstrate that its costs are greater than its expected wholesale market revenues (for the specific generating facilities at issue); and it will have widespread and long-term distortionary effects on wholesale markets.
- (6) The Illinois ZEC program will artificially suppress prices in the wholesale energy and capacity markets, both in the immediate future and over the long-term. While the impact of the ZEC program will be greatest on the wholesale prices where the Clinton and Quad Cities facilities are located, i.e., in the ComEd Zone in PJM and the Zone 4 (Illinois) region in MISO, the impacts will be spread across a large volume of wholesale market transactions throughout these regions. The ZEC program will suppress energy market revenues by approximately **\$107 million annually** in the ComEd Zone of PJM, and by approximately **\$244 million annually** across all of PJM. In MISO, the ZEC program will suppress energy market revenues by **\$26 million annually** in the Illinois Zone 4 region, and by

³ The Clinton generation facility has one nuclear reactor, while the Quad Cities generation facility has two reactors. All of the ZEC payments for the Quad Cities facility are expected to be earned by Exelon for its 75% share of that facility.

Declaration of David W. DeRamus, Ph.D.

\$93 million annually across the broader MISO Central Region. In the wholesale capacity markets, the ZEC program will suppress market revenues by between **\$386 million and \$529 million annually** in the ComEd Zone of PJM. In the MISO capacity market, the ZEC program will likely suppress market revenues by between **\$117 million and \$309 million annually**.

- (7) If allowed to proceed, the Illinois ZEC program will cause irreparable harm, resulting from:
- a. the immediate and long-term artificial suppression of wholesale energy and capacity prices, which cannot be “undone” after the fact;
 - b. the retirement of other more cost-effective generating units, and the foregone investment and market entry by other participants (including by renewable and demand-side resources), resulting from market distortions caused by the ZEC program; and
 - c. the substantial direct costs of the ZEC subsidies borne by Illinois ratepayers, as well as the costs and inefficiencies ultimately borne by ratepayers across the entire region as a result of the long-term market distortions from the ZEC program.
- (8) If allowed to proceed, the Illinois ZEC program will also undermine the faith and confidence of market participants in the integrity and sustainability of the market mechanisms established by FERC and the RTOs. To the extent the ZEC program reflects buyer-side market power, i.e., the artificial suppression of wholesale market prices, the program will cause PJM and MISO market prices to be unjust and unreasonable. The retention of uneconomic generating units in the wholesale markets also would frustrate the explicit purpose of wholesale markets: in establishing capacity markets, FERC intended markets to provide appropriate price signals to encourage the exit of inefficient generation and the entry of more efficient market participants. By artificially suppressing prices across a number of states, the ZEC program will ultimately leading to the replacement of market competition with “competition for subsidies.”⁴
- (9) I also conclude that the ZEC program was structured to ensure that only in-state resources would participate in the program. Immediately after the FEJA was passed, Exelon reversed its prior decision to retire the Quad Cities and Clinton nuclear facilities. This demonstrates that the outcome of the ZEC procurement process is a foregone conclusion, i.e., with Clinton and Quad Cities the predetermined “winners” of the future procurement. The requirements and guidance provided in the FEJA ensure that participation in the ZEC program will be restricted to in-state resources. The FEJA defines “Zero Emissions Facilities” to limit participation only to nuclear generating units, thereby excluding other zero emissions technologies, such as wind or solar. The FEJA further limits participation to nuclear facilities that would otherwise exit the market. The reference prices used to determine the amount of

⁴ See “PJM monitor rails against threat of ‘contagious’ subsidies,” *Energy Wire*, March 13, 2017, available at: <http://www.eenews.net/energywire/2017/03/13/stories/1060051340>, accessed March 30, 2017.

Declaration of David W. DeRamus, Ph.D.

ZEC subsidies is based on wholesale prices in Illinois. The 10-year time horizon for the ZEC program corresponds to the end of the nuclear license for Exelon's Clinton facility. The volume of ZEC credits to be procured corresponds to Exelon's output from its Clinton and Quad Cities facilities. Other provisions of the FEJA provide guidance to ensure that only in-state uneconomic nuclear plants will be selected for the program. The legislative history of the FEJA further demonstrates that the ZEC program is intended to support only in-state nuclear generation. The protectionist result of these in-state preferences is exacerbated here, since Illinois is a net exporter of electricity to other states, and these exports are supported in significant part by the ZEC subsidies – provided solely to Illinois nuclear generating units owned by Exelon.

II. Overview of affected FERC-jurisdictional wholesale markets

- (10) Under the FPA, FERC has exclusive jurisdiction over the transmission of electric energy in interstate commerce and over the sale of electric energy at wholesale in interstate commerce.⁵ A “wholesale” transaction is defined as the sale of electric energy for resale. The FERC has exclusive authority to regulate the wholesale market to ensure that wholesale rates are “just and reasonable.”⁶ Recent state efforts to subsidize new electric generation facilities have been barred when they were found to distort FERC-jurisdictional wholesale markets and rates.⁷

II.A. General structure and purpose of wholesale markets

- (11) To promote competition in wholesale electricity markets, FERC issued Order No. 2000, which encouraged utilities to join an independent system operator (ISO) or regional transmission organization (RTO). RTO/ISOs are independent, nonprofit organizations responsible for wholesale sales and purchases of electricity, grid reliability, and transmission planning and operation to provide efficient market outcomes.⁸ Since trades of electricity in the wholesale market generally occur across multi-state boundaries, RTO/ISOs often are organized regionally, encompassing many states. Two-thirds of the electricity consumed in the U.S. is by consumers in an RTO/ISO.⁹

⁵ 16 U.S.C. § 824(b)(1).

⁶ 16 U.S.C. § 824(d). FERC's exclusive jurisdiction over wholesale rates also extends to the terms and conditions of wholesale transactions.

⁷ In *Hughes v. Talen Energy*, the Supreme Court found that the FPA pre-empted a state's ability to provide subsidies for a new power plant because it intruded on FERC's authority over interstate wholesale rates (*[b]y adjusting an interstate wholesale rate, Maryland's program invades FERC's regulatory turf.*” slip op., at 12.).

⁸ 89 FERC ¶ 61,285. Available at <https://www.ferc.gov/legal/maj-ord-reg/land-docs/RM99-2A.pdf>

⁹ “The Value of Independent Regional Grid Operators,” *The ISO/RTO Council*. Available at http://www.nyiso.com/public/webdocs/media_room/press_releases/2005/isortowhitepaper_final1112005.pdf

Declaration of David W. DeRamus, Ph.D.

- (12) RTO/ISOs use centrally operated, “organized” day-ahead and real time spot markets to balance supply and demand. They also send long-term price signals to balance the supply and demand of generation and transmission infrastructure investment. Some RTO/ISOs like PJM and MISO use capacity markets to supplement revenue deficiencies earned in spot markets, to ensure that adequate resources exist to meet reliable planning needs, and to provide appropriate market signals to encourage efficient market exit and entry of generation resources. In addition, RTO/ISOs plan grid operations and infrastructure investment to ensure efficient response to changes in market fundamentals and/or challenges, such as declining natural-gas prices, shifts in electricity demand, and/or the need to reliably interconnect increased amount of renewable energy resources to the grid.
- (13) RTO/ISO markets are designed to select supply and demand resources that provide electricity at the lowest cost without hampering grid reliability. The physical challenges of maintaining electric supply-demand balance at all times necessitate complex market mechanisms that require FERC approval. Numerous market-rule changes have been implemented in order to improve the efficiency and reliability of the competitive wholesale markets.¹⁰ RTO/ISO markets are overseen by FERC and an independent market monitor (IMM) to ensure that they are structurally competitive, to prevent market manipulation, and to prevent the exercise of either buyer or seller market power.
- (14) The largest part of the state of Illinois (by area) belongs to the MISO RTO, while the remainder of the state, including Chicago and parts of northern Illinois, belongs to the PJM RTO. As described more fully below, PJM and MISO operate two distinct types of electricity markets, i.e., both energy and capacity markets, and the energy markets include both “day-ahead” and “real-time” services.¹¹

II.B. Energy vs. capacity markets

- (15) Energy and capacity markets price different aspects of delivering electric power to the grid. Energy is what is generated and consumed in the moment, and is typically measured in kilowatt-hours (kWh) or megawatt-hours (MWh). Capacity is a measure of the *capability* to generate electric energy, and is typically measured in kilowatts (kW) or megawatts (MW).
- (16) Centralized wholesale markets, such as those administered by PJM, MISO, and other RTO/ISOs, are designed to set a single price of energy at a point in time, typically every five minutes, and at various locations. The clearing price in energy markets is based on the cost of generating the last quantity of electricity needed to meet demand in the moment (and location), with generating resources selected to operate in increasing order of cost. The energy market is intended to secure generation to meet load efficiently (only using higher cost resources when necessary), and to create incentives for generators

¹⁰ These market changes include creation of capacity markets and compensation for demand-response resources.

¹¹ PJM and MISO also operate ancillary services markets, but the effect of the Illinois ZEC program on these markets is relatively small compared to the effect on the energy and capacity markets.

Declaration of David W. DeRamus, Ph.D.

to minimize operating costs and increase plant availability. Energy markets set prices per unit of actual generation, generally expressed in dollars per megawatt hour (\$/MWh).

- (17) The single-price nature of energy markets means that sources of energy with very low operating costs, such as wind turbines and nuclear power plants, often receive energy market revenue in excess of their immediate operating costs. The excess of the energy price over the cost of generation is a plant's net energy revenue.
- (18) Capacity markets have been introduced in most, but not all, centralized markets. Capacity markets establish a price for capacity based on the value it provides to the electric system. As noted above, capacity is the *capability* to produce electric energy. Because heat waves or cold snaps can push the demand for electricity very high for short periods – much higher than the average level over a typical year – significantly more capacity must be available than is needed for producing energy in most hours. Without sufficient capacity, there would be blackouts during peak demand periods. Hence, there may be significant value in a power plant's capacity, even if it is needed only very rarely to actually generate energy.
- (19) Capacity markets were introduced to account for the fact that some generating resources – particularly those with high operating costs that may only operate infrequently, when they themselves are setting the market clearing price – do not earn sufficient net revenue in the energy market to cover their fixed costs. Capacity markets were designed to allow for compensation in addition to net energy revenue so that generators are paid appropriately for the value they provide to the electric system. Capacity market prices in PJM and MISO are generally expressed in dollars per megawatt day (\$/MW-day), although the base commitment period is annual.
- (20) The economic viability of a generator that sells into the wholesale markets depends on its total costs relative to the combined revenue it can receive in both the energy and capacity markets.¹² Plant costs include not only current generating costs, but also the on-going fixed costs that are required to keep the plant ready to operate when needed, and which may be avoidable only through plant retirement. Some power plants, like nuclear generators, have a low cost of generating energy, but high fixed costs. Other types of plants, such as simple cycle turbines burning natural gas or oil, have relatively high costs of generation, but low fixed costs. In both cases, competitive plants earn revenue to cover their costs in the same capacity and energy markets, but may earn a greater or smaller share of their revenues from the energy market relative to the capacity market.
- (21) The design of the wholesale markets, and particularly of the capacity markets, is intended to provide appropriate price signals to generators, developers, and investors, in order to induce economically efficient decisions to build needed, new generation, or to retire old, costly power plants. Because

¹² Centralized wholesale markets also include markets for ancillary services – generation-related services needed to ensure electric system stability.

Declaration of David W. DeRamus, Ph.D.

capacity markets set the price of incremental capacity, and because they provide compensation for the capability to generate, they are essential parts of the overall wholesale market mechanism. Disruption to efficient pricing in the capacity markets – such as that caused by the Illinois ZEC subsidy program – undermines the signals intended to guide efficient market entry and exit.

II.C. PJM energy and capacity markets

- (22) PJM operates competitive wholesale electricity markets and manages the reliability of its transmission grid.¹³ In managing the grid, PJM centrally dispatches generation and coordinates the movement of wholesale electricity in all or part of 13 states (Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia) and the District of Columbia. PJM's markets include energy (day-ahead and real-time) and capacity (Reliability Pricing Model or RPM) services.¹⁴ As of December 31, 2016, PJM had installed generating capacity of 182,449 MW and 986 members, including market buyers, sellers, and traders of electricity in a region of more than 65 million people.
- (23) The PJM energy market procures electricity to meet consumers' demands both in real-time (five minutes) and on a day-ahead (one-day forward) basis. PJM uses locational marginal prices (LMPs) to price energy purchases and sales. LMPs are derived using a physical flow-based pricing methodology that includes local generation costs, transmission congestion, and the cost of transmission losses to move energy within the PJM service territory.¹⁵ Accordingly, LMPs represent the marginal cost to serve the next MW of demand at a specific location, using the lowest production cost of all available generation, while observing all transmission constraints and operating limitations. To ensure the lowest production cost, PJM requires that generators bid the price and amount of generation at generator-specific locations (i.e., a generator "bus") and accepts bids from the lowest until the accepted amount meets the demand. The resulting market clearing price is the LMP and is paid to all accepted bidders in that specific location without regard to the original bid price. LMPs are calculated both in day-ahead and real-time auctions.
- (24) Figure 1 provides a map of 2016 energy prices in PJM, with different colors representing energy prices at different locations (i.e., different LMPs).¹⁶ In 2016, the PJM-wide load-weighted average

¹³ PJM was founded in 1927 as a power pool of three utilities serving customers in Pennsylvania and New Jersey. In 1956, with the addition of two Maryland utilities, it became the Pennsylvania-New Jersey-Maryland Interconnection, or PJM. PJM became a fully functioning ISO in 1996 and, in 1997, it introduced markets with bid-based pricing and locational market pricing (LMP). PJM was designated an RTO in 2001.

¹⁴ PJM introduced the RPM capacity market effective June 1, 2007. PJM also operates ancillary services markets, including the regulation market, the synchronized reserve market, the day-ahead scheduling reserve (DASR) market.

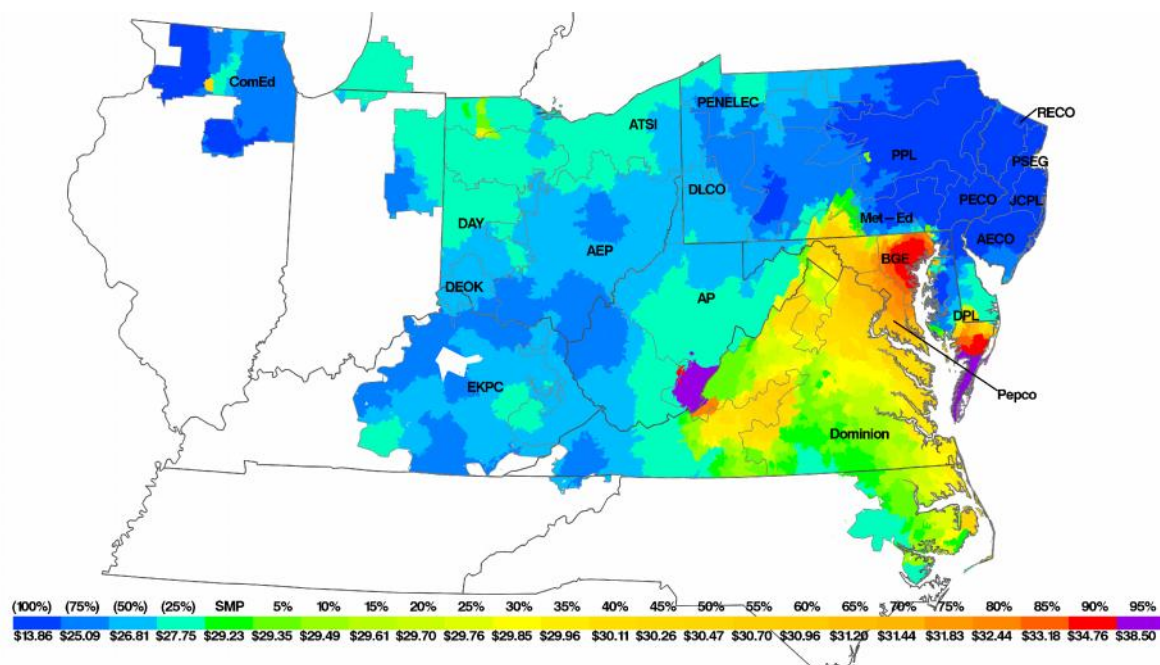
¹⁵ An LMP is comprised of the system energy price (or system lambda), transmission congestion cost, and transmission losses cost.

¹⁶ Monitoring Analytics LLC, "State of the Market Report," March 9, 2017, vol. 2, p. 157

Declaration of David W. DeRamus, Ph.D.

real-time LMP was \$29.23/MWh, which was exceptionally low relative to historical averages.¹⁷ There were significant differences among the zones, however. The highest average price by zone in 2016 was \$38.62/MWh for the BGE zone (around Baltimore, Maryland), reflecting the transmission constraints in that part of PJM. This means that a limited amount of lower-cost energy from elsewhere on the system could be delivered to the zone in some hours, with higher-cost local resources setting the LMP in such hours. Average energy prices in the ComEd zone in Northern Illinois, by contrast, were considerably lower at \$27.66/MWh, reflecting both the relatively large amount of generation supply in that zone relative to local load requirements, as well as the PJM transmission network topology that may limit exports to other parts of PJM (or MISO).

Figure 1: PJM real-time energy LMPs relative to system marginal price, 2016



- (25) Unlike other generators that rapidly change their output in response to fluctuating demand, nuclear generators are inflexible and generally run continuously at maximum output. Since the opportunity costs of not running a nuclear plant are exceptionally high, they generally bid as price-takers in the energy markets to ensure that they can continuously sell their energy, regardless of the clearing prices in the day-ahead and real-time energy market auctions. At times of high energy prices, nuclear plant owners earn very large margins, since fuel costs are far cheaper than for fossil fuel plants. However, the recent decline in natural gas prices, driven primarily by the abundance of cheap shale gas, has decreased energy prices, thereby dramatically reducing the profitability of many nuclear plants, as

¹⁷ Id., p. 156, Table 3-66.

Declaration of David W. DeRamus, Ph.D.

well as other generation owners. Nonetheless, current low energy prices are the result of the operation of competitive markets, as the PJM IMM has found.

- (26) The PJM capacity market, called the Reliability Pricing Model (RPM), was first introduced in 2007. The RPM ensures long-term grid reliability by procuring an appropriate amount of capacity resources needed to meet forecasted energy demand three years in the future. By matching energy supply with future energy demand, the RPM creates long-term price signals to attract needed investments in generation infrastructure and to assure adequate power supplies in the region. In the PJM capacity market, a load serving entity (LSE) is required to have the resources to meet its customers' demand plus a reserve. LSEs can meet that requirement in four ways: (i) with generating capacity they own; (ii) with capacity they purchase from others under contract; (iii) through demand response, in which end-use customers reduce their usage in exchange for payment; or (iv) with capacity obtained through the RPM auctions.¹⁸
- (27) The amount of capacity that LSEs are required to purchase is determined through the RPM, which in turn is subject to FERC oversight. LSEs in PJM procure capacity three years before it is needed through a competitive auction administered according to FERC-approved rules. This results in locational pricing for capacity that varies to reflect limitations on the transmission system and accounts for the differing needs for capacity in various areas of PJM. The RPM uses an administratively determined and FERC-approved "downward sloping" demand curve, which is the energy demand formula used to set the locational capacity price paid to market participants.
- (28) Similar to the energy market, the RPM participants offer power supply resources into the market that either increase energy supply or reduce demand at a certain price and volume at specific locations, called Locational Delivery Areas (LDAs).¹⁹ The PJM capacity market accepts the offer from the lowest bid price until the requisite amount for each capacity zone has been met. The last accepted offer in each capacity zone establishes the market-clearing price for that zone, and all accepted capacity resources in that zone are paid the respective market-clearing price regardless of the original offer price. Accepted capacity resources must deliver energy or reduce demand in the energy market, if warranted, especially during power system emergencies. Otherwise, they are subject to significant penalty payments.

¹⁸ The RPM conducts a series of auctions for a delivery year in the future. The majority of capacity is procured in the first auction for a particular delivery year, which is known as the Base Residual Auction (BRA). This auction is conducted three years in advance of a given delivery year. The RPM model works in conjunction with PJM's Regional Transmission Expansion Planning (RTEP) process to ensure the reliability of the PJM region for future years.

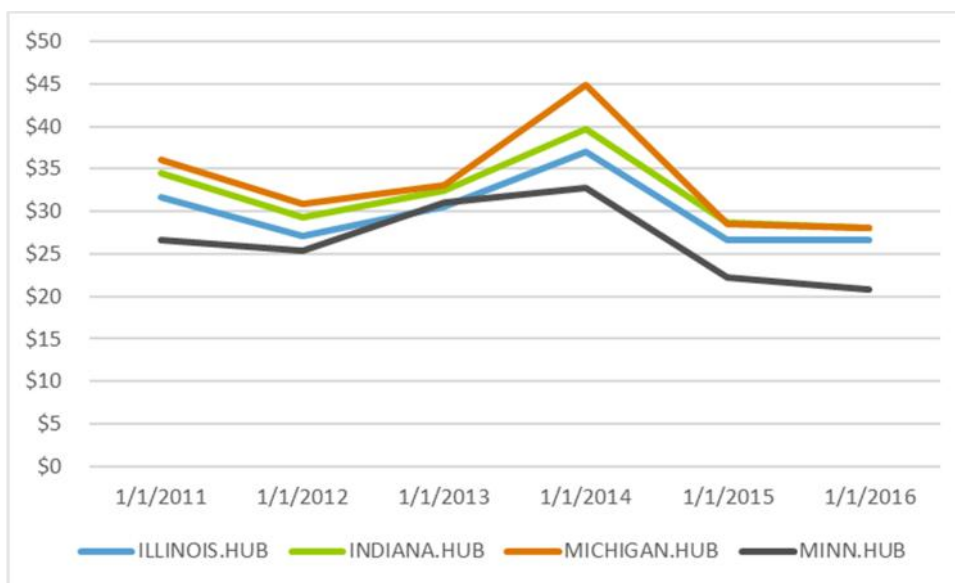
¹⁹ LDAs are established by their ability to move electricity in the event of an emergency. LDAs are determined annually through PJM's Regional Transmission Expansion Plan (RTEP) process. There are currently 27 LDAs in PJM.

Declaration of David W. DeRamus, Ph.D.

II.D. MISO energy and capacity markets

- (29) MISO operates the transmission system and centrally dispatched energy and capacity markets in all or parts of 15 U.S. states and the Canadian province of Manitoba, extending from Michigan and Indiana to Montana, and from Canada to Louisiana and Mississippi. MISO began market operations in April 2005. In 2013, MISO expanded its geographic footprint and established the MISO South region, which includes Entergy's service territory in parts of Arkansas, Mississippi, Louisiana, and Texas.
- (30) The operation of MISO's energy market is similar to PJM's energy market, i.e., centrally dispatched day-ahead and real-time energy markets that procure energy in a least-cost manner through competitive auctions, in which all accepted generators in the auction are paid the location-specific market clearing price (the LMP) regardless of their original bid prices.
- (31) Figure 2 below shows MISO's day-ahead average annual LMPs at major trading hubs (in Illinois, Indiana, Michigan, and Minnesota) during 2001 – 2016. During this time period, the average day-ahead MISO LMPs were lowest in 2016, due to low natural gas prices and slow demand growth. For example, the average day-ahead LMP at the Illinois hub (where the Clinton nuclear station is located) was \$26.66/MWh in 2016, which is about 16% below the 2011 price of \$31.67/MWh, and 28% below the 2014 price of \$37.03/MWh.²⁰

Figure 2: MISO day-ahead LMPs (\$/MWh)



²⁰ The average real-time LMP at the Illinois hub was \$26.42/MWh in 2016, compared to \$29.92/MWh in 2011 and \$34.65/MWh in 2014.

Declaration of David W. DeRamus, Ph.D.

- (32) MISO's capacity market is called the Resource Adequacy Requirement (RAR). LSEs in MISO can meet their capacity requirements (defined by the sum of the LSEs' projected demand and a reserve calculated by MISO and approved by FERC) by self-scheduling capacity resources or by acquiring capacity from annual Planning Resource Auctions (PRAs). PRAs are held annually for each of the 9 load zones within the MISO footprint.²¹ Similar to PJM's RPM auction, MISO's PRA functions as a reverse auction, where the offer price of the last unit needed to meet resource requirements sets the clearing price, which is paid to all cleared resources.²² Unlike PJM's RPM market, MISO's RAR purchases annual capacity obligations one month before the annual delivery period. By contrast, PJM purchases capacity three years in the future.

III. The ZEC price is "tethered" to wholesale markets and prices

- (33) As discussed in more detail below, the ZEC program will fundamentally distort wholesale markets: it will lead to uneconomic units being artificially retained in the market, after market price signals already signaled that they should exit (and after Exelon announced that the affected units would exit); it will lead to exit, and prevent entry, by other more efficient market participants (including by non-emitting resources); and it will artificially suppress wholesale market prices. All of these wholesale market impacts indicate a strong "tethering" of the ZEC program to the wholesale market. There are, however, several other fundamental ways in which the ZEC program is "tethered" to the wholesale markets, reflected in the very design of the program. These linkages between the design of the program and wholesale markets demonstrate that "tethering" is not simply incidental to the program (i.e., because "everything is interconnected in electricity"), but is a reflection of its basic purpose.

III.A. ZEC program is predicated on participation in wholesale markets

- (34) First, in order to receive a ZEC payment, there is an implicit – and unavoidable – requirement that a selected nuclear unit must participate in wholesale markets, given the way both the program and the regional markets are structured. The amount of the ZEC payment received by a participating nuclear unit is based on its actual output. Indeed, as a condition of eligibility, ZEC program applicants must commit to operate the specific units selected for the entire 10-year duration of the program.²³ For a nuclear unit, this effectively means a commitment to run at maximum feasible output, around the clock (subject to availability, maintenance and refueling outages, etc.), for 10 years.

²¹ Since the 2015/2016 PRA, a new LRZ 10 for Mississippi was established.

²² Load pays the Auction Clearing Price (ACP) for the Zone in which it is physically located; cleared capacity is paid the ACP for the Zone where it is physically located; and external resources are paid the price of the Zone where their firm transmission service crosses into MISO.

²³ FEJA(d-5)(1)(A)(iv).

Declaration of David W. DeRamus, Ph.D.

- (35) The output of these units is sold in FERC-jurisdictional wholesale markets. Given the way in which the system operator (PJM or MISO) implements its centralized dispatch function, in order to produce electricity in PJM and MISO, a competitive generator has to participate in – and clear – wholesale energy markets. Even if a nuclear unit decides to “self-schedule” its output without clearing the day-ahead market, the system operator will ensure that the unit will clear in the real-time market (with the wholesale payments or charges to the unit owner adjusted accordingly). In PJM and MISO, there is simply no practical means for a selected nuclear unit to avoid bidding into, and ultimately clearing, the wholesale energy markets, if it is to receive any ZEC payments.
- (36) Similarly, the ZEC program also implicitly and unavoidably requires a selected nuclear unit to bid into the capacity market. By the rules established by the RTOs (and approved by FERC), all competitive generators in the PJM and MISO markets are required to participate in capacity markets, i.e., to submit a bid subject to PJM and MISO rules regarding permissible bid amounts, even if their bids do not clear the market.²⁴ Further, as further discussed below, the formula for the ZEC program provides strong incentives for a participating nuclear unit to submit bids in the capacity market at a level that will ensure that it clears the market (e.g., as a “price-taker”), since any increase in capacity market prices caused by bidding as a “price-setter” (rather than a price-taker) would be offset by a corresponding reduction in its ZEC payments. Thus, the ZEC program’s specific design – in concert with the established rules and structure of the wholesale markets – has the same effect on a nuclear unit’s participation in the wholesale markets as an explicit requirement that it do so.
- (37) Second, the entire ZEC program is predicated on the assumption that the selected nuclear units would have retired in the absence of the ZEC payment. Thus, absent the ZEC program, the units at issue would have ceased participating in the wholesale markets. Certain provisions of the FEJA (discussed further below) require that in order to be eligible to participate in the ZEC program, an applicant must show that its nuclear unit’s costs are such that it would be forced to retire without the ZEC payments, i.e., that wholesale market revenues are insufficient to allow it to recover its costs. Indeed, the stated rationale of the ZEC program is the “preservation of zero emission facilities,” i.e., the retention of nuclear units in the market that would have otherwise retired in the absence of the ZEC payments.²⁵ This basic eligibility requirement – to show a deficiency in wholesale market revenues relative to a unit’s costs – provides a further tethering between the ZEC program and the wholesale market.
- (38) Third, the “tethering” of the ZEC program to the wholesale market is evident in the program’s genesis. The ZEC program was adopted in response to the expected retirement of specific Illinois nuclear plants. These expected retirements were the result of low wholesale market prices, relative to these specific nuclear units’ operating costs. These low wholesale market prices, in turn, were the

²⁴ The capacity markets in PJM and MISO allow load-serving entities – principally vertically-integrated utilities with their own generation – to in effect opt out of the capacity market-clearing process. This option is not relevant to the Illinois nuclear units nor the vast majority of generators in Illinois.

²⁵ 20 ILCS 3855/1-75(d-5)(1)(C)

Declaration of David W. DeRamus, Ph.D.

result of increased competition from lower-priced natural gas generation; market entry by new generation, including new renewable generation; and increased wholesale market participation by other participants, such as providers of demand response and energy efficiency resources. The retirement of uneconomic units – and entry by more efficient units – in response to wholesale market price signals is precisely the result that FERC intended with competitive electricity markets. The fact that the ZEC program was developed in response to a perceived deficiency in wholesale market outcomes provides a further “tethering” of the program to wholesale markets and prices.

III.B. The ZEC price is calculated based on wholesale prices

- (39) The explicit “tethering” of the ZEC subsidy to wholesale prices is evident in the specific formula for the ZEC credit adopted by the FEJA. As shown in Figure 3, the amount of subsidy earned by a participating nuclear generator is designed to adjust as wholesale electricity prices fluctuate:²⁶
1. The FEJA stipulates that the Illinois ZEC price is to be based on the value of the “Social Cost of Carbon” (SCC), which it has set equal to \$16.50/MWh in 2017. The SCC value specified in the FEJA is derived from a range of estimates published by a U.S. government interagency working group (recently withdrawn), which are expressed in terms of dollars per metric ton of CO₂.²⁷ The FEJA has selected one of these SCC estimates, which it purports to convert to \$16.50/MWh based on the carbon intensity of electricity generation in Illinois.²⁸ The FEJA holds the SCC value of \$16.50/MWh constant for the first six years of the program, unlike the (withdrawn) SCC values reported by the U.S. government interagency working group, which increase annually. Beginning in 2023, the SCC value used to set the ZEC price will increase by \$1/MWh, and continue to increase by an additional \$1/MWh each delivery year thereafter.
 2. The FEJA states that the ZEC price in an applicable delivery year will be reduced below the SCC by the amount by which the “market price index” for the applicable delivery year exceeds the “baseline market price index” for the 12-month period ending May 31, 2016. If the resulting “Price Adjustment” is greater than or equal to the SCC in an applicable delivery year, then no payments are due in that year.

²⁶ 20 ILCS 3855/1-75(d- 5)(1)(B)(i)

²⁷ The FEJA relies on estimates of the SCC reported by the U.S. federal government Interagency Working Group on Social Cost of Carbon (August 2016 Technical Update), using a 3% discount rate, adjusted for inflation for each applicable year. The Interagency Working Group does not report a single value for the SCC, but rather provides a wide range of values, using alternative discount rates of 2.5%, 3%, and 5%, as well as a “high impact” estimate (corresponding to the 95th percentile of estimates based on a 3% discount rate). On March 29, 2017, by Executive Order, the Interagency Working Group on Social Cost of Carbon was disbanded, and the published SCC estimates were withdrawn.

²⁸ The FEJA does not specify exactly how the Interagency Working Group’s SCC estimate of the costs per metric ton of CO₂ was converted to \$16.50/MWh, as used in the Illinois ZEC program. The Interagency Working Group’s SCC estimates vary by year, and the FEJA does not specify which year’s estimate was used. The Interagency Working Group’s estimate of the SCC for 2016, using a 3% discount rate, is \$38 per metric ton of CO₂.

Declaration of David W. DeRamus, Ph.D.

3. The “market price index” is the sum of projected energy prices at the PJM Northern Illinois Hub, and the average of projected PJM and MISO capacity prices for the specific delivery zones in which Illinois is located. The “baseline market price index” is equal to \$31.40/MWh, which was calculated based on the historical PJM day-ahead energy and average PJM/MISO capacity prices for these same Illinois delivery points (or zones) over the 12-month period ending May 31, 2016.

Figure 3: Derivation of Illinois ZEC payment

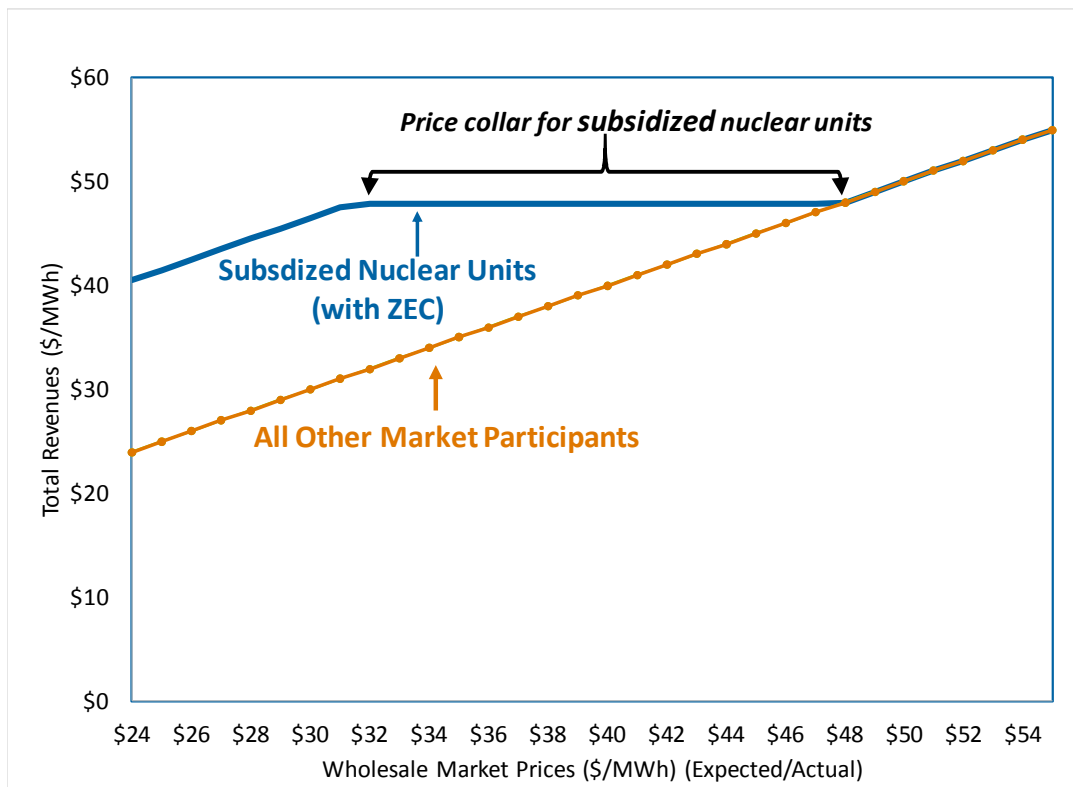


* The SCC remains fixed for the first six years and then escalates at \$1/MWh per year thereafter.

The amount of the ZEC payment received by a generator will thus fluctuate between \$0 and \$16.50/MWh, depending on future wholesale energy and capacity prices in Illinois. A participating nuclear generator (i.e., Exelon) will receive no ZEC payments in a given delivery year if projected energy and capacity prices in Illinois rise above \$47.90/MWh for that year (= \$31.40 baseline market index + \$16.50 SCC). Within these two bookends, the ZEC payment varies in a formulaic way based on current and projected wholesale energy and capacity prices.

- (40) In effect, the ZEC price formula establishes a “price collar” (or “revenue collar”) for subsidized nuclear units at \$47.90/MWh, which largely eliminates their risks from changes in wholesale market prices. If total projected market prices are equal to \$35/MWh, for example, a nuclear generator would expect to earn $\$35 + [(\$16.50 - (\$35 - \$31.40))] = \$47.90/\text{MWh}$. If the following year, projected market prices fell back to \$32/MWh, the nuclear generator would expect to earn $\$32 + [\$16.50 - (\$32 - \$31.40)] = \$47.90/\text{MWh}$, identical to what it expected to earn the prior year. Indeed, the ZEC price is sufficiently high to keep the generator’s expected revenues constant at \$47.90/MWh over a wide range of expected market prices, as shown in Figure 4 below. This constancy in the resulting prices received by the nuclear plant owner makes the Illinois ZEC price formula highly similar to the explicit state-mandated “contract for differences” that the Supreme Court considered unconstitutional in *Hughes v. Talen Energy*. The only difference here is that this constant “contract for difference” effect only applies when wholesale prices are in the range of \$31.40 to \$47.90/MWh – although wholesale prices in the ComEd zone for PJM, for example, have been in this range fairly persistently since 2009. However, even if wholesale prices fall below \$31.40, the \$16.50/MWh maximum ZEC payment still provides substantial downside price protection, even if this ZEC price cap does not keep the nuclear unit’s total revenues constant.

Declaration of David W. DeRamus, Ph.D.

Figure 4: ZEC “price collar” for subsidized nuclear units vs. market compensation

- (41) The “price collar” of \$47.90/MWh established by the Illinois ZEC program corresponds roughly to the average break-even costs (levelized) for nuclear generating units, at least as reported by Exelon for two of its “at risk” nuclear units in New York, which have average costs of \$49.60/MWh.²⁹ Thus, the ZEC can be considered a type of “make-whole” price intended to make an uneconomic nuclear generating unit “whole” with regard to the differential between its purportedly deficient wholesale market revenues and its expected costs (subject to an important caveat regarding exactly what costs are being included, and how).
- (42) Indeed, this demonstrates that not only are two of the three elements in the ZEC pricing formula directly “tethered” to wholesale prices (i.e., the “baseline market index” and “market price index”), but so is the third element, the SCC, albeit in a slightly round-about way. The Illinois ZEC program was initially designed such that the ZEC price would be set explicitly on the difference between a nuclear generating unit’s costs and wholesale market revenues, as reflected in an April 3, 2016 draft summary of the proposed program.³⁰ It was only after the U.S. Supreme Court’s *Hughes* decision on

²⁹ See NY CES Order, p. 140, fn. 99. The two referenced Exelon units for this cost estimate are the recipients of similar ZEC subsidies established by the New York Public Service Commission. As discussed below, however, the actual break-even cost of the Illinois nuclear units is unclear and may be lower than this, as noted in the 2015 Illinois Report.

³⁰ “The price at which winning zero emission resources will be compensated is calculated annually, and is the difference between (i) the weighted average of all zero emission resources’ average annual zero emission resource cost for the

Declaration of David W. DeRamus, Ph.D.

April 16, 2016 that the ZEC formula was changed to be based on the SCC, as reflected in the final version of the FEJA. The \$16.50/MWh value of the SCC derived for the FEJA, when added to the prevailing wholesale market prices (as of May 2016), is (not coincidentally) relatively close to the asserted break-even (levelized) cost of “at risk” nuclear units. While the reliance on the SCC in the ZEC formula allows Illinois to couch the subsidy as a payment for an environmental attribute, the effect of the payment – and its intent – is to be a “make-whole” payment to cover the perceived deficiency in wholesale market revenues, relative to the operating costs, for the nuclear units at issue.

- (43) The ICC may argue that because the ZEC’s “market index” uses forward market prices, not actual wholesale market prices, this somehow “untethers” the ZEC formula from the wholesale market. Such an argument would ignore the fact that the “baseline market index” in the ZEC formula (i.e., the \$31.40/MWh) is based on actual, historical wholesale market prices (for 2016), not forecasts. But even as it pertains to the “market index” forecast price component, such an argument is unconvincing in economic terms.
- (44) The market index specified in the ZEC formula encompasses both energy and capacity prices. The energy component is based on “forward” prices, which are traded on various exchanges. These forward prices are determined based on actual market prices, supplemented by market expectations of future changes in prices. The shorter the “window” between the forecast and current time period, the closer the forecasts will tend to be to actual market prices, with forecasts ultimately converging to actual prices.³¹ Capacity prices applied in the ZEC formula are not forecasts, but are actual prices, because they are determined in advance of the delivery year. The MISO capacity market establishes capacity prices and obligations as of April each year for a delivery year of June through May (extending into the following year). The PJM capacity market clears three years in advance of the delivery year for the main auction. PJM holds incremental auctions subsequent to the base auction, but final capacity prices paid by load are fixed several months prior to the start of the delivery year.
- (45) The ZEC program allows ZEC prices to change over time, with the price for each delivery year set close to the beginning of that year. Thus, as the forecasts applicable to each delivery year are updated based on actual prices as the ZEC pricing date approaches (supplemented with revised expectations of future prices), the resulting ZEC prices will be inherently – and very closely – “tethered” to actual market prices. As an economist, I understand the term “tethering” to mean that there is an important linkage, or a fundamental dependency, between the ZEC price and the wholesale market. Using this definition, the ZEC price would be fundamentally “tethered” to wholesale market prices, even if it only used forecast prices.

planning year and (ii) the zero emission resource's projected energy revenues and capacity revenues for the planning year.” See “Summary of Zero Emission Standard (ZES) Legislation,” confidential discussion draft of April 3, 2016, p. 2.

³¹ When forward contracts are settled by the exchanges, they are settled against actual prices. This further demonstrates the inherent linkages between forward prices and actual wholesale market prices.

Declaration of David W. DeRamus, Ph.D.

III.C. ZECs are easily distinguishable from RECs

- (46) The FEJA has crafted the ZEC program to provide some superficial similarities to state Renewable Energy Credit (REC) programs: it is couched as an environmental program, i.e., to preserve the “zero emissions” benefits of nuclear generation; it is to be implemented via a procurement process (the exact parameters of which have yet to be determined); and it describes the ZEC subsidy as a payment for an “environmental attribute.” The Illinois ZEC program, however, is easily distinguishable from the REC programs established by many states, in a number of fundamental respects: in terms of the ZEC program’s purpose of preventing the retirement of inefficient plants; its major direct and foreseeable negative effects on regional wholesale markets; its insulation of program participants from wholesale market risks; its frustration of FERC’s regulatory objectives in establishing wholesale markets; its absence of a true market-based procurement process; and (as discussed further below) its predetermined outcome to only support specific in-state uneconomic nuclear units.
- (47) RECs are designed to enable states to implement their Renewable Portfolio Standards (RPS) programs, in keeping with their environmental objectives. REC programs use market-based mechanisms, i.e., with actual price competition between alternative suppliers of renewable energy, to incentivize new entry and innovation at the least cost. In many programs, RECs can be traded (often on exchanges), thereby allowing utilities to meet their renewable obligations more cost-effectively. REC programs have been successful in encouraging early adoption of new technologies, thereby enabling subsequent cost reductions and efficiencies with increased scale and innovations. Even when some states establish specific REC “tiers,” e.g., a “solar REC,” alternative suppliers can compete on price to supply that REC to the market, often using different underlying technologies within that tier, and at different (competing) generation locations. REC programs do not limit eligibility to suppliers whose wholesale market revenues are less than their costs; nor do states use REC price formulas that change the value of RECs based on wholesale market prices.
- (48) The Illinois ZEC program, by contrast, is aimed at preserving older, inefficient in-state nuclear generating units – and their attendant jobs – even though the nuclear units have long been in the market, with a long-established technology, and have operated profitably in prior years when wholesale prices were higher. When Exelon acquired its nuclear units, it did so with full awareness of the risks – and profit opportunities – it faced as a generation owner selling into competitive wholesale markets. Now that competitive wholesale market conditions are no longer conducive to these units’ profitability, the ZEC program in effect would shift the regulatory paradigm: it would allow Exelon to fully recover (and potentially over-recover) its costs, up to certain limits; it would shield these units from market risk for the next 10 years; and it would allow Exelon to take advantage of “upside” opportunities if wholesale market prices rise sharply in future years.
- (49) ZEC prices are also not market prices. The ZEC prices are not determined by competitive bidding by alternative suppliers for the “good” ostensibly being acquired (electricity generated with zero

Declaration of David W. DeRamus, Ph.D.

emissions). Indeed, ZEC program participants do not submit supply offers based on price, but rather they submit detailed cost information. While the FEJA does not precisely specify how the IPA is to select among alternative applicants to the program (in the unlikely event that any nuclear generator other than Exelon would submit an offer), its general guidance indicates that they are to be selected based on an administrative determination regarding the perceived deficiency in wholesale market revenues for a given nuclear generating unit, relative to its costs. ZECs are further distinguishable from RECs in other ways as well, as summarized in Table 1, below.

Table 1: Comparison of RECs and ZECs

	RECs	ZECs
Origin	Environmental protection: reduce emissions of CO2 and other air pollutants by encouraging new entry	Save in-state jobs and tax revenues by keeping uneconomic nuclear plants in the market
Eligibility	Open to all qualified renewable energy resources, regardless of economic need; typically many participants	Limited to nuclear plants that would cease to operate without subsidies (in Illinois: one owner, Exelon)
Mechanism	Competitively traded in voluntary open markets	Selected through a state procurement process with criteria designed to pre-select in-state units
Value	Varies based on supply and demand in competitive auction markets, independent of FERC-regulated wholesale markets	Price formula specified by the state (with price caps), but “tethered” to FERC-jurisdictional wholesale electricity prices
Tenor	Short-term (annual or shorter)	Long-term (10 years or longer)
Purpose	Support nascent renewable energy technologies; encourage investment and innovation; target declining costs	Subsidize existing, older, uneconomic nuclear plants to retain in-state jobs; may also be directed at suppressing market prices
Outcome	Entry by new renewable energy resources; enhanced competitiveness of wholesale markets	Keeps uneconomic nuclear from retiring; distorts competition in the wholesale markets; allows exercise of buyer market power
Wholesale market risks	Renewable energy owners still exposed to market risks	Insulates selected uneconomic nuclear owner from market risks via “make-whole” payments
Wholesale market price impact	New entry by many participants, incentivized both by RECs and RPS requirements, reduces energy prices; impact on capacity market prices is small due to low capacity value of renewables	Significant suppression of energy and capacity prices due to size of nuclear units; “domino effect” puts further pressure on distressed assets in other states, incentivizing “competition for subsidies”
Wholesale market bidding incentives	REC programs do not change renewable resources’ bidding incentives in wholesale markets	ZEC price formula changes recipients’ bidding incentives due to “make-whole” payment structure

Declaration of David W. DeRamus, Ph.D.

- (50) The FEJA points to the “positive externalities” of nuclear units, e.g., their lack of CO₂ emissions, as a justification for the ZEC subsidies. Nuclear power, however, also has “negative externalities,” such as the unresolved costs and risks of disposing spent nuclear fuel, or the risks of a catastrophic event. While nuclear facility owners (or ratepayers) bear some of these costs and risks, a significant portion is borne by the U.S. government (and ultimately taxpayers). Nuclear power also benefits from other subsidies, such as federal support for R&D, federal loan guarantees for new construction, and the implicit subsidies of construction cost overruns borne by ratepayers (prior to restructuring).³²
- (51) Regardless of how much weight one places on each of these considerations, however, the “positive externalities” associated with a given nuclear facility are not sufficient justification to allow the ZEC program to fundamentally distort competitive wholesale markets. There are many non-distorting ways of “internalizing” the costs of CO₂ emissions (and other pollutants), such as imposing a carbon tax, or participating in regional cap-and-trade programs (such as the Regional Greenhouse Gas Initiative). Illinois also could have petitioned FERC, and applied to MISO and PJM, for a change in market rules to explicitly value the asserted attributes of these facilities; or for other measures that could enable the units to continue operating, e.g., to address the claimed reliability concerns noted in the FEJA. Instead, Illinois chose to unilaterally implement a program that will fundamentally undermine FERC’s competitive wholesale market construct, and disrupt wholesale markets in many other states.

IV. The IL ZEC program will distort FERC-jurisdictional wholesale market prices and outcomes

IV.A. Illinois 2015 Report

- (52) Several prior studies have shown that using the ZECs to retain the Clinton and Quad Cities nuclear facilities in the market will result in a significant distortion of wholesale market prices and auction outcomes. These studies are couched in terms of measuring the impact of the retirement of these facilities on wholesale prices (i.e., the retirements were expected to increase wholesale prices). The reverse is simply a logical extension of these studies: if the uneconomic nuclear generating units would have retired as a result of market forces, but stayed in the market solely as a result of the ZEC “out of market” payments, the price impacts reported in these studies show the amount by which the ZEC program caused wholesale market prices to be artificially depressed.

³² The Clinton nuclear station was subject to billions of dollars in cost overruns by the time it was completed in 1987. “Nuke Plant by the Numbers,” *The Southeast Missourian*, July 28, 1997. Available at: https://news.google.com/newspapers?nid=1893&dat=19970728&id=kH0pAAAAIABJ&sjid=VNgEAAAAIABJ&pg=3983_5430326&hl=en Accessed March 30, 2017. These cost overruns were ultimately borne by Illinois ratepayers. Exelon acquired the plant (for a small fraction of its cost) in the Illinois transition to competitive markets.

Declaration of David W. DeRamus, Ph.D.

- (53) In response to the Illinois General Assembly's House Resolution 1146, the Illinois Commerce Commission (ICC), the Illinois Power Agency (IPA), the Illinois Environmental Protection Agency (Illinois EPA), and the Department of Commerce and Economic Opportunity (DCEO) (collectively, the Illinois Agencies) issued a joint report dated January 5, 2015 titled "Potential Nuclear Power Plant Closings in Illinois" (the 2015 Report).³³ The 2015 Report addressed issues related to the early retirement of certain "at-risk" nuclear power plants in Illinois.³⁴ Clinton, Quad Cities, and Byron, all of which are owned by Exelon, were identified as Illinois nuclear units at risk of retirement. The 2015 Report was the basis for the FEJA and is referenced in the FEJA.
- (54) The 2015 Report recognizes that the "problem" of at-risk nuclear units is due to the decline in wholesale market prices. These prices are a direct result of the competitive wholesale markets that were established, designed, approved, and overseen by FERC; administered by independent RTOs; subject to regular independent monitoring; and modified via well-established rule-making and governance procedures, involving a wide range of parties (ultimately subject to approval by FERC). The 2015 Report documents that the wholesale energy prices (LMPs) available to Exelon's Illinois nuclear plants have declined by approximately 38% since 2007, primarily because of the sharp drop in the price of natural gas, which powers the generating units that are often the marginal, i.e., price-setting, units in both PJM and MISO. Among Exelon's fleet of nuclear units, the energy market LMPs for Quad Cities and Clinton have been the lowest and second lowest (respectively) for the period 2007-2013, while the LMPs for Byron were the third lowest. The 2015 Report also concludes that the combined energy and capacity revenues available to Clinton and Quad Cities in Illinois are significantly lower than those available to Exelon's nuclear plants outside Illinois.
- (55) As a result of the decline in wholesale prices, Exelon has warned for several years that Clinton, Quad Cities, and Byron were at risk for premature closing.³⁵ While the 2015 Report finds that the costs of Clinton and Quad Cities would have exceeded total revenues from energy and capacity market sales in all years during 2007-2013, it also cautions that because of the limited cost data available, it is not clear whether Exelon's Illinois plants earn sufficient revenues to cover their operating costs.³⁶
- (56) It is important to reiterate that the "problem" identified in the 2015 Report is that wholesale electricity prices fell to levels at which certain high-cost nuclear power plants in Illinois might no longer be

³³ The 2015 Report is available at http://www.ilga.gov/reports/special/Report_Potential%20Nuclear%20Power%20Plant%20Closings%20in%20IL.pdf

³⁴ The ICC studied the impact of nuclear plant closures on transmission and electricity rates. The IPA examined how nuclear plant closures would affect reliability and the adequacy of generating capacity in the Midwest. The Illinois EPA studied how nuclear plant closures would affect the level and societal cost of greenhouse gas emissions, and the DCEO examined the impact of nuclear plant closures on jobs and economic activity in Illinois. The Report also identified potential ways of preventing the closure of the at-risk nuclear plants.

³⁵ See "Exelon Warns State It May Close 3 Nukes," *Crain's Chicago Business*, March 1, 2014. Available at: <http://www.chicagobusiness.com/article/20140301/ISSUE01/303019987/exelon-warns-state-it-may-close-3-nukes> Accessed March 30, 2017.

³⁶ 2015 Report, at p. 39.

Declaration of David W. DeRamus, Ph.D.

economic to operate. The Illinois ZEC program is ostensibly intended to correct the “problem,” but it would do so by exacerbating its source, because the program would artificially suppress energy and capacity market prices. In doing so, the ZEC program would inflict harm on other generators spanning PJM, MISO, and other interconnected electric regions, effectively “exporting” the problem elsewhere and undermining the price signals that are critical to the successful, efficient operation of regional wholesale power markets in the longer term.

- (57) The 2015 Report includes assessments of energy market impacts in PJM and MISO. One of these assessments was conducted by Monitoring Analytics, the IMM for PJM. The IMM focused on the retirement of the Quad Cities and Byron nuclear plants, and estimated the impact on LMPs for the ComEd Zone on a “hot weather alert” day in June 2014. The study found that the unavailability of these two plants during these conditions would significantly increase LMPs in the ComEd zone. The IMM concluded that such results were to be expected, given the assumed removal of 4,000 MW of Illinois baseload generation. However, the IMM also provided the following caution:

The fact that energy market prices would increase does not support providing subsidies to these plants in order to forestall retirement. Any decision to retire the plants would be based on the basic economics of the plants. [...] Such a [basic economics] review would also have to account for the substantial increase in capacity market revenues that is expected to result from PJM’s new capacity market design proposal. ***If a well structured wholesale power market does not provide enough revenue to support one or both plants, then an appropriate conclusion would be that the clear market signal is to retire one or both plants.***³⁷

- (58) The 2015 Report concluded with an evaluation of potential “market-based solutions” identified by the Agencies. In developing solutions, the Agencies acknowledged that Illinois is a part of the PJM and MISO markets, so that “the use, dispatch, and compensation for all generating plants located in Illinois is dependent on consumer decisions made in over 20 states and Canadian provinces.”³⁸ Moreover, the Agencies also recognized that an Illinois “market-based solution” cannot conflict with FERC rules, stating that “a narrowly tailored solution that incentivizes electricity outputs from nuclear assets in Illinois could be considered a violation [of the FERC rules].”³⁹ The Illinois ZEC program fails to address these “core realities”⁴⁰ for a workable market-based solution.
- (59) In the remainder of this section, I evaluate the magnitude of the harm the Illinois ZEC program would impose in PJM and MISO, drawing on the results of the analyses presented in the 2015 Report.

³⁷ “Nuclear Plant Retirement Impact Preliminary Analysis of High Load Day,” Monitoring Analytics, October 30, 2014, at pp. 5-6.

³⁸ 2015 Report, at p.152.

³⁹ Id., at p.153.

⁴⁰ Id., at p.152.

Declaration of David W. DeRamus, Ph.D.

IV.B. Analysis of the market impact of the Illinois ZEC program

- (60) The near-term effect of keeping uneconomic nuclear capacity operating and selling into the wholesale power markets is unambiguous: it will suppress market energy and capacity prices. This is a simple function of how such markets work, the operating characteristics of the subsidized nuclear plants, and the incentives inherent in the Illinois ZEC program. Information from studies presented in the 2015 Report, along with available market data, allows me to calculate a conservative estimate of the likely impacts in PJM and MISO, as follows:
- a. Retaining Quad Cities alone in the PJM energy market (i.e., excluding the additional impact from retaining Clinton in MISO) will suppress energy prices across PJM, with a likely reduction in generator revenues of **\$244 million annually**. Within the local ComEd Zone, the price suppressing effect is more pronounced. Based on generation volume in the zone, the reduction in revenue is likely to be approximately **\$107 million annually**, or a little less than half the PJM aggregate impact.
 - b. Retaining Quad Cities in the PJM capacity market will suppress clearing prices in the upcoming May 2017 auction for the 2020/21 delivery year, with a likely reduction in generator revenues of between **\$386 million** and **\$529 million** for the annual delivery period.
 - c. Retaining Clinton alone in the MISO energy market (i.e., excluding the additional impact from retaining Quad Cities in PJM) will suppress energy prices across the MISO Central Region, and it is likely to reduce generator revenues by approximately **\$93 million annually**. Within Zone 4 (Illinois), the price suppressing effect is likely to reduce generator revenue by approximately **\$26 million**, or a little more than a quarter of the MISO Central aggregate impact.
 - d. Retaining Clinton in the MISO capacity market will suppress clearing prices in the annual Planning Resource Auctions, with a likely reduction in capacity revenues for generators in Illinois of between **\$117 million** and **\$309 million** annually.

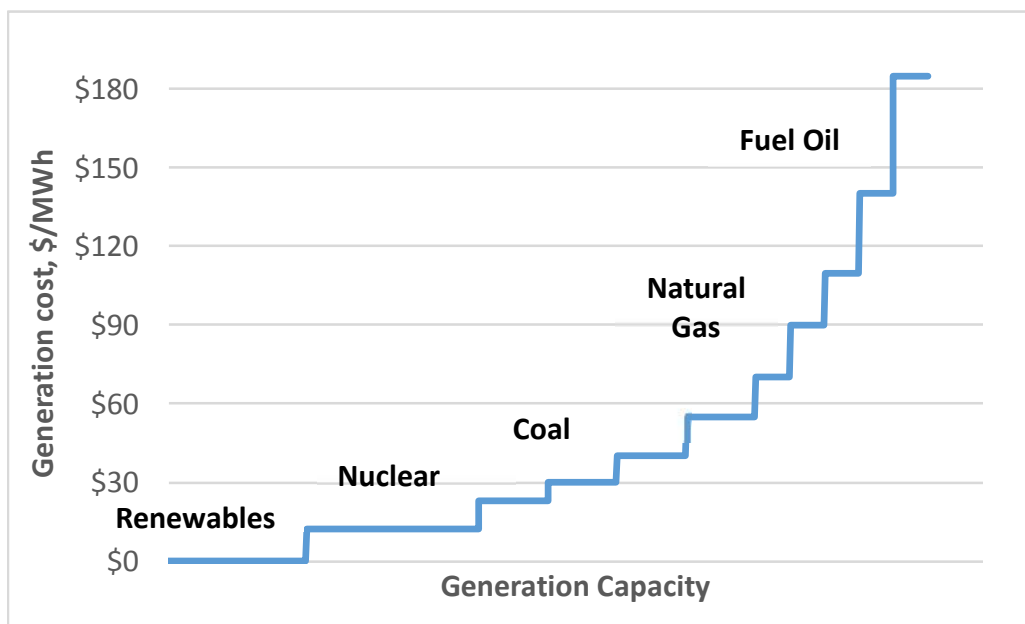
IV.B.1. Impact of ZEC nuclear subsidy on energy markets

- (61) As described above, the centralized wholesale energy markets administered by the RTOs produce clearing prices at each point in time – typically every five minutes – by selecting the volume of generating resources, in increasing order of cost, that is needed to meet demand. For a given moment (I will use an hour for ease of description), there is a stepwise supply curve, or “stack,” that represents the supply offers in order from low to high. This is illustrated in Figure 5. Each resource type has a different range of generation costs, and the combined capacity available at a particular cost makes up

Declaration of David W. DeRamus, Ph.D.

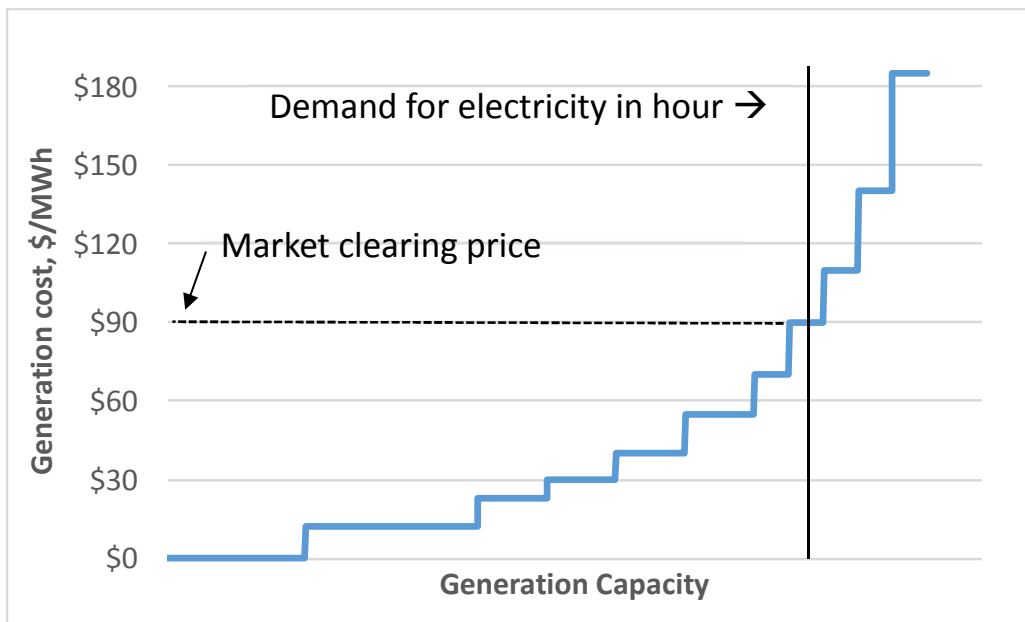
one step of the supply curve. Typically, renewable generation, such as wind or solar, has an energy cost near zero and establishes the first supply step on the lower left. The variable cost of generation by nuclear plants is very low, and typically it is the next resource type in order of variable cost (i.e., ignoring their relatively high fixed costs). The practical need to ensure that a nuclear generating unit continues to operate around the clock means that they are often offered into energy markets at a price of zero, but in any case, nuclear units would be selected to run in most hours on the basis of their low variable costs. In Illinois, nuclear units account for approximately 48 – 50% of annual energy generated; in the ComEd Zone of PJM, they account for 77% of annual energy generated.

Figure 5: Illustrative wholesale energy market supply curve



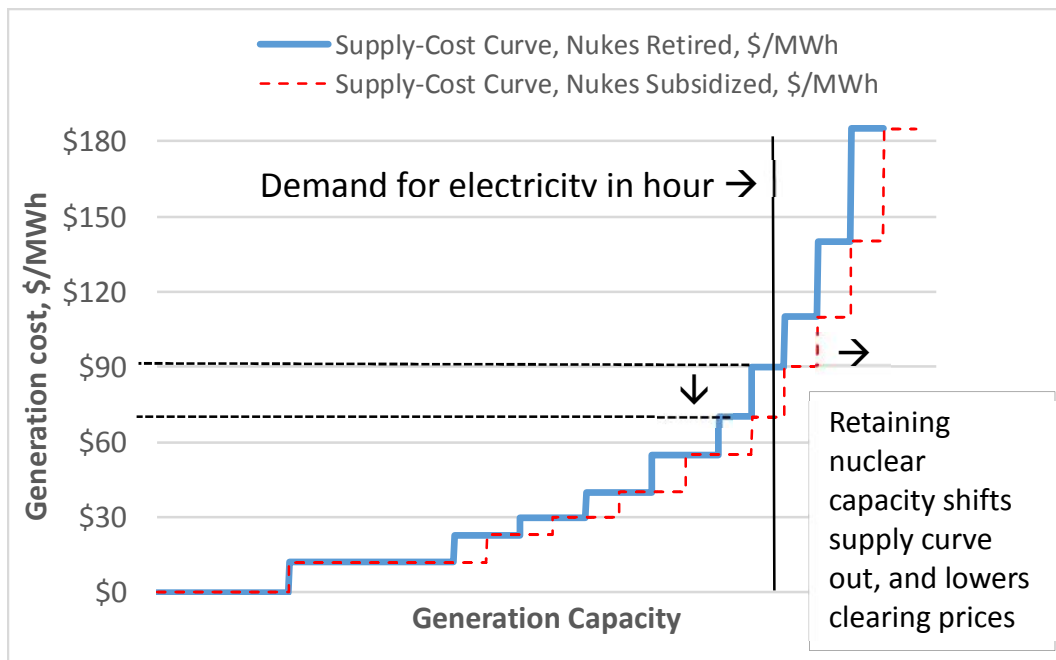
- (62) In increasing order of variable costs, the next resources would typically be large coal-fired generating units; followed by large, efficient gas-fired units; followed by smaller, less-efficient fossil fuel units; and finally at the top of the stack, small oil-fired units. The quantity of electrical load, or demand, on the system in a given hour determines the quantity of generation that must be procured (i.e., the distance to the right along the supply stack), and the highest-cost resource needed sets the clearing price for that hour. This is illustrated in Figure 6.

Declaration of David W. DeRamus, Ph.D.

Figure 6: Determination of market clearing price

- (63) The effect of the ZEC subsidy is to cause otherwise uneconomic nuclear plants to stay in the market rather than retire. Since nuclear plants are very low on the supply stack (i.e., they are far to the lower left in the figure), keeping these plants in the generating market increases the horizontal length of the nuclear capacity step, and so causes most of the supply curve to shift to the right. Because nuclear plants are large, in many hours this shift of the supply curve will mean that a higher-cost unit that otherwise would be needed to serve load and would clear the market is no longer needed. Another, lower-cost unit becomes the marginal resource, and the market clearing price is reduced. This effect of shifting the supply curve is illustrated in Figure 7.

Declaration of David W. DeRamus, Ph.D.

Figure 7: Illustrative impact on energy supply curve and market clearing prices

- (64) As discussed above, at the request of the ICC, PJM estimated the impact of various scenarios related to the retirement or retention of Illinois nuclear plants.⁴¹ PJM estimated that the effect of Quad Cities alone retiring would be to increase the projected average energy price across the entire PJM footprint by between 0.8% and 1.1% in 2019, depending on additional scenario assumptions such as the prevailing natural gas price. Impacts would be felt across the system, and would be greater in the local ComEd zone, increasing energy prices there between 2.7% and 3.2% in 2019. These estimated impacts are based on the retirement of Quad Cities alone – i.e., they do not reflect the retirement of the nearby Clinton plant in MISO, which would also affect the energy markets in PJM.
- (65) In 2016, annual generation, including imports, clearing the PJM real-time energy market totaled approximately 835 million MWh. PJM's average energy clearing price for the year was a historic low of \$29.23/MWh – about 20% lower than for the prior year, influenced predominantly by low natural gas prices. If energy prices were suppressed by 1% across PJM (a conservative estimate, since PJM's estimated price impacts do not include Clinton), expected annual generator revenue would fall by approximately \$244 million (835 million MWh x \$29.23/MWh x 1%). This estimate of the impact of the Illinois ZEC program on PJM energy prices is likely to be conservative, since it is based on a historically low reference price, and retaining Clinton will also have an impact on energy prices in PJM, even though it is located in MISO.

⁴¹ 2015 Report, starting p. 55.

Declaration of David W. DeRamus, Ph.D.

- (66) The LMP impact of retaining Quad Cities is more pronounced in the ComEd Zone, where the plant is located. The PJM analysis presented in the 2015 Report estimates a price impact of retirement between 2.7% and 3.2% of the average annual energy price. Again, this estimate is conservative for the purposes of assessing ZEC program effects, because it excludes the additional expected impact associated with Clinton. A 3% impact on the ComEd Zone load-weighted real-time LMP in 2016 – which was \$27.66, even lower than the historic low for PJM as a whole – can be translated into a dollar impact using the generation volume for the zone in 2016, which was 129 million MWh. The reduced generator revenue would be approximately \$107 million (129 million MWh x \$27.66 x 3%).
- (67) The impact of retaining Clinton in the MISO energy markets can also be estimated conservatively based on the results of PJM’s analysis. PJM estimated energy market effects on the Ameren Illinois pricing zone, within MISO Local Resource Zone 4, which itself represents virtually all of Illinois outside of the ComEd/PJM portion.⁴² Ameren constitutes more than 70% of Zone 4 load. The PJM analysis estimated an impact from the retirement of Clinton of between 1.2% and 2.7% of average energy prices. This impact excludes any effect from the contemporaneous retirement of Quad Cities.
- (68) A 2% reduction in average energy prices for MISO’s Zone 4 can be translated into an aggregate dollar impact using the average real-time LMP for MISO’s Illinois Hub, which was \$26.52 in 2016, slightly lower than the comparable energy price in PJM’s ComEd Zone for 2016. Annual customer load for Zone 4 is approximately 50 million MWh. Using this as a proxy for generation affected by LMPs, the price suppression impact would be \$26 million (50 million MWh x \$26.52 x 2%). This is likely highly conservative for several reasons: 1.) as previously noted, the energy price impact estimate is for Clinton alone, excluding any compounding effect from Quad Cities; 2.) 2016 energy prices were at historic lows; and 3.) the load proxy likely significantly understates Zone 4 generation. Regarding the last factor, Zone 4 currently has generation capability greater than local electricity demand, so generation generally exceeds load.⁴³
- (69) As is the case in PJM, energy price impacts would extend in MISO well beyond Illinois. A 1% energy price effect over the MISO Central region, representing aggregate annual load of approximately 350 million MWh, translates to an aggregate price suppression of approximately \$93 million annually (350 million MWh x \$26.52 x 1%).

IV.B.2. Impact of ZEC nuclear subsidy on capacity markets

- (70) Retaining the uneconomic Quad Cities and Clinton plants via ZEC subsidies will also suppress clearing prices in the PJM and MISO capacity markets. The economic principle that drives market

⁴² Small portions of northwestern Illinois are included in MISO Zones 1 and 3.

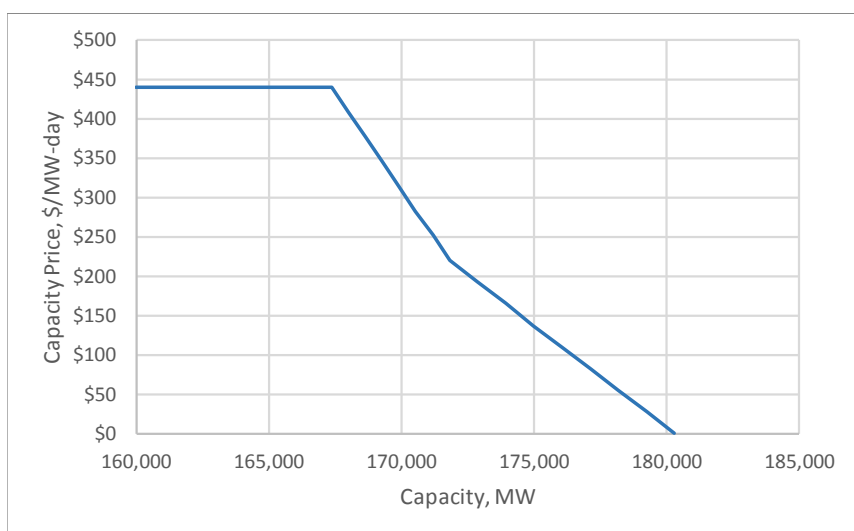
⁴³ In addition, generation will always exceed load because some energy is lost in the process of being transmitted from the generator to the consumer.

Declaration of David W. DeRamus, Ph.D.

suppression in the capacity market is essentially the same as for the energy market: an artificial increase in supply pushes down market clearing prices.

- (71) The next PJM capacity market auction occurs in the first half of May 2017. This will be the Base Residual Auction (BRA) for the 2020/21 delivery year. The PJM-wide demand curve applicable for the auction is shown in Figure 8. The aggregate resource requirement is 168,000 MW, but as discussed above, the demand curve ensures that capacity in excess of the requirement is priced and procured, consistent with PJM's estimate of incremental capacity value to the system.

Figure 8: PJM RTO capacity market demand curve – 2020/21 BRA



- (72) Capacity prices in PJM have ranged in recent years between roughly \$120/MW-day and \$170/MW-day (weighting multiple auction results applicable to delivery years from 2015/16), indicating that the RTO as a whole has capacity significantly in excess of the resource requirement. Figure 8 shows the RTO-wide demand curve, which in surplus conditions (i.e., along the right-most part of the curve) prices incremental (or decremental) capacity at \$0.026/MW. Like the energy market, the capacity market also accounts for constraints on moving power from one location to another. When such constraints are binding, as has occurred in the ComEd delivery area in recent auctions, capacity prices in the constrained-in region clear at higher levels. The clearing price for the ComEd region in the 2019/20 Base Residual Auction was \$202.77/MW-day, compared to prices elsewhere in PJM of \$100/MW-day and \$120/MW-day.
- (73) The effect of retaining 1,790 MW⁴⁴ of Quad Cities capacity in the market, rather than allowing it to exit because of economic retirement, would suppress clearing prices by about \$46/MW-day (1,790

⁴⁴ 1,790 MW reflects a 1.8% reduction of Quad Cities' installed capacity, which corresponds to the 'unforced capacity' value that would be applicable in the PJM capacity auction.

Declaration of David W. DeRamus, Ph.D.

MW x \$0.026/MW), if the market were unconstrained, i.e., if the RTO-wide demand curve were applicable. The impact on the ComEd area would likely be significantly greater. A scenario analysis performed by the PJM market monitor with respect to the 2019/20 capacity market results, which evaluated the effect on ComEd clearing prices of a change in the zonal transfer limit by 1,860 MW, comparable to the quantity of Quad Cities capacity, derived an impact of \$63/MW-day.⁴⁵ The range of price impacts can be translated into a range of aggregate dollar impacts based on the volume of capacity clearing the market in the ComEd zone, which totaled approximately 23,000MW in the 2019/20 auction. The lower price suppression value of \$46/MW-day corresponds to an annual capacity revenue reduction of \$386 million (23,000MW x \$46/MW-day x 365 days). The higher value of \$63/MW-day corresponds to an annual capacity revenue reduction of \$529 million (23,000MW x \$63/MW-day x 365 days).

- (74) Capacity market effects in MISO can be estimated based on the available offer curves, i.e. the offer prices and volumes from prior auctions. In the most recent MISO Planning Resource Auction, for the 2016-17 delivery year, the capacity clearing price was \$72/MW-day for Zones 2 through 7, spanning most of the Midwest region. The data show that the offer that set the clearing price was for a resource located in Illinois Zone 4. The data also show that only 7 MW further up the offer curve, the clearing price would have been \$110.77/MW-day, and that a shift up the curve by 1,100 MW, corresponding to Clinton's capacity, would have pushed the clearing price to \$174.61/MW-day. While it is not possible to determine from the data what volume of Clinton capacity cleared the capacity market, because resource-identifying information is not made available by MISO, the difference between the two alternative points on the offer curve provide reasonable bounds on the likely price suppression from retaining Clinton in the market rather than allowing it to retire. Based on the cleared capacity of 8,242 MW from Zone 4 only, these values translate into reduced capacity market revenue of between \$117 million and \$309 million annually (8,242 MW x (\$111/MW-day - \$72/MW-day) x 365 days = \$117 million; and 8,242 MW x (\$175/MW-day - \$72/MW-day) x 365 days = \$309 million).

IV.C. The IL ZEC program will distort market bidding behavior

- (75) Given the results of the analysis above, it should be evident that the ZEC program will change the bidding behavior of many market participants – which reflects the fundamental “tethering” between the ZEC program and the wholesale markets. The most direct impact on bidding behavior is that the program will cause uneconomic nuclear generating plant owners to submit supply offers into wholesale markets in which they otherwise would have exited. In the absence of the ZEC program, Clinton (a 1,065 MW facility) would not bid into the MISO energy and capacity auctions for any delivery period after June 2017, for example, since it would have already retired. Similarly, while

⁴⁵ Monitoring Analytics, “Analysis of the 2019/2020 RPM Base Residual Auction” (August 31, 2016), p. 81. Available at: http://www.monitoringanalytics.com/reports/Reports/2016/IMM_Analysis_of_the_20192020_RPM_BRA_20160831.pdf

Declaration of David W. DeRamus, Ph.D.

Quad Cities (a 1,819 MW facility) was not scheduled to retire until June 2018, the ZEC program will have an immediate impact on its bidding behavior as well, particularly in the capacity market: it would not bid into the PJM capacity markets in April/May 2017 (i.e., in the BRA for delivery years 2020/21) in the absence of the ZEC program.

- (76) The ZEC program will not only determine *whether* a nuclear unit will bid into the wholesale markets, it will also likely affect *how* it does so, i.e., it will change the specific bid strategies that it employs. This change in bidding behavior is the result of the fundamental change in a unit's compensation created by the ZEC program (as analyzed above in the discussion of the "price collar"). A change in a market participant's "profit function" will almost necessarily cause a change in its bidding strategy. The affected nuclear units have a strong incentive to run continuously at maximum output, and the ZEC program makes them relatively immune to changes in wholesale prices across a wide range of market outcomes. Any incremental benefit they may obtain from bidding to increase wholesale prices – e.g., to reflect their going-forward costs in capacity markets, for example – will be offset by a corresponding reduction in the ZEC payment, to the extent that these price increases are incorporated into forecast prices.
- (77) PJM's different zonal capacity market prices vary significantly, both across the zones and over time, depending on the availability of local capacity resources and transmission constraints.⁴⁶ During 2007 – 2014, market clearing prices in the PJM ComEd zone varied between \$16.46/MW-day in 2012 and \$174.29/MW-day in 2010. This wide variability in capacity prices provides Exelon with the incentive to maximize its capacity revenues by strategically bidding its nuclear fleet in Illinois – and indeed, across all of PJM – on a portfolio basis. In other words, Exelon may be able to maximize its profits across its portfolio of generating units (nuclear and other units) by selectively bidding in different units at different prices, i.e., potentially sacrificing capacity revenues for some units by bidding above the expected clearing price, in order to secure higher capacity revenues for the remainder of its units from the resulting price increase (subject to the capacity market rules established by PJM and approved by FERC).
- (78) On May 29, 2014, Exelon announced that its Quad Cities, Byron, and Oyster Creek nuclear plants did not clear the PJM capacity auction for the delivery period 2017/2018.⁴⁷ Despite the fact that more than 4,000 MW of its Illinois nuclear fleet failed to clear PJM's base residual auction, Exelon said its PJM capacity revenues would increase by \$150 million in 2017 relative to 2016.⁴⁸ Exelon's estimate was supported by other analysts. UBS Securities reported that Exelon "couldn't have played its hand any better," as Exelon would earn almost \$150 million more in capacity revenue from 2017/18 than it

⁴⁶ Transmission constraints are local capacity import capability limitations caused by transmission facility limitations, voltage limitations or stability limitations. The amount is determined by the capacity emergency transfer limit (CETL) and the capacity emergency transfer objective (CETO).

⁴⁷ Exelon presentation at the Sanford C. Bernstein Strategic Decisions Conference on May 29, 2014.

⁴⁸ Id.

Declaration of David W. DeRamus, Ph.D.

would have if all of its capacity had cleared (i.e., the additional supply would have reduced the clearing prices). UBS said Exelon's ideal strategy was to "withhold" 4,457 MW of its PJM fleet capacity from the PJM capacity markets. Failing to clear 4,457 MW of capacity reduced Exelon's daily revenue by \$267,000 for those units (including Quad Cities), but it increased the capacity market clearing prices by \$33/MW-day. With this higher clearing price, Exelon's remaining 20,543 MW fleet of generation capacity was able to earn \$148 million more in revenue than if the entire portfolio had cleared at the lower price.^{49, 50}

- (79) The ZEC program will fundamentally change Exelon's incentives in how it bids the Quad Cities and Clinton facility into the capacity markets. Now, any increase in capacity prices will be offset by a future reduction in Illinois ZEC payments. This provides Exelon a significantly greater incentive to bid Quad Cities in as a price taker in future capacity auctions. Exelon's incentives to bid in as a price-taker in all capacity auctions is perhaps most evident for Clinton, since Clinton is Exelon's only nuclear unit in MISO. There, any increase in capacity prices that Clinton could hope to earn for that unit will be offset by a corresponding reduction in its ZEC payment. Thus, its incentive will now be to bid Clinton into the MISO capacity market as a price-taker – with a depressing effect on wholesale prices.
- (80) The ZEC program will also change other participants' bidding behavior. If other generation or demand-side resources decide to exit or not enter the market as a result of the ZEC program, they would not be submitting offers in the wholesale markets when they otherwise would have done so. The ZEC also is likely to change the bidding strategies of many other participants who remain in the market. Many sellers develop their offers based on the offers that they expect other participants are likely to submit.⁵¹ Other sellers will know that the uneconomic nuclear units will remain in the market as a result of the ZEC program, and will be able to assess the changes in these nuclear units' bidding incentives; and this information may be sufficiently important to cause these other sellers to change their offer strategies. The Illinois nuclear units at issue represent a sufficiently large amount of capacity that their retention in the market could well have a significant impact on other suppliers' offers.

⁴⁹ See "How Exelon Won by Losing," *RTO Insider*, June 3, 2014. Available at: <https://www.rtoinsider.com/exelon-pjm-capacity-mkt/> Accessed March 30, 2017.

⁵⁰ Subsequently, Exelon's Quad Cities and Byron plants were bid into and cleared PJM's transitional capacity auction (for its new "Capacity Performance" capability standard) for the same 2017/18 delivery period, at an even higher clearing price. See <https://www.rtoinsider.com/pjm-transition-auction-17524/>

⁵¹ There is an extensive economic literature on supplier bidding incentives in electricity markets that discusses this. See e.g., Peter Cramton, "Competitive Bidding Behavior in Uniform-Price Auction Markets," *Proceedings of the Hawaii International Conference on System Sciences*, January 2004, available at: <ftp://www.cramton.umd.edu/papers2000-2004/cramton-bidding-behavior-in-electricity-markets-hawaii.pdf>

Declaration of David W. DeRamus, Ph.D.

V. The IL ZEC program will cause irreparable harm

V.A. ZEC program will harm other market participants by artificially suppressing market prices

- (81) If allowed to proceed, the Illinois ZEC program will cause immediate and long-term harm to wholesale market participants – other than to Exelon, the sole recipient of the subsidies. Exelon previously announced that Clinton would retire in June 2017, while Quad Cities would retire in 2018. Any continued participation by Clinton and Quad Cities in the wholesale markets after those dates will artificially – and significantly – suppress wholesale prices. Similarly, the continued participation by Clinton and Quad Cities in capacity markets after the planned retirement dates will also artificially suppress market prices. In contrast to energy markets, the capacity markets are forward markets, and some of the relevant capacity markets for delivery years after the previously announced retirement dates are already occurring even prior to the official start of the ZEC program. For example, the PJM capacity market auction for 2020/2021 occurs in April/May 2017, and as a result of the ZEC program, Quad Cities will now participate in that auction (and others). Similarly, the auction process for MISO capacity markets for 2017/2018 has already begun, and Clinton’s participation in that auction will artificially suppress prices. As demonstrated by the analysis above, the artificial price suppression caused by the ZEC subsidies will result in a substantial reduction in wholesale market revenues.
- (82) The ZEC program will distort wholesale market prices immediately and in the long run. The program obligates uneconomic nuclear generating units to continue to generate, and thus to continue to bid into the wholesale markets, over the entire 10-year duration of the program. Furthermore, in PJM, the capacity markets are 3-year forward markets. Thus, the impact of the ZEC program on PJM capacity auctions held in 2017 will suppress wholesale prices paid to market participants three years hence – as well as in earlier periods, to the extent that the program causes nuclear units to change their bidding behavior in any interim capacity auctions.
- (83) The significant impact of the Illinois ZEC program on PJM and MISO energy and capacity auction prices cannot be “undone” after the fact. Once the wholesale markets clear, those prices are used to make financial settlements among the market participants; to make generation dispatch decisions (i.e., to determine which generating units are instructed to run in any given hour by the RTO); and, as examined below, to make decisions regarding whether to exit (i.e., retire) or enter the markets. Since the ZEC program will artificially suppress wholesale market prices outside of Illinois as well, this will aggravate the financial challenges faced by other plants in other states, including other nuclear

Declaration of David W. DeRamus, Ph.D.

units. As the PJM market monitor notes, market competition is replaced by “competition for subsidies,”⁵² as companies try to retain their own units in the market via out-of-market subsidies.

V.B. ZEC program will cause market exit and reduce market entry by more efficient participants

- (84) The artificial price suppression caused by the ZEC program will frustrate FERC’s central purpose in establishing competitive markets. FERC has encouraged RTOs to adopt capacity markets to provide the price signals necessary to encourage efficient market exit and entry. If a nuclear plant is unable to earn sufficient wholesale market revenues from energy and capacity markets to make it financially sustainable to remain in the market, the uneconomic plant should exit. As capacity prices (and energy prices) rise, new entry and/or increased investment by more efficient generation becomes more economic. This new entry and investment – including by new renewable generation, demand-side participants, and energy efficiency resources – in turn will moderate future price increases.
- (85) The ZEC program, by contrast, encourages uneconomic nuclear plants in Illinois to remain in the market, despite the wholesale markets signals that they should retire. The resulting suppression of capacity and energy prices then causes other, more economic plants to retire instead. In 2016, PJM’s IMM concluded that 96 generating units in PJM with 14,500 MW of capacity in PJM are “at risk” of retirement,⁵³ in addition to the approximately 5,000 MW of capacity that is already expected to retire between 2017 and 2020.⁵⁴ While it is difficult to determine which of these generating facilities would stay in the market if the uneconomic nuclear units were allowed to retire, the suppression of wholesale market prices makes it far more likely that other marginal plants will be forced to retire (assuming they are not similarly supported with out-of-market subsidies by their states).
- (86) The ZEC program is also likely to reduce entry by new, more efficient market participants. Current low energy and capacity prices in PJM have reduced incentives to invest in new generation, especially in the western portion of PJM (PJM West region). In the PJM ComEd zone, total wholesale market revenues have been insufficient since 2007 to cover the costs of new combustion turbine or combined cycle natural gas units, or the costs of new wind and solar facilities.⁵⁵ Retaining uneconomic nuclear units in the market through ZEC subsidies will further exacerbate this situation.
- (87) The distortionary impact of the ZEC program on investment decisions is already beginning to occur. In response to the passage of the FEJA, Exelon has already begun to make substantial additional

⁵² See “PJM monitor rails against threat of ‘contagious’ subsidies,” dated March 13, 2017. <http://www.eenews.net/energywire/2017/03/13/stories/1060051340> last accessed March 30, 2017.

⁵³ 2016 State of the Market Report for PJM, Monitoring Analytics, LLC (March 9, 2017), Volume 2, page 43.

⁵⁴ Id., page 58.

⁵⁵ Id., pages 287-94.

Declaration of David W. DeRamus, Ph.D.

investments in its Clinton and Quad Cities facilities – even though the ZEC procurement has not yet occurred. Exelon expects to be able to recover the cost of these investments from Illinois ratepayers from the ZEC subsidies (in combination with its wholesale market revenues). Since Exelon would not have made these investments absent the ZEC program and its associated revenue guarantees, the program has effectively shifted the risks of these investments from a wholesale market participant (Exelon) to Illinois ratepayers. Once these investments are made, they become a “sunk cost,” and thus further change the cost-benefit calculations in Exelon’s future decisions regarding the participation of these units in the wholesale markets, relative to the *status quo ante*.

- (88) The artificial price suppression caused by the ZEC program will also harm the competitive process of the wholesale markets. Suppressing market prices by paying out-of-market subsidies to uneconomic nuclear plants is a form of buyer market power. This buyer market power, provided by state intervention, reduces confidence in competitive wholesale markets, as well as in the established regulatory processes (subject to FERC oversight) that exist for parties to propose changes to those markets. Undermining confidence in markets and regulatory processes, in turn, reduces the willingness of actual or potential future market participants to participate in those markets – to the ultimate detriment of all electricity customers in the affected regions.
- (89) As should be evident from the discussion above, the ZEC program not only frustrates FERC’s regulatory objectives and framework in establishing wholesale markets, but it also frustrates the environmental objectives that the FEJA purports to advance. The artificial suppression of wholesale prices caused by retaining uneconomic nuclear units discourages investments in renewable generation, or efficient gas-fired generation, which could displace higher emitting generating sources. It also discourages market participation by demand-side resources, such as demand response or energy efficiency resources. Indeed, after rising rapidly in PJM for the past several years, demand response resources declined in 2016, consistent with the decline in wholesale market prices.⁵⁶

V.C. ZEC program will harm ratepayers

- (90) The ZEC program will also ultimately harm ratepayers, most directly by imposing hundreds of millions of dollars in subsidy costs on Illinois ratepayers, starting on June 1, 2017. Most of the subsidies to Exelon will be paid by Illinois retail customers taking service from Exelon’s affiliate, ComEd. The amount of subsidies that Illinois ratepayers will be required to provide Exelon is

⁵⁶ In PJM, demand response participates in the energy market via the “economic program” and in the capacity market via the “emergency program.” Most of the revenues earned by demand response resources in PJM are from the capacity market. In 2016, the revenue earned by demand response resources declined by 20%, reflecting a decline in PJM energy and capacity prices, as well as a lower volume of demand response resources.

Declaration of David W. DeRamus, Ph.D.

substantial. According to Exelon, the cost of the ZEC program to Illinois ratepayers will be approximately \$235 million annually, on average over the 10 years of the program.⁵⁷

- (91) It is unclear how Exelon derived its estimate, but it may understate the annual cost of the subsidies, particularly in the early years. Exelon's estimate of the 10-year average annual cost will depend on its projections of future wholesale prices. As shown above, future wholesale price changes have a large impact on the amount of the ZEC subsidy paid to Exelon. Particularly in the early years of the program, the "market price index" may not exceed the "baseline" index of \$31.40 in some years, and thus the price of the ZEC subsidy would be \$16.50/MWh. Exelon's output from Clinton and Quad Cities⁵⁸ is approximately equal to the ZEC purchase requirement of 16% of Illinois load, as specified in the FEJA. Multiplying \$16.50/MWh by Exelon's historical output from Clinton and Quad Cities⁵⁹ equals a total annual subsidy payment of approximately \$340 million.
- (92) The FEJA imposes a cap on the allowable percentage increase in Illinois retail rates attributable to the ZEC, and Exelon states that it accounts for these limits in its \$235 million average annual cost estimate. If the retail rate cap is exceeded, the FEJA reduces the required ZEC purchase volumes, not the ZEC prices. It is difficult to determine the precise impact of these potential volume limits on the amount of subsidies paid to Exelon, since the adjustment provisions in the FEJA appear to allow subsidies to be "banked" across years; i.e., subsidies that exceed the rate cap in one year may be applied to another year in which the cap was not exceeded (e.g., if wholesale prices increase).⁶⁰ However, whether the direct cost of providing the subsidies is \$235 million or \$340 million annually, or something in between, the burden on Illinois ratepayers will be substantial and immediate.
- (93) An alternative way of evaluating the harm to Illinois ratepayers is to calculate the premium that they are effectively required to pay to subsidized nuclear units relative to wholesale prices earned by other market participants. Since ZEC payments are based on a participating unit's actual output, it is reasonable to compare the price of the ZEC to current energy prices of between \$18/MWh and \$25/MWh.⁶¹ A ZEC price of \$16.50/MWh (as allowed under the FEJA) for each MWh of energy that a subsidized nuclear unit sells into FERC-jurisdictional markets represents a premium paid by Illinois ratepayers of between 66% and 92% above current energy prices. The magnitude of this price

⁵⁷ Exelon presentation at the Q4 2016 earnings conference call, dated February 8, 2017.

⁵⁸ For this calculation, I only use the output corresponding to Exelon's 75% ownership share of Quad Cities.

⁵⁹ This is based on Exelon's total output from Clinton (100%) and Quad Cities (75%) of 20,611,589 million MWh for 2014, the reference year often cited in the FEJA. The maximum output from these two units combined over 2012 – 2015 was 21,003,203 million MWh, which would correspond to ZEC subsidies of \$346 million.

⁶⁰ 20 ILCS 3855/1- 75(d5)(2).

⁶¹ Average real-time energy prices in Illinois (ComEd in PJM and Illinois Hub in MISO) have trended around \$25/MWh in 2017 through March. MISO prices have been in the range of \$18/MWh - \$20/MWh in March 2017, and as low as \$12/MWh on a daily average basis.

Declaration of David W. DeRamus, Ph.D.

premium paid by Illinois ratepayers will change over the 10-year duration of the ZEC program, based on changes in wholesale capacity and energy prices.

- (94) The distortionary effect of the ZEC subsidies on markets will also harm ratepayers in all the affected wholesale markets. Proponents of ZEC programs often point to wholesale price suppression as a benefit to ratepayers. As it applies to the Illinois program, however, this argument ignores the fact that all of the subsidy costs will be borne by Illinois ratepayers, while the asserted “benefits” of wholesale price suppression are spread over all of PJM. Furthermore, while artificial price suppression through out-of-market subsidies may provide a short-term “benefit” to buyers of electricity (as does any exercise of buyer market power), it deprives ratepayers of the benefits of competitive wholesale markets in the medium- and long-term. Ratepayers benefit from efficient market exit and entry, as this provides investment, innovation, competitive prices, and lower costs over time. Since the ZEC program artificially distorts market exit and entry decisions, ratepayers in all the affected wholesale markets will ultimately bear the long-term cost of these distortions.
- (95) Furthermore, ratepayers can also participate indirectly in wholesale markets via demand response and energy efficiency programs (typically via “aggregators”). Demand response and energy efficiency resources are just as disadvantaged by distorted wholesale prices as owners of generation, since artificial price suppression provides more limited opportunities for such resources to participate in wholesale markets. Some Illinois customers also already purchase all, or a substantial portion, of their electricity through “green power” programs. Nonetheless, these customers will be required to pay the ZEC subsidies, even though they are already paying for the “environmental attributes” of their power through their retail choice programs. This “double-charging” for the environmental attributes of their electricity consumption is harmful to these customers and unduly discriminatory towards providers of such “green power.”

V.D. ZEC program will harm ratepayers by overcompensating nuclear units relative to actual costs

- (96) As discussed above, the “price collar” of \$47.90/MWh established by the Illinois ZEC program effectively ensures that Exelon’s Clinton and Quad Cities units will earn at least this amount of revenue, as long as wholesale energy and capacity prices are above \$31.50/MWh. The use of the SCC to set this price collar was proposed after earlier legislative proposals had a more direct cost-based cap of \$42/MWh, likely based on information from Exelon regarding the costs of Clinton and Quad Cities.⁶² Thus, under earlier proposals, the subsidy to Exelon would have been equal to the difference between the plants’ \$42/MWh costs and their expected wholesale market revenues; while the final legislation determines the payment based on the difference between \$47.90 and the plants’ expected

⁶² SB 1585 (May 5, 2016), pp. 82 – 83.

Declaration of David W. DeRamus, Ph.D.

wholesale market revenues. This change provides a windfall subsidy to Exelon, and a corresponding “deadweight” loss to ratepayers, of \$5.90/MWh above the purported cost of these units.

- (97) It is difficult to reconcile the amount of the ZEC subsidy with the cost of the nuclear units at issue based on publicly available information. The 2015 Illinois study reported a relatively wide range of different estimates for the costs of these units. EIA data, for example, show the costs of Clinton and Quad Cities in the range of \$24 - \$25/MWh,⁶³ while EPA data suggest costs in the range of \$32 - \$46/MWh.⁶⁴ While Exelon stopped publicly reporting its nuclear plant costs after 2014, it appears that they were approximately \$27.51/MWh in 2014.⁶⁵ None of the available information suggests that the costs of the Clinton and Quad Cities facilities are as high as \$47.90.⁶⁶ If the costs of the nuclear units are less than \$47.90/MWh, it implies that a potentially large portion of the payment is unnecessary to achieve the stated objective of the program: namely, to retain the “environmental attributes” of the plants by retaining them in the market. Such excessive charges for the ZEC subsidy represent an additional harm to ratepayers.
- (98) Other changes were implemented in the final legislation as compared to earlier draft proposals, which could impact whether the ZEC subsidies are greater than Exelon’s costs of the units over the life of the program. For example, the duration of the ZEC program was extended to 10 years and the \$16.50/MWh SCC value was held constant until 2023, with increases of \$1/MWh annually thereafter. Without access to detailed cost projections from Exelon (and projections of future efficiency improvements), it is difficult to assess the ratepayer impact of these changes, relative to the original proposal with the ZEC price based explicitly on Exelon’s actual costs. The final legislation also set the maximum retail customer impact for the program at 1.65% of their 2009 retail rates (measured in terms of cents per kWh). As discussed above, it is difficult to assess the impact of these provisions on Exelon’s ultimate cost recovery, but the rate cap may limit the extent to which the ZEC price of \$16.50/MWh enables Exelon to earn the full amount of the implied premium of \$5.90/MWh above its asserted costs of \$42/MWh – or not.⁶⁷ Regardless of how market prices and Exelon’s costs unfold in the future, however, the shift to \$16.50/MWh for the ZEC price in the FEJA provides Exelon with a substantial premium above its stated costs of \$42/MWh in the early years of the program – including

⁶³ EIA 923 in 2015 real dollars.

⁶⁴ 2015 Report, at p. 31, in 2011 real dollars.

⁶⁵ In its 2014 10-K, Exelon reported that its nuclear unit costs of production were \$19.33/MWh, while NEI reported average U.S. nuclear plant capital costs of \$8.18/MWh in 2014, for a total estimated costs of \$27.51/MWh.

⁶⁶ The costs of Exelon’s New York nuclear units in New York may be in this range, as noted above.

⁶⁷ For example, assume that forecast wholesale prices used for the market price index were to rise to \$42/MWh by May 2018 (prior to the start of the 2018/2019 delivery year). The ZEC price would then fall to \$5.90/MWh (since the market index would be higher than the baseline index by $\$42 - \$31.40 = \$10.60$; and $\$16.50 - 10.60 = \5.90). Even if the rate cap binds on the full \$5.90/MWh, *any* ZEC subsidy in this scenario would allow Exelon to recover in excess of its asserted costs of \$42/MWh. The likelihood that the ZEC subsidy will overcompensate Exelon for its costs increases as wholesale prices increase, since the lower the ZEC price, the less likely the retail rate cap will be a binding constraint on the ZEC procurement volume.

Declaration of David W. DeRamus, Ph.D.

the upcoming 2017/2018 delivery year – that should be sufficient to ensure *at least* full cost recovery, and potentially additional profits.

VI. The IL ZEC program provides undue in-state preferences

- (99) It is my understanding that the dormant Commerce Clause (U.S. Const. art. I, Section 8) prohibits states from discriminating against or unduly burdening interstate commerce, and that Plaintiffs have alleged that the ZEC program violates the Commerce Clause. From an economic perspective, a prohibition against in-state preference is consistent with the objective of preventing state-level protectionism, which would otherwise inhibit efficient trade and commerce among the states. It is my understanding that the Supreme Court has taken a similar view: “Preservation of local industry by protecting it from the rigors of interstate competition is the hallmark of economic protectionism that the Commerce Clause prohibits.”⁶⁸
- (100) In evaluating whether the Illinois ZEC program provide undue in-state preferences, I have reviewed: a.) actions and statements by Exelon prior to and after the FEJA was passed; b.) statements by the Governor of Illinois; c.) the declarations and findings of the FEJA; d.) the 2015 Report (referenced above) on which the FEJA was based; e.) the specific provisions of the FEJA; and f.) the legislative history of the FEJA, including prior proposals. The requirements and guidance provided in the FEJA ensures that participation in the ZEC program will be restricted to in-state resources, consistent with the FEJA’s stated purpose.

VI.A. Statements and actions by Exelon

- (101) Exelon’s actions demonstrate that it considers its Clinton and Quad Cities facilities to be the pre-determined recipients of ZECs under the Illinois program. This recognition by Exelon is particularly important, given that: it owns all of the nuclear generating facilities in Illinois, with the exception of MidAmerican Energy’s 25% minority interest in Exelon’s Quad Cities facility; it is (by far) the largest owner of nuclear generation in PJM; and it has an ownership interest in approximately 67% of the “distressed” nuclear generating capacity in all of PJM and MISO.⁶⁹
- (102) On May 6, 2016, Exelon announced its intention to retire its Clinton and Quad Cities nuclear facilities “if adequate legislation is not passed during the spring Illinois legislative session.”⁷⁰ A month later,

⁶⁸ West Lynn Creamery, Inc. v. Healy, 512 U.S. 186 (1994).

⁶⁹ This does not include Exelon’s Byron nuclear generating facilities as an “at-risk” facility.

⁷⁰ “Exelon Statement on Early Retirement of Clinton and Quad Cities Nuclear Facilities,” press release by Exelon dated May 6, 2016. <http://www.exeloncorp.com/newsroom/exelon-statement-on-early-retirement-of-clinton-and-quad-cities-nuclear-facilities> last accessed March 30, 2017.

Declaration of David W. DeRamus, Ph.D.

Exelon announced it would shut down Clinton (in June 2017) and Quad Cities (in June 2018) due to “the lack of progress on Illinois energy legislation.”⁷¹ On December 1, 2016, in response to extensive lobbying by Exelon, the Illinois General Assembly included the ZEC program in FEJA in the final hours of its annual session.⁷² A week later, on the same day the governor signed the legislation into law, Exelon reversed its decision to close these two plants and announced that Quad Cities and Clinton “are now planned to operate for at least another 10 years as a result of the legislation.”⁷³ One week later, Exelon announced its plans to fast-track several capital projects at these plants, which had been previously cancelled or put on hold as Exelon was preparing for their retirement.⁷⁴ Exelon also promised to hire more than 400 permanent employees to assist with these capital projects.⁷⁵ Most recently, on a February 8, 2017 earnings call, Exelon included expected revenues from the Illinois ZEC program as a separate component of its gross margins.⁷⁶ Exelon estimates that the cost to Illinois customers for the ZEC program will be as high as \$235 million per year for the duration of the 10-year program.⁷⁷ Exelon would not have taken these actions, made these accounting changes, and made these disclosures, if the results of the ZEC procurement process were not, in effect, predetermined by the FEJA, with Clinton and Quad Cities the only “zero emissions” facilities that were *de facto* eligible to receive the Illinois ZEC subsidies. These actions by Exelon at the end of 2016 and early 2017 do not reflect an assessment that Clinton and Quad Cities are likely to be selected in the June 2017 ZEC procurement; but that their selection is a certain result.

VI.B. The stated goals and findings of the FEJA

- (103) Although environmental objectives are among the stated goals of the FEJA, the purpose of the ZEC program is also, if not primarily, to save local jobs, specifically those at the Clinton and Quad Cities facilities. The job promotion and protection purpose of the FEJA is evident in its very title: the “Future Energy Jobs Act.” At the signing ceremony of FEJA, Governor Rauner stated, “[t]he Future Energy Jobs bill protects taxpayers, ratepayers, and the **good-paying jobs at the Clinton and Quad Cities’ plants.**”⁷⁸ It is difficult to understand the basis for this statement by the Governor in 2016,

⁷¹ “Exelon Announces Early Retirement of Clinton and Quad Cities Nuclear Plants,” press release by Exelon dated June 2, 2016. <http://www.exeloncorp.com/newsroom/clinton-and-quad-cities-retirement> last accessed March 30, 2017.

⁷² “Illinois governor signs energy bill to help Exelon nuclear plants,” *Platts*, December 7, 2016. <http://www.platts.com/latest-news/electric-power/washington/illinois-governor-signs-energy-bill-to-help-exelon-21280324> Accessed March 30, 2017.

⁷³ “Governor Rauner Joins Hundreds of Community Members, Local Business Leaders, Environmental Groups and Nuclear Plant Employees for Signing of Future Energy Jobs Bill,” press release by Exelon dated December 7, 2016. <http://www.exeloncorp.com/newsroom/governor-rauner-signing-of-future-energy-jobs-bill> last accessed March 30, 2017.

⁷⁴ “Future Energy Jobs Bill Already Delivering Job Growth, Economic Impact,” press release by Exelon dated December 14, 2016. <http://www.exeloncorp.com/newsroom/fejb-econ-impact-rls> last accessed March 30, 2017.

⁷⁵ *Id.*

⁷⁶ Exelon presentation at the Q4 2016 earnings conference call, dated February 8, 2017.

⁷⁷ *Id.*

⁷⁸ “Governor Rauner Joins Hundreds of Community Members, Local Business Leaders, Environmental Groups and

Declaration of David W. DeRamus, Ph.D.

prior to the criteria for the ZEC procurement process even being established, unless the selection of Clinton and Quad Cities for the ZEC program was a foregone conclusion by those charged with drafting, passing, and implementing the legislation. Immediately after the FEJA was passed, the Nuclear Energy Institute similarly stated that the FEJA would keep the Clinton and Quad Cities facilities from retiring and would preserve “4,200 direct jobs” at those two plants.⁷⁹

- (104) In support of the ZEC program, the General Assembly made certain findings and declarations in the FEJA that specifically referenced the “premature closure of existing nuclear power plants in Illinois,”⁸⁰ noting that it had directed the ICC (and other Illinois agencies) to prepare the 2015 Report to identify ways of ensuring that the closure of at-risk Illinois “does not occur.”⁸¹ The fact that the General Assembly included these findings and declarations in the FEJA suggests that the purpose of the ZEC program is to prevent the closure of nuclear facilities in Illinois; that the FEJA was intended to avert the perceived “adverse consequences” of these Illinois plant closures on reliability and the regional economy, in addition to its stated environmental goals; and that the only way for the ZEC program to achieve these objectives is by *de facto* limiting eligibility for participation in the program to uneconomic nuclear units in Illinois.
- (105) The following passage in the 2015 Report indicates how the ICC and IPA are likely to implement the FEJA:

Illinois solution. In considering the market-based solutions included herein, the General Assembly should be cognizant that these solutions provide varying degrees of certainty for **ensuring that funds provided by Illinois consumers would be utilized primarily to support assets within Illinois.** In assessing potential market-based solutions, the value of **keeping those funds expended and associated economic activity within the state** may be considered.⁸²

Since the ICC and the IPA were among the primary authors of the 2015 Report, it is reasonable to infer that in implementing the Illinois ZEC program (as directed by the FEJA), they would take into consideration whether an applicant to the program would provide such an “Illinois solution” (assuming any nuclear generating facilities outside Illinois would even apply to the program).

Nuclear Plant Employees for Signing of Future Energy Jobs Bill,” press release by Exelon dated December 7, 2016. <http://www.exeloncorp.com/newsroom/governor-rauner-signing-of-future-energy-jobs-bill> last accessed March 30, 2017.

⁷⁹ “Illinois Joins New York in Recognizing Value of Nuclear Plants,” press release by the Nuclear Energy Institute dated December 1, 2016. <https://www.nei.org/News-Media/Media-Room/News-Releases/Illinois-Joins-New-York-in-Recognizing-Value-of-Nu>, accessed March 24, 2017. “Legislators in Illinois today passed the Future Energy Jobs Bill, a measure that will **ensure the continued operation of the Clinton and Quad Cities nuclear power plants** in that state.” As the COO of NEI states in the same article, “The Future Energy Jobs Bill, now headed to the governor’s desk, preserves more than \$1.2 billion in annual economic activity across Illinois, including **4,200 direct jobs at Clinton and Quad Cities** and thousands more jobs that the plants support.” (Emphasis added.)

⁸⁰ FEJA, Section 1.5 “Zero emission standard legislative findings,” (5). (Emphasis added.)

⁸¹ *Id.*, (7). (Emphasis added.) *See also*, *Id.*, (4) – (8).

⁸² 2015 Report, p. 154. (Emphasis added.)

Declaration of David W. DeRamus, Ph.D.

VI.C. Specific provisions of the FEJA

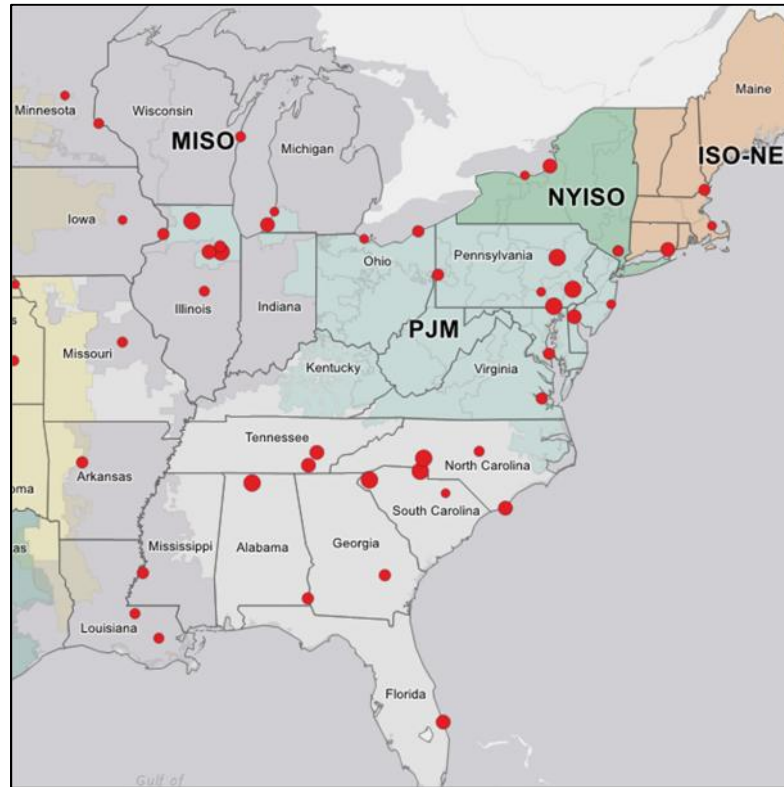
VI.C.1. ZEC participation is limited to nuclear facilities

- (106) There are several specific provisions of the FEJA indicating that the ZEC program is intended to be limited to in-state nuclear units. First, as defined by the FEJA, the term “Zero Emission Facility” is a misnomer. If the purpose of the program is to limit greenhouse gases and/or other emissions, a zero emission facility would be reasonably defined to apply to a generating facility that emits no CO₂ or other air pollutants. The FEJA, by contrast, defines a “Zero Emission Facility” as “a facility that: (1) is fueled by **nuclear power**; and (2) is interconnected with PJM Interconnection, LLC or the Midcontinent Independent System Operator, Inc., or their successors.”⁸³
- (107) As a result of requirement (1), solar, wind, or hydroelectric generating facilities are not eligible to participate in the ZEC program, even though they emit no CO₂ or other pollutants. Nor are demand response or energy efficiency aggregators eligible to compete with nuclear units to reduce emissions from electric generation through the ZEC program, even though they may be able to do so more cost effectively. The FEJA uses the language of “emissions reduction” as evidence of its ostensible objective, but the unavoidable implication of the definitions used in the FEJA is that its purpose is to support the retention of nuclear generation.
- (108) As a result of requirement (2), only nuclear facilities interconnected with PJM or MISO are eligible. In theory, this suggests that other nuclear facilities outside Illinois should be eligible to participate in the program. As shown in Figure 9, below, there are a large number of nuclear facilities in PJM and MISO. If the primary purpose of the program is to reduce emissions, however, particularly of CO₂, there is no reason for the program to be limited to PJM or MISO facilities. Illinois residents are just as affected by CO₂ emissions in New York, Florida, or China, as they are by CO₂ emissions in Illinois. A given reduction in CO₂ emissions is equally beneficial to Illinois residents, regardless of where the CO₂ reduction occurs. The consequences of CO₂ emissions are not local, but global in nature.

⁸³ FEJA, Section 1-10. Definitions. (Emphasis added.)

Declaration of David W. DeRamus, Ph.D.

Figure 9: Nuclear facilities in PJM, MISO, and neighboring control areas



VI.C.2. ZEC participation is limited to nuclear facilities with insufficient market revenues

- (109) The language in the FEJA indicates that eligibility to participate in the ZEC program is limited to nuclear facilities that would otherwise exit the market in the absence of the ZEC program. As noted above, the FEJA states that the purpose of the ZEC program is to allow for the “**preservation of [existing] zero emission facilities.**” Accordingly, the FEJA states in the ZEC procurement process, “the selection of winning bids shall take into account... any existing environmental benefits that are **preserved** by the procurements ... and would **cease to exist** if the procurements were not held, including the **preservation of zero emission facilities.**”⁸⁴
- (110) The FEJA also requires that ZEC applicants submit detailed cost data.⁸⁵ The only reason to require submission of such information is if participation is limited to loss-making nuclear units. The ZEC payments are not based on a plant’s costs, nor will applicants submit an offer bid (i.e., with a price at which it is willing to sell ZECs). Instead, the ZEC payment is based solely on the (estimated) SCC value – which the FEJA derives from Illinois’ specific electric generation profile – and wholesale

⁸⁴ FEJA, (d-5)(1)(C) (Emphasis added.)

⁸⁵ FEJA, (d-5)(1)(A)(iii).

Declaration of David W. DeRamus, Ph.D.

price benchmarks. As discussed above, other portions of the FEJA reference the need to retain nuclear generating units that would otherwise exit the market (and specifically, units in Illinois).⁸⁶

- (111) I note, however, that if the FEJA limits participation in the ZEC program to uneconomic nuclear units, the record does not demonstrate that Quad Cities and Clinton meet that criterion. As the 2015 Report (the basis for the FEJA) stated, “Because of the limited cost data available, it is not entirely clear whether or not Exelon’s Illinois plants earn sufficient revenues to cover their operating costs.”⁸⁷

VI.C.3. ZEC participation is effectively limited to uneconomic nuclear facilities in Illinois

- (112) The specific language of the FEJA cited above indicates that the program is intended to apply only to in-state resources. Other provisions of the FEJA further underscore that the ZEC program will be used to support only *uneconomic* nuclear facilities in Illinois, and not the many other nuclear units in the state. Thus, unlike other environmental programs (such as RECs), the ZEC program cannot be appropriately characterized as a payment for a zero-carbon attribute, but rather as a subsidy for inefficient plants. First, ZEC prices will be based on wholesale prices in Illinois. As noted above, eligibility to participate in the ZEC program is explicitly limited to nuclear units in PJM or MISO. The ZEC prices, however, are not based on PJM or MISO average wholesale prices, for example, but instead are based on: (a) energy prices at the PJM Northern Illinois Hub; (b) the PJM capacity price for the “rest of RTO zone group” and (starting in 2020) the “ComEd zone,” both of which pertain to wholesale market prices in Illinois; and (c) the MISO capacity price for Zone 4, which also pertains to Illinois. The use of these locational wholesale market prices to determine compensation for the selected units provides strong incentives for participation by in-state resources, strong disincentives for participation by out-of-state resources (who are exposed to different wholesale prices), and a strong signal to potential participants that the program is intended to support Illinois resources.
- (113) The statute also directs the IPA to use a “public interest” standard in selecting among program applicants – assuming (improbably) that any nuclear generating unit owner in PJM or MISO other than Exelon would apply to the program, and assuming (also improbably) that Exelon would apply for its non-Illinois plants to be considered. While it is unclear exactly what this “public interest” standard requires, the remainder of the guidance provided by the FEJA (cited above) strongly suggests that it refers to the public interest in Illinois, including the preservation of economic activity (i.e., jobs) associated with the at-risk Illinois nuclear plants. As noted above, in the 2015 Report, the ICC also stated that it would be appropriate to ensure that Illinois ratepayer funds were used only to

⁸⁶ FEJA, (d-5)(1)(C). “[W]inning bids shall be selected based on public interest criteria that include, but are not limited to, minimizing carbon dioxide emissions that result from electricity consumed in Illinois and ... would cease to exist if the procurements were not held, including the preservation of zero emission facilities.”

⁸⁷ 2015 Report, at p. 39.

Declaration of David W. DeRamus, Ph.D.

support the retention of in-state at-risk nuclear units and to support in-state “economic activity.”⁸⁸ It is thus reasonable to infer that in conducting the ZEC procurement, the ICC and the IPA would consider that ZEC subsidies paid by Illinois ratepayers could only be used to support in-state resources, under the “public interest” criterion of the FEJA.

VI.C.4. ZEC program design is uniquely applicable to Clinton and Quad Cities

- (114) Two other elements of the ZEC program appear to be directed not just at in-state Illinois resources, but at Exelon’s Clinton and Quad Cities facilities specifically. First, the FEJA has specified a 10-year time horizon for the duration of the ZEC program. Not coincidentally, the current nuclear operating license for the Clinton facility ends in September, 2026: 9 years and 3 months from the start of the program (although after the FEJA was passed, Exelon announced that it would seek to extend Clinton’s operating license).⁸⁹ Furthermore, as noted above, Exelon had put on hold several major capital expenditures for the Clinton and Quad Cities facilities, which it restarted immediately after the legislation passed. A 10-year duration for the ZEC program would also be consistent with the objective of enabling these specific investments – but only if these specific Illinois generating units were the sole intended recipients of the ZEC subsidies.
- (115) Second, the volume of the ZEC requirement corresponds to Exelon’s combined output from its Clinton and Quad Cities nuclear units. The FEJA requires that the IPA procure an amount of ZECs approximately equal to 16% of the electricity delivered by utilities to Illinois’ retail customers in 2014.⁹⁰ This corresponds to approximately 22 million MWh of electricity (a more precise estimate would require identifying Illinois utilities with less than 100,000 customers on whose behalf the IPA does not procure power and energy).⁹¹ In 2014, Exelon’s output from its Clinton and Quad Cities facilities was 20.6 million MWh of electricity; in 2012, its output was 21 million MWh.⁹² Exelon’s maximum feasible output from these two facilities is approximately 21.4 million MWh (at operating capacity). One could hypothesize that this close correspondence between the ZEC volume requirements and Exelon’s output from Clinton and Quad Cities would be equally close for any two nuclear plants; but Clinton is (unusually) a one-unit nuclear station, and Exelon has a 75% share of Quad Cities. Thus, it is difficult to ascribe this result to anything other than a legislative intent to ensure that the outcome of the ZEC procurement would be to support only in-state nuclear units, and

⁸⁸ Id., at p. 154.

⁸⁹ Exelon 2015 Form 10-K.

⁹⁰ FEJA, (d-5)(1).

⁹¹ Illinois total retail load in 2014 was 141,540,287 MWh. The ZEC volumes do not apply to Illinois utilities with less than 100,000 customers on whose behalf the IPA does not procure power and energy. I estimate that this accounts for at least 2% of Illinois load, based on the load served by MidAmerican Energy. $16\% \times 98\% \times 141.5 \text{ million} = 22 \text{ million MWh}$.

⁹² As referenced above, Exelon’s output from Quad Cities relates only to its 75% ownership share. It is my understanding that MidAmerican Energy’s 25% share of this facility does not intend to participate in the ZEC program and would be ineligible, since it recovers its costs from its retail customers (subject to cost-of-service retail rates).

Declaration of David W. DeRamus, Ph.D.

specifically Exelon's Clinton and Quad Cities facilities – and to exclude out-of-state units, even if they are nuclear units.⁹³

VI.D. Legislative history of the FEJA

- (116) The legislative history of the FEJA also demonstrates that the ZEC program is intended to support only in-state nuclear generation. Earlier versions of the bill, drafted with significant input from Exelon, also indicate that the purpose of the legislation was to keep open Clinton and Quad Cities specifically. On May 5, 2016, ComEd (Exelon's retail affiliate) and Exelon issued a proposal (the "Next Generation Energy Plan") with many elements, including ZECs, that ultimately are reflected in the FEJA:

ComEd and Exelon have released a new bill they say reconciles the state's competing interests... The bill includes **supports for the two Exelon nuclear plants** that the company has maintained are in danger of closing if left to market forces. It calls for an independent review of the plants' financial prospects, and if "**available market revenues are insufficient, the plants will be eligible for compensation for their zero emissions attributes,**" as described by Joe Dominguez, Executive Vice President of Governmental and Regulatory Affairs and Public Policy for Exelon... The new proposal is based on a plan crafted for New York's nuclear plants, Dominguez said, and as the legislation is written **only Exelon's Quad Cities and Clinton nuclear plants would be eligible** for aid.⁹⁴

- (117) Exelon made similar statements about its proposal in a press release, titled, "Next Generation Energy Plan to **Protect and Create Jobs, Deliver Clean Energy and Jumpstart Solar Development, Nearly Double Energy Efficiency, Provide for \$1B in Low-Income Assistance, and Secure Future of Illinois' Nuclear Plants:**"

An exciting new part of this bill is an innovative **Zero Emission Standard** that will create a level playing field for all clean energy sources to compete... "The program introduced in today's bill **only compensates financially challenged plants after a full and complete review of costs** by the experts at the Illinois Commerce Commission and the Illinois Power Agency," said Joe Dominguez, executive vice president, Governmental and Regulatory Affairs and Public Policy, Exelon. "**The Zero Emission Standard will preserve Illinois' at-risk nuclear energy facilities, which serve as economic engines for the state and communities in which they operate,** maintain the reliability of the grid, and avoid substantial amounts of carbon emissions."⁹⁵

⁹³ EPSA has a member that owns a nuclear facility in Pennsylvania. Based on the analysis above, this nuclear facility would be precluded from participating in the Illinois ZEC program.

⁹⁴ "Surprise Energy Bill Turns Up Heat on Nuclear, Solar Debates," May 5, 2016, *Midwest Energy News*. <http://midwestenergynews.com/2016/05/05/surprise-illinois-energy-bill-turns-up-heat-on-nuclear-solar-debates/>, accessed March 24, 2017.

⁹⁵ Exelon press release, "Next Generation Energy Plan to Protect and Create Jobs, Deliver Clean Energy and Jumpstart Solar Development, Nearly Double Energy Efficiency, Provide for \$1B in Low-Income Assistance, and Secure Future of Illinois' Nuclear Plants," May 5, 2016, available at: <http://www.exeloncorp.com/newsroom/next-generation-energy->

Declaration of David W. DeRamus, Ph.D.

- (118) I have reviewed other drafts of the legislation, such as Illinois SB 1585 and its proposed amendments, and several provisions are explicit as to the purpose of the ZEC program. Illinois SB 1585 proposed that the ZEC be calculated as the difference between a unit's costs and its projected wholesale market revenues for a given planning year.⁹⁶ SB 1585 fixed the "average annual zero emission resource cost" at \$42/MWh for the first four years of the program (with adjustment provisions thereafter). Much of the language of the FEJA mirrors the language in SB 1585 (with the notable exception of the use of the SCC value in the FEJA in place of costs in determining the amount of the subsidy). Based on Exelon's involvement in the legislative process behind FEJA and the lack of more definitive publicly available information on Exelon's nuclear unit costs, it is reasonable to assume that the \$42/MWh referenced in SB 1585 represents Exelon's asserted costs of its Clinton and Quad Cities units (or potentially, all of its Illinois units). This further demonstrates that the purpose of the ZEC legislation was to support Exelon's Clinton and Quad Cities facilities.
- (119) In addition, in a proposed amendment to SB 1585 dated May 27, 2016, a provision was included that would have relieved a utility from an obligation to purchase ZECs, unless at least one ZEC was procured from a facility directly interconnected to same zone "balancing authority or zone" as the purchasing utility.⁹⁷ Given that no at-risk nuclear unit could participate in the market with only one ZEC, this provision would effectively require the IPA to purchase ZECs from in-state resources.

VI.E. Protectionist effects of the FEJA are exacerbated by exports

- (120) Undue in-state preferences are a form of economic protectionism that is detrimental to interstate commerce. As with other forms of protectionism, undue in-state preferences are detrimental to the welfare of in-state citizens, due to the higher prices they are ultimately forced to pay; and to the welfare of out-of-state citizens, due to their foregone opportunities to sell their goods and services in other states.
- (121) The protectionist result of the Illinois ZEC program is exacerbated by the fact that Illinois is a significant net exporter of electricity to other states. Illinois has a large amount of baseload capacity (including from nuclear units) relative to its load. Recently, for example, Exelon announced that its Byron nuclear facility in Illinois (located in PJM) would export power to other states in the Midwest, including Michigan, Indiana, and Wisconsin.⁹⁸ While Illinois imports power in certain peak periods, e.g., on hot summer days in Chicago, on average over the course of a year, it is a net exporter to other states. Between 2009 and 2015, Illinois exported more than 53 million MWh on average, or

[plan](#), accessed March 24, 2017.

⁹⁶ SB 1585 (May 5, 2016), pp. 82 – 83.

⁹⁷ Proposed Amendment to SB 1585, May 27, 2016, Section G.

⁹⁸ "Exelon seeks right to export power from big Illinois nuke," *Crain's Chicago Business*, March 24, 2017. Available at: <http://www.chicagobusiness.com/article/20170324/ISSUE01/170329896/exelon-seeks-right-to-export-power-from-big-illinois-nuke>; accessed March 29, 2017.

Declaration of David W. DeRamus, Ph.D.

approximately 27% of total Illinois net generation. Thus, by retaining uneconomic nuclear units in the markets as a result of the ZEC program, the Illinois subsidies will help support its electric power exports (supplied out of its portfolio of resources) to other states. Illinois exports ultimately benefit from Illinois subsidies in ways that competing generation in other states (or in Illinois) do not. As a consequence, the Illinois in-state subsidies have a distortionary effect on interstate commerce, in addition to the impacts discussed above.

Declaration of David W. DeRamus, Ph.D.

I declare under penalty of perjury under the laws of the United States that the foregoing facts are true and correct to the best of my knowledge.



David W. DeRamus, Ph.D.

March 31, 2017

Date