Company Exhibit _____

BEFORE THE
PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company for Authority to Provide for a Standard Service Offer Pursuant to R.C. 4928.143 in the Form of an Electric Security Plan	)))))))	Case No. 14-1297-EL-SSO

DIRECT TESTIMONY OF

PAUL A. HARDEN

ON BEHALF OF

OHIO EDISON COMPANY
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
THE TOLEDO EDISON COMPANY

AUGUST 4, 2014

INTRODUCTION

Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.

A. My name is Paul A. Harden, Senior Vice President, Fleet Engineering, for FirstEnergy Nuclear Operating Company ("FENOC"), a subsidiary of FirstEnergy Corp. ("FirstEnergy"). My business address is 341 White Pond Dr., Akron, OH 44320.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND, PROFESSIONAL QUALIFICATIONS, AND EMPLOYMENT EXPERIENCE.

A. I earned a Bachelor of Science degree in Nuclear Engineering from the University of Cincinnati and a Masters of Business Administration degree from the University of Notre Dame. I was a licensed Senior Reactor Operator at the Palisades Nuclear Plant, and I am a Registered Professional Engineer in Michigan. I also served in the U.S. Navy Reserve as an electronics technician.

I joined FENOC in January 2008 as Vice President, Nuclear Support. I was named Site Vice President of Beaver Valley in August 2009 and was promoted to my current position in April 2013. Prior to joining FENOC, I was Fleet Vice President of Projects and Engineering for Nuclear Management Company in Hudson, Wisconsin. I also served as Site Vice President, Director of Site Operations and Director of Engineering at the Palisades Nuclear Plant in Michigan, and as Recovery Director at the Kewaunee Nuclear Plant in Wisconsin.

As Senior Vice President, Fleet Engineering, I am responsible for all site and fleet engineering and nuclear fuel design and procurement functions that support our three nuclear generating stations. In addition, I am responsible for the fleet engineering and technical support for all fossil fueled and hydroelectric generating stations of FirstEnergy subsidiaries.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My testimony discusses the operations of two generating plants that Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company (collectively, the "Companies") have identified as sources of energy, capacity, ancillary services and environmental attributes to be purchased from FirstEnergy Solutions Corp. ("FES") in a potential transaction supporting the Economic Stability Program. These are the Davis-Besse Nuclear Power Station ("Davis-Besse") and the W.H. Sammis Plant ("Sammis") (collectively, the "Plants"). In addition, the Companies would buy FES's entitlement to the output of the Ohio Valley Electric Corporation ("OVEC"), and I will discuss the operations of OVEC as well. As I explain below, the Plants are good, efficient generation facilities which benefit the State of Ohio and, if the Economic Stability Program is implemented, will be able to continue operating over the long term.

THE GENERATING PLANTS

Q. PLEASE GENERALLY DESCRIBE DAVIS-BESSE.

A. Davis-Besse, located about twenty-one miles east of Toledo, was the first nuclear plant in Ohio and has been in operation since 1977; it is a zero-carbon resource. Davis-Besse is designed to be a baseload unit rated at 908 megawatts (894 MW PJM Installed Capacity ("ICAP")). Davis-Besse can generate enough electricity to serve approximately 715,000 households.

Davis-Besse employs approximately 740 employees and contractors with an annual payroll of $64.7 million. In addition, Davis-Besse will have approximately 700 contractors on-site for a 1-2 month period during a typical planned outage. In 2013, Davis-Besse paid more than $5.8 million in property taxes and $26.8 million in payroll

taxes. The plant spends more than $180 million annually on fuel, labor, contractors, materials and equipment. Davis-Besse is owned by FirstEnergy Nuclear Generation, LLC ("FNG"), a subsidiary of FES, and operated by FirstEnergy Nuclear Operating Company ("FENOC").

Q. PLEASE DESCRIBE MAJOR COMPONENTS OF DAVIS-BESSE.

A. The major components of Davis-Besse include: (i) the reactor; (ii) steam generators; (iii) containment; (iv) turbine; (v) generator; (vi) condenser; and (vii) cooling tower. I will describe each of these below.

The Reactor – The reactor has a pressurized water design provided by the Babcock and Wilcox Company ("B&W"), and incorporates 177 fuel assemblies to produce 2817 megawatts thermal ("MWt") power. The operating cycle is two years in duration with each refueling outage replacing one-third of the fuel assemblies in the reactor with new fuel assemblies.

Steam Generators – Davis-Besse uses two vertical once-through steam generators. The steam generators function as heat exchangers, producing the superheated steam that is used to drive the turbine generator, which ultimately produces electricity. The original once-through steam generators were provided by B&W and were replaced in 2014 with replacement steam generators provided by B&W.

Containment – The containment is a free-standing cylindrical steel vessel with a hemispherical dome and an ellipsoidal bottom which is designed to withstand a loss-of-coolant accident. The containment vessel is completely surrounded by a reinforced concrete shield building with a cylindrical shape and a dome roof. The shield building provides biological shielding during normal operation and during postulated accident

conditions and provides environmental protection for the containment vessel from adverse weather conditions and tornado projectiles.

Turbine – Davis-Besse's turbine was manufactured by General Electric. The turbine is a tandem-compound four flow consisting of one high pressure ("HP") section and two low pressure ("LP") turbines.

Generator – The generator is a three phase, 25,000 volt, conductor cooled wye connected synchronous unit manufactured by General Electric. The generator is rated at 1,069 mega volt amps ("MVA") at 60 pounds per square inch gauge ("psig") hydrogen pressure, 0.90 power factor.

Condenser – The condenser is a horizontal tubed, multi pressure, double shell steam surface condenser manufactured by Ingersoll Rand.

Cooling Tower – The cooling tower is a natural draft, counter flow, hyperbolically shaped, reinforced concrete structure designed by the Research-Cottrell Company. The tower's concrete diameter is 415 feet at the base, and the structure's height is 493 feet.

Q. WHAT IS THE STATUS OF DAVIS-BESSE'S OPERATING LICENSE?

A. Davis-Besse's operating license expires on April 22, 2017. In August 2010, FENOC filed with the United States Nuclear Regulatory Commission ("NRC") a License Renewal Application. Davis-Besse's License Renewal Application is currently under review. The License Renewal Application requests renewal of Davis-Besse's operating license for a period of 20 years beyond the expiration of the current license term. I have no reason to believe Davis-Besse's operating license will not be approved for renewal. The replacement of the reactor pressure vessel head in 2011 and the replacement of steam generators earlier this year have enhanced the safe, efficient and reliable operation of

Davis-Besse and will enable it to operate through a 20-year renewal of its operating license.

Q. PLEASE GENERALLY DESCRIBE SAMMIS.

A. Sammis is among the largest coal-fired power plants in Ohio. Sammis is comprised of seven coal-fired units that collectively produce 2,220 megawatts of electricity (2130 MW PJM ICAP).[1] Sammis can generate enough electricity to serve approximately 1.8 million households. Units 6 and 7 are designed to be baseload units rated at 1,200 megawatts, and Units 1-5 are load-following units rated at 1,020 megawatts. The plant uses an average of 18,000 tons of coal daily for an annual average of 6.6 million tons, including coal from Ohio coal mines.

Sammis employs approximately 400 employees and contractors with an annual payroll of $34 million. In 2013, it paid more than $5.5 million in property taxes and $14.1 million in payroll taxes. Sammis spends more than $460 million per year on fuel, labor, contractors, materials and equipment, with approximately $52 million spent each year on Ohio coal alone. Sammis is owned by FirstEnergy Generation, LLC, a subsidiary of FES.

Q. PLEASE DESCRIBE THE MAJOR COMPONENTS OF SAMMIS.

A. The major components of Sammis' seven steam turbine generating units include: (i) turbines; (ii) generators; (iii) boilers; (iv) circulating water system; and (v) stacks. I will describe each of these below.

Turbines – Each of the seven units at the Sammis Plant has a turbine train with turbine elements that are all coupled together in series. Units 1 through 4 each have one high pressure ("HP") turbine, one combined intermediate pressure ("IP") and low pressure

[1] Five emergency diesel units at Sammis produce a total of 13 megawatts.

("LP") turbine ("IPLP"), and one double flow low pressure ("DFLP") turbine. Unit 5 has two DFLP turbines, as well as one combined HP-IP turbine. Unit 6 has three DFLP turbines, one double flow HP turbine, and one double flow IP turbine. Unit 7 has two DFLP turbines, one double flow HP turbine, and one double flow IP turbine. All Sammis turbines were manufactured by Westinghouse Electric Company, now Siemens Power, except for the turbines in Units 1 and 2 which were manufactured by General Electric Company.

Generators – The Unit 1 and 2 generators were manufactured by General Electric while the Unit 3 through 7 generators were manufactured by Westinghouse. All are hydrogen-cooled. The Unit 1 through 4 generators are rated at 224 MVA and produce 20,000 volts at 60 hertz. The Unit 5 generator is rated at 393 MVA and produces 24,000 volts at 60 hertz. The Unit 6 and 7 generators are rated at 800 MVA and produce 20,000 volts at 60 hertz. The generators at all seven units have a 0.85 power factor. The 20,000 volts supplied by the Unit 1 and 2 generators is increased to 138 kilovolts ("KV") by their respective main transformers before being transmitted across the electrical grid. The voltage supplied by the Unit 3 through 7 generators (20,000 volts) is increased to 345 KV by their respective main transformers before being transmitted across the electrical grid.

All five emergency diesel generators were manufactured by General Motors Electro-Mechanical Division. They are air cooled and rated at 3,575 kilo volt amps ("KVA"), have a 0.80 power factor and produce 4,160 volts at 60 hertz which is distributed throughout the Sammis Plant.

Boilers – The Unit 1 through 4 boilers are Foster Wheeler designed, subcritical drum type with a combination radiant and convective superheater and a single convective reheater.

The boiler is designed for a maximum continuous rating ("MCR") of 1,250,000 lbs. of steam per hour (lb/hr) and a pressure of 2,450 psig, 1050°F at the superheater. The reheater steam temperature is controlled at 1000°F. Pulverized coal is supplied to the furnace by five Raymond Bowl type mills. The furnace is front wall fired and has fifteen burners (three columns of five high) with overfire air and urea injection for NO_x control. Coal is transported from the pulverizers to the boilers by exhauster fans. There are two Ljungstrom air preheaters and the boiler is balanced draft.

The Unit 5 boiler is a sub-critical once-through steam generator provided by B&W. The boiler is designed with an MCR of 2,355,000 lb/hr steam flow at 2625 psig and 1005°F and the reheater is controlled at 1000°F. The steam generator has both primary horizontal and secondary pendant superheater and a pendant reheater. In 1984, the entire lower furnace was replaced with a spiral tube design. Pulverized coal is supplied to the furnace by eight B&W EL 76 ball and race mills. Coal is transported to the boiler by primary air fans and combustion occurs by twenty-four B&W DRB 4Z type, opposed wall burners. There are two Ljungstrom, horizontal shaft air preheaters and the boiler is balanced draft.

The Unit 6 and 7 boilers are supercritical once-through steam generators provided by B&W. Both boilers are designed with an MCR of 4,628,000 lb/hr steam flow at 3500 psig and 1005°F and the reheater is controlled at 1000°F. The steam generator has both primary horizontal and secondary pendant superheaters and both horizontal and pendant reheaters. Pulverized coal is supplied to the furnace by five B&W MPS-89N ring roll mills. Coal is transported to the boiler by primary air fans and combustion occurs by

thirty B&W DRB XCL type, opposed wall burners. There are two Ljungstrom, horizontal shaft air preheaters and the boiler is balanced draft.

Fuel oil is used to light-off all the boilers and establish a coal flame.

Circulating Water System – Instead of cooling towers, Sammis uses water from the Ohio River for the circulating water system. The circulating water system includes two circulating water pumps for each unit, and has a total capacity of 1,252,000 GPM (gallons per minute).

Stacks – A new concrete stack was constructed as part of Sammis' wet flue gas desulfurization ("WFGD") retrofit. The stack is 850 feet high and 94 feet in diameter and contains three separate flues, one from each absorber. Each flue is manufactured from fiberglass reinforced plastic piping and is 32 feet in diameter.

Q. PLEASE GENERALLY DESCRIBE OVEC.

A. OVEC operates the Kyger Creek Plant in Cheshire, Ohio. This plant has a baseload name plate capacity of 1,086 MW. OVEC also operates the Clifty Creek Plant in Madison, Indiana. That plant has a baseload nameplate capacity of 1,304 MW. OVEC has 467 employees in Ohio, with a total Ohio payroll of approximately $35 million. OVEC was formed in 1952 by investor-owned utilities – its Sponsoring Companies – to serve the large electric power requirements projected for the uranium enrichment facilities then under construction by the Atomic Energy Commission near Portsmouth, Ohio. OVEC and the Sponsoring Companies operate under an Amended and Restated Inter-Company Power Agreement ("ICPA") effective August 11, 2011 and extending through June 30, 2040. Under the ICPA, FirstEnergy Generation, LLC, an FES subsidiary, is entitled to power participation benefits and requirements equaling 4.85% of OVEC's output, which based on OVEC's nameplate capacity is 115.9 megawatts.

Q. WHAT IS THE VALUE PROVIDED BY BASELOAD UNITS?

A. Baseload units are designed to run at all times throughout the year and meet a portion of a region's minimum energy demand by producing energy at a constant rate. Baseload units usually have low avoidable costs relative to other production facilities. In essence, baseload units are the bedrock that ensures reliability for retail customers by operating around the clock and providing voltage support and other services that are essential to the reliable operation of the grid.

Q. DO THE PLANTS ENHANCE THE GENERATION ASSET MIX IN OHIO?

A. Yes. Because these Plants have an on-site fuel capability, they are available on a 24x7 basis and can support prolonged operations during disruptive events such as the January 2014 Polar Vortex. Sammis targets an on-site fuel supply of approximately 30 days. Davis-Besse runs approximately two years between refueling outages, and can operate some time beyond that at a slightly reduced percentage of its rated power. Davis-Besse also targets having new fuel on site more than 30 days in advance of planned refueling outages. The operating characteristics of nuclear and coal plants make them essential to reliability in times of stress on the grid.

ENVIRONMENTAL CONTROLS

Q. IS DAVIS-BESSE IN COMPLIANCE WITH THE CLEAN AIR ACT ("CAA")?

A. Yes. Davis-Besse operates an Auxiliary Boiler under Ohio Environmental Protection Agency synthetic minor permit P0110436.

Q. DOES DAVIS-BESSE COMPLY WITH CLEAN AIR INTERSTATE RULE ("CAIR"), CROSS STATE AIR POLLUTION RULE ("CSAPR"), MERCURY AIR TOXICS STANDARD ("MATS") AND GREENHOUSE GAS ("GHG") REQUIREMENTS?

A. Yes. Generally, these requirements are directed toward major U.S. Environmental Protection Agency ("U.S. EPA") Title V air permits and are inapplicable to Davis-Besse. Davis-Besse's synthetic minor air permit addresses the above requirements by limiting the generation run time for the Auxiliary Boiler.

Q. WHAT ENVIRONMENTAL CONTROL EQUIPMENT IS INSTALLED AT SAMMIS?

A. Significant environmental investments have been made at Sammis, including a $426 million air quality control system installed between 1980 and 1984, which was at the time the largest environmental retrofit in North America, and extensive retrofits in 2010. These environmental investments include:

- *WFGD/Scrubbers* - In 2010, Sammis was retrofitted with a $1.8 billion state-of-the-art air quality control system. This includes WFGD known as scrubbers, which were installed on all seven coal units and are designed to remove in excess of 95% of sulfur dioxide. There are a total of three absorbers (scrubbers); two of these absorbers are used on Units 5 through 7 and the third absorber is used on Units 1-4;
- *NO_x Control Systems* - Units 6 and 7 were retrofitted with Selective Catalytic Reduction ("SCRs") in 2010. The SCR process adds ammonia to the flue gas as it passes through a catalyst, and is designed to remove up

to 90% of the nitrogen oxide from the flue gas. The absorbers and SCRs were manufactured by B&W. Units 1-5 are equipped with Selective Non-Catalytic Reduction (SNCR") to control nitrogen oxide by the injection of ammonia into the boiler to achieve approximately a 25% reduction in nitrogen oxide on these five units; and

- *Particulate Collection Systems* - Units 1 through 4 use "baghouse" technology to remove particulate matter, and Units 5 through 7 have electrostatic precipitators ("EPs"). Collectively, this technology is designed to remove over 99.6% of the particulate matter in the flue gas.

Q. IS SAMMIS IN COMPLIANCE WITH THE CAA?

A. Yes. Sammis is required to meet opacity, particulate matter ("PM"), SO_2 and NO_x emissions standards established by the U.S. EPA under the CAA. Using the EPs, baghouses, WFGD and SNCR/SCR environmental control systems already discussed, Sammis is in compliance with the CAA's emission requirements.

Q. WHAT DOES CAIR REQUIRE, RELATIVE TO SAMMIS?

A. CAIR requires reductions of NO_x and SO_2 emissions in two phases (2009/2010 and 2015), ultimately capping SO_2 emissions in affected states to 2.5 million tons annually and NO_x emissions to 1.3 million tons annually. Like the CAA, CAIR allows trading of NO_x and SO_2 emissions allowances within defined geographical areas to achieve compliance.

Sammis' SO_2 allowances from the CAA Acid Rain Program are also used to satisfy the CAIR SO_2 requirements. Sammis also receives annual and ozone season NO_x allocations under the CAIR program and can purchase additional NO_x allowances if required. Sammis is in compliance with the CAIR emissions requirements.

Q. WHAT IS THE CURRENT STATUS OF CSAPR?

A. CSAPR, which will replace the CAIR rule, requires further reductions in SO_2 and NO_x that generating units are permitted to emit by establishing emission caps for each pollutant by state. CSAPR was designed as a cap and trade program, similar to the CAIR program, but with limits on interstate trading. Because Sammis is equipped with scrubbers and SNCR/SCR, no additional emissions controls will be required for compliance with CSAPR.

Q. IS SAMMIS IN A POSITION TO COMPLY WITH THE MATS RULE?

A. Yes. The MATS rule was finalized by the U.S. EPA on December 21, 2011, and will take effect on April 16, 2015. MATS will establish more stringent emission standards for PM, mercury, and hydrochloric acid ("HCl") and impose new work practice standards and monitoring, recordkeeping and reporting requirements. Sammis is in full compliance with the more stringent limits.

Q. IS SAMMIS IN COMPLIANCE WITH GHG REQUIREMENTS?

A. Yes. Sammis is in full compliance with the U.S. EPA's GHG emissions collection and reporting rules and has continuous CO_2 monitoring systems in place to compile information submitted in annual reports.

CONCLUSION

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes. I reserve the right to supplement my testimony.

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Summary: Testimony (Direct) of Paul A. Harden electronically filed by Ms. Tamera J Singleton on behalf of Ohio Edison Company and The Cleveland Electric Illuminating Company and The Toledo Edison Company