BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of The Dayton Power and Light Company for Approval of Its Plan to Modernize Its Distribution Grid	:	Case No. 18-1875-EL-GRD
In the Matter of the Application of The Dayton Power and Light Company for Approval of a Limited Waiver of Ohio Adm.Code 4901:1-18-06(A)(2)	:	Case No. 18-1876-EL-WVR
In the Matter of the Application of The Dayton Power and Light Company for Approval of Certain Accounting Methods	:	Case No. 18-1877-EL-AAM

THE DAYTON POWER AND LIGHT COMPANY'S GRID ARCHITECTURE STATUS REPORT

Pursuant to the Commission's report titled *PowerForward: A Roadmap to Ohio's Electricity Future* ("Roadmap") released August 29, 2018 and consistent with its Finding and Order of February 27, 2019 in Case No. 18-1595-EL-GRD (PowerForward Collaborative), The Dayton Power and Light Company ("DP&L") submits its Grid Architecture Status Report ("GASR").

The purpose of this submission is to provide a current-state assessment of DP&L's grid architecture as described on pages 15 and 16 of the Commission's Roadmap. On page 15 of the Roadmap it states ". . . each EDU should work towards developing a cyber-physical platform consisting of uniform core components . . . ." The Roadmap further defines five categories that are referred to as the "core components of the platform" (Roadmap page 16). Those core components are Field Automation, Substation Automation, Operational Communications Infrastructure, Sensing and Measurement, and Operational Analytics. These technology groups were developed using the "logical technology stack" developed by the Department of Energy and included in its report *Modern Distribution Grid Report Vols. I-III.* That logical technology stack is pictured on page 15 of the Roadmap.

In order to provide the Commission with the appropriate context for the current state of DP&L's grid architecture, the Company will provide an overview of its grid architecture using the core components and the identified sub-components on page 16 of the Roadmap.

The Company has submitted a plan to modernize its distribution grid in this docket, Case No. 18-1875-El-GRD. As part of its plan the Company will be advancing its grid architecture through the implementation of many of the components of its plan. However, for the purposes of this filing, the Company will focus predominantly on its present capabilities. The information provided within this filing applies to DP&L's entire certified territory. While DP&L believes that the Grid Modernization Platform encompasses a larger group of devices and systems than those explicitly set forth on pages 15-16 of the Power Forward Roadmap as well as referenced within the DOE Modern Distribution Grid Report, the following is a description of the Company's grid architecture capabilities using the core component framework contained on page 16 of the Roadmap.

Field Automation:

- Distribution automation: As described on page 37 of the DOE Modern Distribution Grid Report, DP&L has little to no distribution automation. The Company presently has manually operated switches on its distribution system. To conduct switching on its distribution system to isolate faults and restore customers, the Company has to dispatch crews to the desired location of each switch to be operated and request the crews to manually operate each device. The Company recently installed a set of three automated reclosers as a pilot project in a suburban area of its service territory.

- Volt-ampere reactive ("Volt/VAR") management: The Company presently manages the voltages, reactive power flow and losses on its distribution system through manual processes. Settings are completed on tap changers and capacitor banks at substations and those devices make adjustments autonomously as voltage fluctuations are sensed. Line capacitors and line regulators are used to make long-term voltage adjustments to its circuits. The Company minimizes losses on its distribution system through the placement of capacitor banks on its distribution circuits. Outside of substation voltage readings that are obtained via substation Supervisory Control and Data Acquisition ("SCADA"), the Company can only monitor the voltage and losses through manual measurements taken by field crews or through the use of temporary field recording devices that are installed and the data retrieved manually at periodic intervals.
- Power flow controllers: The Company does not have any power flow controllers installed on its distribution grid at this time.

Substation Automation:

- SCADA: The Company has SCADA installed in 83% of its distribution substations. A significant number of those SCADA installations are older and use analog technology that is incompatible with today's grid modernization digital standards. While all of the SCADA installations provide sensing and measurement for its transformers, breakers and other substation devices, not all of DP&L's SCADA installations currently support remote controlled operation of equipment such as load tap changers and circuit breakers. Thus, DP&L's current SCADA system monitors a limited number of data points, and only some of the devices can be adjusted remotely. DP&L has adopted Distributed Network Protocol ("DNP") as its standard communications protocol for substation SCADA and new or replacement installations are updated to this standard. Very few of the Company's substation Remote Terminal Units ("RTUs") have any advanced computing capabilities.

- Adaptive protection: The Company has deployed advanced protection equipment in some of its substations as its electro-mechanical relays and associated equipment have needed replacement (i.e., failures, end of life, substation expansions/reconfigurations, etc.). This digital equipment has improved the operation and protection of the Company's transmission and distribution system. At this time, however, field personnel are still dispatched to the substation to retrieve event data and to confirm and/or manually make changes to relay and protection settings. However, migrating to a standard set of digital equipment will allow the Company to ensure it can deploy a more consistent relay setting process, change control procedures and remove older equipment out of service to maintain or improve the reliability and operating performance of the substation equipment.

Operational Communications Infrastructure:

- Wide area network: The Company has a wide-area network that consists of data circuits with the commercial carriers as well as a digital microwave system and a fiber-optic network that are both owned by the Company as well as "dark fiber" that the Company has obtained IRUs ("Indefeasible Right of Use") for its use. The wide-area network connects the Company's operating facilities as well as a number of its substations for both enterprise and operational communications. MPLS ("Multi-Protocol Labeled Switching") technology has been employed to segregate and manage the communications traffic from both a security perspective as well as a quality of service ("QOS") perspective.
- Field area network, including neighborhood area network: The Company's field area network currently consists of a Harris land mobile radio ("LMR") system in which it communicates via voice with its field crews. Additionally, the Company makes use of a multiple address system ("MAS") that extends its communications beyond the fiber and microwave systems to certain substations beyond the reach of those systems. However, not all of the Company's substations have digital communications and the MAS system requires updating or replacement. Since the Company currently has not deployed AMI or distribution

automation, it does not have or make use of a neighborhood area network ("NAN").

- Communications network management system: As part of an upgrade to its telecommunications infrastructure in 2010, the Company installed a communications network management system. This "manager of managers" is used to monitor the performance of the entire telecommunications platform as well as allows the telecommunications engineers and field technicians to conduct provisioning and troubleshooting. This is particularly useful as much of this equipment is distributed across a large part of the Company's 6,000 square mile service territory.

Sensing and Measurement:

- Advanced metering infrastructure, including advanced meters: The Company has not deployed AMI. It does have approximately 2,500 interval meters at certain industrial and commercial customers (out of approximately 55,000 total C&I) that the Company communicates with via cellular technology.
- Production metering: For DERs that have been interconnected to DP&L's system, the Company has required the installation and use of an interval meter for net metering purposes.
- Grid asset sensors: The Company has deployed and is using sensors for asset monitoring at some of its substations. These asset monitors include transformer fault detectors, dissolved gas sensors, and temperature

sensors. Information from those sensors are typically communicated via SCADA to the System Operating group via specific data or alarm points or through a substation major or minor alarm scheme. In most cases, the grid asset sensors can communicate a change of state or that there is a problem (i.e., alarm), but not the magnitude or rate of change of what is being measured or monitored.

- Environmental sensors: The key environmental sensors deployed by the Company are for security purposes - cyber and physical detection and monitoring. These are predominantly used at its key operations facilities as well as some of its transmission and distribution substations. They include the use of cameras, ID card readers, substation intrusion detection system, as well as several cyber tools that detect and prevent intrusion and other threats. More of these sensors will be required in the future as resiliency and security of the distribution grid become increasingly important.
- Grid sensors: The Company has deployed approximately 200 advanced line sensors at specific various locations on its distribution system to measure current where SCADA is not available, as well as to measure single-phase load on branch lines. As part of its Distribution Modernization Plan, the Company proposed to deploy additional sensors across its distribution system to provide comprehensive sensing and measurement.

Operational Analytics:

- Field data management: Meter information is presently stored in the Company's MV-90 system for interval data and its customer information system for other usage information. The Company's MV-90 system has limited capabilities for storing interval data. It cannot handle the volume and quantities of data for a larger population of interval meters.
- Sensor information and other event data from substation equipment is managed through the Company's limited SCADA system. Much of the sensor and substation data is fed into the Company's PI Historian software and database. Event data contained within substation relays is manually obtained by field personnel who download the data into laptops and return the information to the operating centers for engineers to evaluate.
- Electrical network connectivity model: The Company maintains an "as-built" connectivity model of its distribution system in its GIS system. Connectivity has been developed from the substation circuit breaker down to the last protective device; however, the Company currently does not have connectivity information down to the individual customer/meter. The Company's GIS does not have the capability today to maintain an "as-operated" connectivity model.
- Distribution state estimation: The Company recently acquired CYME software and is working to integrate the software with its GIS and other tools and systems to establish the platform for a future distribution state estimation system. This initial deployment will provide basic state

estimation capabilities. However, further important functionality will be obtained through the implementation of the Company's Distribution Modernization Plan ("DMP").

- Outage management system ("OMS"): The Company has an internally developed OMS system. The current OMS has limited functionality whereby it accepts Integrated Voice Response ("IVR") information and actual customer contact information for outage events. Much of the outage analysis is done manually by the Company's dispatchers and engineers. The OMS is used to assign crews to outage cases, but there is no computer-aided dispatching functionality associated with the OMS nor compatibility with AMI functionality. The OMS also utilizes a very rudimentary ETR algorithm ("Estimated Time of Restoration").
- Geographic information system: The Company uses an Esri GIS system to track its key distribution assets. This includes equipment and devices such as poles, overhead conductors, underground conductors, protective devices (i.e., fuses), transformers, capacitor banks, regulators, etc. The GIS holds the location of each of the devices as well as their spatial and connectivity relationships, but does not provide information showing customer to individual transformer connectivity or steady-state processes for continuous tracking of field asset deployments. As described above regarding the connectivity model, the current GIS maintains an "as built" model instead of an "as operated" model; however, future functionality for the GIS will include these improved capabilities, connectivity down to the

customer/meter, as well as attaching maintenance and inspection information.

- Meter data management system: As mentioned previously, data from the very few interval meters deployed in the Company's service territory is housed in the Company's MV-90 software system and database. The MV-90 system, however, is not capable of handling AMI data.
- Advanced distribution management system ("ADMS"): The Company does not presently have an ADMS.
- Asset management: The Company uses a number of different databases and software systems to perform asset management at the transmission line, substation and distribution system levels. The Company has proposed a more comprehensive asset management system and functionality as part of its DMP.
- Workforce management: The Company does not have a single workforce management tool. The OMS system is used to assign crews to outage calls/cases and all low-voltage, distribution service work is dispatched and managed through a software tool that was internally developed. Maintenance and inspection activities are assigned and tracked through individual databases. A comprehensive workforce management tool was included as part of the Company's DMP.

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CERTIFICATE OF SERVICE

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