BEFORE THE

PUBLIC UTILITIES COMMISSION OF OHIO

THE DAYTON POWER AND LIGHT COMPANY

CASE NO. 18-1875-EL-GRD
18-1876-EL-WVR
18-1877-EL-AAM

Distribution Modernization Plan

DIRECT TESTIMONY OF THOMAS G. HULSEBOSCH

- ☐ **MANAGEMENT POLICIES, PRACTICES, AND ORGANIZATION**
- ☐ **OPERATING INCOME**
- ☐ **RATE BASE**
- ☐ **ALLOCATIONS**
- ☐ **RATE OF RETURN**
- ☐ **RATES AND TARIFFS**
- ■ **OTHER**

ON BEHALF OF
THE DAYTON POWER AND LIGHT COMPANY

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Tom Hulsebosch. My business address is 5910 North Central Expressway, Suite 950, Dallas, TX 95206.

Q. By whom and in what capacity are you employed?

A. I am employed by West Monroe Partners, LLC as a Senior Managing Director for the Energy and Utilities practice. Our consulting firm has worked with The Dayton Power and Light Company ("DP&L" or "Company") to develop portions of the Distribution Modernization Plan ("DMP"), including this benefits analysis and the proposed Analytics Center of Excellence (Analytics "CoE").

Q. How long have you been in your present position?

A. I have been in my present position as the founder of the Energy and Utilities practice at West Monroe Partners since 2008.

Q. What are your responsibilities in your current position?

A. At West Monroe Partners, I am the Senior Managing Director of the firm's Energy & Utilities practice, as well as being a member of the executive team and a member of the board of directors. I help utilities develop their grid modernization programs that optimize costs and benefits given their unique circumstances. My team and I work with utilities across the United States and Europe on grid modernization business cases, technology, and organizational strategy, as well as implementing these programs to realize the benefits for the stakeholders. I have worked on more than twenty utility modernization business cases over the past ten years, which has resulted in the approach used to quantify the benefits to society, customers, and the utility in DP&L's DMP. This experience has led to my work over the past years with DP&L to develop several iterations of the DMP, which is captured in Schedule A "Grid Modernization R&D Asset" and explained in additional detail by Witnesses Hall and Adams.

I am also active in the creation and execution of utility business analytics programs that provide the necessary business insights for a utility to manage its grid transformation programs. The business analytics effort is needed to utilize the new data available to the utility through the grid modernization program to ensure that the intended value is being delivered to the various stakeholders, while the utility manages the program scope, schedule, and budget.

Q. Will you describe briefly your educational and business background?

A. I earned a bachelor's degree in electrical engineering from Marquette University and a master's degree in electrical engineering from the Illinois Institute of Technology. I joined West Monroe Partners in 2008 from Strategy 2 Solution, LLC, which focused on developing broadband network solutions for municipalities, utilities, corporations, and service providers. Prior to that, I worked in the telecommunication industry for twenty years in many roles including hardware and software engineer, solution architect, product management, and developing international telecommunication standards in service of helping communication service providers and private operators, such as utilities and municipalities.

Q. What is the purpose of this testimony?

A. The purpose of this testimony is to support and explain the customer and societal benefits associated with DP&L's DMP, and to explain the Analytics CoE initiative that is part of DP&L's DMP.

Q. Which workpapers are you supporting?

A. I am supporting the following workpapers:

- **WP-B** "Customer Benefits"
- **WP-C** "Societal Benefits"
- **WP-7.2** "Analytics Center of Excellence (CoE)"

II. CUSTOMER BENEFITS

Q. How will DP&L's DMP benefit customers?

A. **Workpaper WP-B "Customer Benefits"** provides a breakdown of the approximately $1.2 billion in nominal dollars in customer benefits, including:

i. Energy and Demand Benefits of $517 million in nominal dollars, which includes:

a. Reduced cost of peak demand due to Conservation Voltage Reduction ("CVR");

b. Reduced cost of purchased power due to CVR;

c. Energy savings from more optimally loaded distribution transformers, or Transformer Load Management ("TLM");

d. Reduced unaccounted for energy due to theft reduction;

e. Reduction in energy losses from premises with inactive meters;

f. Reduction in energy usage due to enhanced online customer portal adoption;

g. Peak demand savings due to Time-Of-Use ("TOU") rates;

h. Savings from energy costs with the shift of usage from on-peak to off-peak due to TOU rates;

i. Prepay program energy and demand reduction benefits;

j. Avoided peak demand increase from utilization of Battery Storage pilots;

k. Savings from energy costs with the shift from on-peak to off-peak electric vehicle ("EV") charging; and

l. Avoided peak demand increase from shifting EV Charging to off-peak charging.

ii. Additional customer EV-related savings of $246 million in nominal dollars, which includes savings resulting from switching to EVs from gas-powered cars, which will lead to a net-reduction in the money spent on electric charging versus gas.

iii. Improved Reliability Benefits of $455 million in nominal dollars, which includes:

a. Customer outage reduction from distribution and substation automation ("DA/SA"); and

b. Customer outage reduction from Advanced Metering Infrastructure ("AMI").

These customer benefits and other benefits that accrue to society at large will be explained later in this testimony.

Q. Are the nominal costs stated in your testimony also expressed in Present Value (PV), or Net Present Value (NPV), terms?

A. Yes. DP&L conducted financial analysis, as described in Witness Hall's testimony, to calculate the respective PV and NPV terms for all facets of the business case. The customer benefits described in this testimony are available in WP-B and can be understood in present value following the same methodology explained by Witness Hall.

Q. Can you identify the amount of energy and peak demand that DP&L believes can be saved through the DMP?

A. Yes, Workpaper WP-B "Customer Benefits" provides a detailed summary of energy and peak demand savings to be realized through the DMP. Overall, DP&L expects to drive approximately $517 million in nominal dollars in energy and demand savings for customers over a twenty-year period. These energy and demand saving calculations used wholesale electricity and capacity price forecasts through 2040 supported by Witness Augustine from Charles River Associates at the request of DP&L.

Q. Why are wholesale electricity and capacity price forecasts used to calculate energy and demand benefits instead of retail rates?

A. The wholesale price forecasts for energy and demand are used in the calculation of the energy and demand benefits for two key reasons. First, many of the energy and demand benefits are appropriately valued at the wholesale costs, such as unaccounted for energy, which is purchased on the wholesale market, but not billed directly to customers as retail energy by DP&L or by the retail energy providers operating in the DP&L territory. While some of the energy benefits would result in a reduction in energy recorded on customer meters, which customers would value at retail rates, the range of retail rates vary significantly by retail energy provider and by the customers' rate plans. The second reason that wholesale rates were used in the DP&L DMP benefits analysis was to be more conservative in the calculation of the energy and demand benefits. The actual benefits would be higher if retail rates were used.

Q. Please explain the methodology used to estimate the demand and energy savings resulting from CVR.

A. The peak demand reduction is shown on Workpaper WP-B "Customer Benefits." This is calculated by taking the peak demand off all feeders conditioned for voltage and VAR optimization and under control of the Advanced Distribution Management System ("ADMS") for CVR control and then multiplying by 3.7%, which is the DP&L estimation for reduced peak demand with CVR of the optimized circuits. The reduction in peak demand is then multiplied by the annual value of demand to calculate the annual savings in reduction of peak demand.

The amount of energy savings represents 1.5% of the total energy delivered on the optimized feeders. The reduction in purchased power due to CVR is multiplied by the wholesale cost of energy for each year to calculate energy savings due to CVR. The demand and energy savings resulting from CVR are summarized on Workpaper WP-B "Customer Benefits."

Q. Please explain the methodology used to estimate the energy savings resulting from TLM.

A. Another way DP&L will be able to reduce energy consumption is from optimally loading distribution transformers. Over the past ten years, DP&L has replaced, on average, 750 overhead transformers and 150 pad mount transformers annually. Energy and demand data from the grid enabled through the DMP will allow DP&L to right-size distribution transformers to be replaced. This improved sizing based on local loads will reduce the number of transformer replacements required annually and improve the efficiency of the transformers that are replaced. DP&L estimates that properly sizing transformers will yield 0.40% energy savings compared to non-optimally sized transformers. The resulting energy savings is calculated by the projected energy reduction multiplied by the wholesale value of energy for each year and is reflected in Workpaper WP-B "Customer Benefits."

Q. Please explain the methodology used to estimate the energy and demand savings resulting from theft reduction.

A. As is explained in Witness Storm's testimony, upgraded metering infrastructure proposed as part of the DMP will help DP&L to reduce theft and, in turn, reduce energy consumption and demand resulting from unauthorized usage. The energy and demand benefits associated with theft reduction are quantified in Workpaper WP-B "Customer Benefits" for both residential and single-phase C&I customers. Based on an estimate of "unaccounted for energy" attributable to theft and wholesale energy rates, a projection of savings from theft reduction is quantified based on the average consumption per customer and the cumulative number of residential and single-phase C&I meters. Additionally, benefits associated with detection and reduction of energy consumption that occurs on inactive meters is also included in Workpaper WP-B "Customer Benefits." After energy benefits (measured in kWh) and demand benefits (measured in kW) are quantified, these values are multiplied by wholesale electricity and capacity price forecasts, respectively, through 2040 supported by Witness Augustine from Charles River Associates.

Q. Please explain the methodology used to estimate the energy and demand savings resulting from the introduction of an enhanced online customer usage portal.

A. As Witness Tatham explains in his testimony, DP&L plans to enhance the existing online portal ("ePortal") as part of the DMP. Part of the enhancements focus on presenting customer usage data through the ePortal utilizing data available through AMI. The benefits associated with energy reduction driven by ePortal adoption can be found in Workpaper WP-B "Customer Benefits." Energy savings projections are calculated based on a gradual escalation over a period of ten years following the implementation of AMI to a penetration of 6% of the eligible customer base of single-phase C&I and residential customers—defined as those who have not opted out of having a smart meter installed and have access to the ePortal. The reduction in energy due to the ePortal is multiplied by the annual value of wholesale energy to calculate the annual savings. Additionally, the demand reductions due to behavioral changes in usage by residential and single-phase C&I customers are quantified.

Q. Please explain the methodology used to estimate the energy and demand savings resulting from the introduction of TOU rates.

A. The introduction of TOU pricing is expected to drive changes to both energy and demand for those customers who opt-in once the rates are offered. A fundamental assumption of TOU pricing is that it will be structured to encourage consumers to shift usage patterns away from historical peak demand timeframes. The demand reduction driven by TOU rates are illustrated on Workpaper WP-B "Customer Benefits." Energy and demand savings projections are calculated based on a gradual escalation over a period of ten years following the implementation of AMI to a TOU program penetration of 20% participation of the eligible customer base. Additionally, it is projected that customers utilizing TOU rates will reduce, on average, energy consumption by 2.5% and demand by 10%. The penetration of eligible customer base, reduction of demand, and reduction of energy usage are conservative estimates based on TOU programs that have been implemented by other utilities. The resulting reduction in energy and demand due to TOU rates is then multiplied by the wholesale costs of energy and demand for each year to calculate demand savings, which is shown on Workpaper WP-B "Customer Benefits."

Q. Please explain the methodology used to estimate the energy and demand savings resulting from the introduction of a Prepay program.

A. As Witness Tatham notes in his testimony, the introduction of a Prepay program is intended to provide an option for customers to set self-imposed limits on energy consumption and, in turn, monthly bills. Energy and demand savings projections are calculated based on a gradual escalation over a period of five years following the implementation of AMI to a penetration of 5.2% of the eligible customer base. Energy savings projections are calculated based on a steady-state estimate that, on average, there will be a 10% reduction in energy consumption. Demand savings projections are calculated based on a steady-state estimate that, on average, there will be a 0.5% reduction in demand. The resulting reduction in energy and demand due to Prepay rates is then multiplied by the wholesale costs of energy and demand for each year to calculate demand savings, which can be found in Workpaper WP-B "Customer Benefits."

Q. Please explain the methodology used to estimate the demand savings resulting from Battery Storage.

A. The introduction of battery storage infrastructure will enable DP&L to discharge stored energy at times of high demand. By supplementing existing capacity with this alternative source, consumers stand to benefit from reduced peak demand. The demand savings associated with battery storage are shown on Workpaper WP-B "Customer Benefits." As Witness Hall explains in more detail, the capacity proposed as part of the initial pilot is 1,500kW and increases to 11,500kW as part of the pilot extension. The demand savings associated with battery storage are calculated assuming 50% storage discharge on an average of two hours of discharge per day. The resulting amount of avoided peak demand is then multiplied by the wholesale capacity price forecast through 2040 supported by Witness Augustine from Charles River Associates.

Q. Can you identify the customer benefits of DP&L's DMP associated with EVs?

A. Yes, as described below, those benefits fall into two categories. First, the introduction of an EV rate will shift charging to off-peak hours and will thus lower energy and demand charges for customers. Second, DP&L's plan to install EV charging stations throughout its territory will help to increase the adoption of EVs for consumers across DP&L's

service territory, which will lead to a net-reduction in the money spent on electric charging versus gas.

Q. Please explain the methodology used to estimate the first customer EV benefit, the energy and demand savings resulting from the introduction of intelligent EV charging.

A. A three-step approach was taken to determine the system peak demand reductions associated with intelligent EV charging rates enabled through the DP&L DMP. First, the EV population in the DP&L service territory over the 20-year benefit period was forecasted. Second, the savings that could be achieved through intelligent EV charging was forecasted along with the forecasted amount of coincident peak demand impact on system load relative to uncoordinated EV charging. After energy benefits (measured in kWh) and demand benefits (measured in kW) were quantified, these values were multiplied by wholesale electricity and capacity price forecasts, respectively, through 2040 supported by Witness Augustine from Charles River Associates. The reduction in peak demand due to intelligent EV charging is shown in Workpaper WP-B "Customer Benefits." Third, the EV miles driven by the population of EVs was forecasted in order to calculate the reduction in EV energy costs due to the lower cost of electricity/mile vs. gasoline costs/mile, as well as the amount of Green House Gas ("GHG") emission reductions.

Q. Please explain intelligent EV charging and why it is needed.

A. Intelligent EV charging is a special TOU rate designed to incentivize the time of day that it is beneficial to have an EV owner charge their vehicle. This coordinated shift in EV charging demand will reduce the rise in system peak as compared to uncoordinated EV charging. Uncoordinated EV charging has been shown to increase peak system loads. Intelligent EV charging will incentivize EV charging to off-peak times, helping to reduce increases to peak system loads and avoiding overloading distribution equipment. Intelligent EV charging is being used in places like California to incentivize EV charging when an excess amount of renewable energy is available. An article in Electric Utility on February 26, 2018 called "The Benefits of Electric Vehicle Adoption for Electric Power Utilities and Distributors" captured information from studies on the topic of managing the EV charging process to avoid the additional costs of increase peak demand and minimizing distribution system infrastructure upgrades. It stated "Managed EV charging can reduce the peak load impacts by 90%, according to the Rocky Mountain Institute ("RMI") study conducted across New York, Texas, California, Hawaii, and Minnesota."

Nature Energy journal published an article called "Impact of uncoordinated plug-in EV charging on residential power demand" on January 22, 2018, which identifies the consequences of uncoordinated EV charging. These impacts include increased peak demand for homes and businesses with demand rates and higher overall system peak demands for the utility. In the DP&L DMP, the benefit of reduced individual customer demand charges is not taken into consideration, nor are the benefits of extended distribution transformer life. However, other solutions in the DP&L DMP such as TLM and the customer ePortal will help customers realize these additional benefits when they manage the timing of their EV charging.

The value of system peak reduction due to intelligent EV charging was captured as part of Workpaper WP-B "Customer Benefits." In addition to the benefits of system peak reduction, the benefits of using the lower cost electricity during off-peak time was also quantified as a benefit in Workpaper WP-B "Customer Benefits."

Q. How did you determine the reduction in coincident peak demand due to intelligent EV charging?

A. In April 2015, the Idaho National Laboratory published a report that studied the impact on experimental electric rates on residential charging behavior. This study showed that the EV impact on system peak significantly dropped when there was a specially designed EV rate that created a large difference between the EV rate and standard rate during the incentive charging time of day. This study is an analysis of an SDG&E pilot EV program that included 8,000 residential EV participants and showed the impact from uncoordinated EV charging as compared to when the customers were enrolled in an off-peak EV charging program.

The research from Idaho National Labs and RMI was used to forecast the percentage of time that EV loads could be expected to be plugged in and charging during the on-peak time when the utility would be interested in shifting load. This research was also used to estimate the percentage of customers that could be incented to sign-up for an intelligent EV charging program. With these key variables identified, the reduction in the peak system load due to intelligent EV charging was calculated, given the population of EV's in the DP&L service territory. Once the reduction in system peak demands was calculated, it was then multiplied by the forecasted cost per KW. The demand reduction benefits from the intelligent EV charging program can be found in Workpaper WP-B "Customer Benefits."

Q. Please explain the methodology used to estimate the additional Customer EV-related Savings associated with DP&L's plan to install EV charging stations.

A. In response to expected growth in EV adoption and in line with the PUCO's vision for addressing the needs for both urban and corridor travel charging stations, DP&L's DMP proposes deployment of public EV charging stations and an intelligent EV charging program. DP&L anticipates that the penetration of EVs will increase significantly over the next twenty years. With EV adoption, customers will be able to save money on the energy source used to power their vehicles. Not only is electricity a cleaner fuel as compared to gasoline, but it is also considerably less expensive per mile for the vehicle owner. The benefit analysis looks at the customer cost of electricity needed to power the projected EVs and compares this amount to the cost of gasoline for the same number of miles driven. This benefit calculation is summarized in Workpaper WP-B "Customer Benefits", which shows the results for the forecasts for i) Number of EVs in DP&L's Service Territory, ii) Number of EV Miles Driven, iii) Total dollars that would have been spent on gas for EV miles, iv) Consumer Cost of electricity for EV miles driven, v) Energy Savings by Utility Consumers for Conversion, vi) Portion of EV Energy Saving Due to DP&L DMP.

Q. How was the EV population forecasted for DP&L's service territory?

A. Several key variables were used to forecast the EV population including i) the number of passenger cars in the DP&L service territory, ii) the projected population growth in the

DP&L service territory, and iii) the percentage of EV sales as a percentage of new car sales over time. The United States Bureau of Labor and Statics web site was used to estimate the number of passenger vehicles in the DP&L service territory, as well as the average time that a car is on the road.

A study done by the International Energy Agency in 2017 titled "Global EV Outlook 2017 Two million and Counting" captures the previous growth of EVs around the globe and includes projections for future growth of EVs in the United States market. This study projects that 30%-45% of new cars sold in the United States will be EV by 2030, and the study predicts that the purchase price of EV cars will be the same as internal combustion engine vehicles by this time. The extended driving ranges for EVs, lower operating costs, and the "green factor" are expected to drive a 54% growth in EVs in the United States in 2019 according to this study. This study shows that, in 2016, 0.9% of the registered cars in the United States were EV while 5% of the cars in San Francisco were already EVs. In 2016, Beijing already had achieved an EV penetration of 7.3%, and in Oslo, 36% of the cars were already EVs. The DP&L DMP uses more conservative estimations for new EV sales in the DP&L service territory of 0.5% of new car sales in 2019 rising to 20% by 2030. The EV population forecast by year can be found in Workpaper WP-B "Customer Benefits."

Alliance for Automobile Manufacturers announced in the summer of 2018 that it would be pushing an advertising campaign for Drive Electric in the Northeastern part of the United States. Sixteen different automobile manufactures that are part of the Alliance are offering now or will be offering EV models by 2019. The 2017 International Energy

Agency report also points out that the number of vehicles in its forecast does not include vehicles in fleets (municipal, United States Post Office, delivery services, etc.) or electric buses or electric trucks. The forecasted percentage of new car sales being EV along average number of cars per home in the service territory and expected customer growth were used to determine the annual EV population. The resulting annualized projection of the EV population within DP&L's service territory can be found in Workpaper WP-B "Customer Benefits."

Q. How was "Total EV Miles Driven" projected for DP&L's service territory?

A. The total EV miles driven was calculated by multiplying the number of EV vehicles by the number of anticipated EV miles driven per vehicle. The 2015 research by the Idaho National Laboratory studying the 2011-2013 SDG&E EV experimental charging rate pilot identified that the average number of miles driven by the EVs in the study was 7800 miles annually. This information was used in estimating the EVs miles driven annually in the DP&L DMP analysis. Vehicle miles of fleets, electric buses, and electric trucks were not included in these calculations.

Q. How was the difference in customer spend on gas-powered vehicles vs. electric vehicles calculated?

A. The total dollars that would have been spent on gas for EV miles driven was calculated by taking expected average miles per gallon forecast obtained from EPA estimates multiplied by the forecasted cost of gasoline. Consumer cost of electricity for EV miles driven was then calculated by taking the EV miles driven by the forecast miles per KWH and multiplied by the forecasted wholesale cost of electricity. EV Energy Savings is simply calculated by subtracting Consumer cost of electricity for EV miles driven from total dollars that would have been spent on gasoline for the same miles.

Q. Do you claim that all of the projected increase in EVs in DP&L's service territory will result from DP&L's DMP?

A. No, there will be customers in DP&L's service territory that will purchase EVs regardless of whether DP&L implements its DMP; however, DP&L's plan to install EV charging stations in its service territory will help to resolve "range anxiety" for DP&L's customers, and thus accelerate the adoption of EVs. On July 12, 2017 the Institute for Physics published a paper titled "The Role of Demand-Side Incentives and Charging Infrastructure on Plug-In EV adoption: Analysis of US States." This research created a forecast of the impact of public charging accessibility to increased adoption of EVs. This research studied the impacts of the $36 million of public charging stations funded by the American Recovery and Reinvestment Act ("ARRA") deployed between 2011 and 2014. The research estimates that EV penetration can be increased between 2.3% to 9.75%, based on the type of vehicle, if enough public charging stations were available to address "range anxiety." The average improvement in EV sales was 7.2% when enough public charging stations were deployed. The portion of EV energy savings due to DP&L DMP is calculated by multiplying 7.2% times the total EV energy savings.

Q. What is the estimated value of Improved Reliability Benefits?

A. Workpaper WP-B "Customer Benefits" provides a breakout of the expected improvement to reliability as a result of DA/SA and AMI. Overall, DP&L expects to have approximately $455 million in nominal dollars in improved reliability benefits for its customers over a twenty-year period.

Q. Please explain the methodology used to quantify the increase in reliability resulting from the deployment of DA/SA and AMI equipment.

A. As discussed in the testimony of Witness Gebele, the new digital devices in the substations and along the distribution circuits will facilitate improved reliability along all portions of the energy delivery infrastructure. Outage times are decreased through the direct monitoring and control of the substation breakers and the coordinated use of reclosers, resulting in automated Fault Location, Isolation, and Service Restoration ("FLISR") of the non-faulted segments of the distribution feeder. With the capabilities from sensors along the distribution circuits, the ADMS will be able to highlight the most probable fault location in a faulted segment, which will significantly reduce the customer service restoration time for those customers impacted by an outage. The improved reliability was modeled based upon a reduction in the number customer outages and a reduction in the length of these outages stemming from better detection at the time the outage occurs and when power has been restored. The AMI network combined with the Outage Management System ("OMS") will improve the notification as to when outages occur, when power is restored, as well as where is the source of the outage based on the analysis of the outage messages from the AMI system routed to the OMS coupled with information from the SCADA system. The automated outage notification and power restoration that is done between the AMI and OMS platforms will reduce the number of unknown nested outages that are left unaddressed during weather events after the primary outage cause on a feeder is repaired. On July 7, 2015 SDG&E represented that its reduction in outage time was 10-25 minutes based on the type of outage with the combined deployment of AMI and an OMS.

In addition to the non-SCADA outage improvements through the use of AMI and OMS equipment, the SA and DA equipment deployment will result in quick isolation of outages due to faults on the feeder primary. The coordinated action of the ADMS and the SA and DA devices will reduce the number of customers impacted by circuit lockout outages resulting in a lower SAIFI. This automatic fault isolation will also provide quicker identification of the potential source and location of the outage, which can reduce the length of the outages seen by the customers on the faulted section of the feeder, resulting in lower SAIDI. These technologies driving the reduction of SAIDI and SAIFI are described in Witness Gebele's testimony.

Q. How was the value of Improved Reliability Benefits determined?

A. The customer benefits of improved reliability were calculated using the United States Department of Energy Interruption Cost Estimate ("ICE") model. The ICE model values the economic benefit of reliability for each of the key customer classes. While there are benefits to all customer types when electric reliability is improved, the customer type receiving the most economic value due to the DMP reliability improvements were the medium-sized C&I customers. These customers typically do not have redundant feeds of electricity from multiple substations like some of the more sophisticated C&I customers, so the reliability improvements will be seen by almost all of the customers in this class. All large C&I customers that have redundant feeds from multiple substations were not included in the ICE model calculations. All the residential customers were included in the ICE model calculations, but the economic value to this customer segment is less for the same improvement in SAIDI and SAIFI as compared to C&I customers.

To translate the ICE results to the twenty-year benefit stream, the benefits are spread across the twenty-year span of DP&L's DMP based on the timing of the improvements and number of customers impacted each year. The overall reduced outage minutes are captured in Workpaper WP-B "Customer Benefits." The value per minute of reduced outages is a combination of the SAIDI and SAIFI improvement specifically for the DP&L service territory and for the expected number of customers that will see the direct benefits. The economic benefit is calculated by multiplying the number of minutes of avoided outage by the value of an avoided outage minute for each customer class.

Q. Why was it reasonable to use the DOE ICE model to calculate reliability benefits?

A. The ICE model was created for the DOE by Berkeley Labs to translate improvements in SAIDI and SAIFI to economic benefits of key customer segments for utilities based on their size and location in the United States. The ICE model was introduced into the electric utility industry over ten years ago and has been through many iterations including the latest in 2018. More information of this model and the method that it uses to translate reliability improvements to quantified customer economic impacts can be found at www.icecalculator.com.

Customer reliability benefit calculations based on the DOE ICE model have been used by many utilities to translate reliability improvement to economic benefits and can be found in technical literature, industry conference presentations, and utility fillings. As part of the DP&L DMP benefit analysis, a circuit-by-circuit analysis was performed to identify key factors such as redundant ties and number of circuit lockout outages on the feeder to determine the number of customers in each major category that would see direct benefits due to the proposed DP&L DMP upgrades. To avoid overstating reliability benefits the large C&I customers that have redundant feeds were removed from the benefit calculations.

III. SOCIETAL BENEFITS

Q. What other benefits will DP&L's DMP create for society?

A. DP&L's DMP is also expected to yield a reduction in Green House Gas ("GHG") emissions, create new jobs, and deliver economic stimulus to DP&L's service territory and the surrounding region relative to the capital investment proposed over the twenty-year timeframe. The economic stimulus benefits and GHG benefits are felt by society across Ohio and surrounding states. Workpaper WP-C "Societal Benefits" summarizes the GHG benefits, which is $53.6 million in nominal dollars. The economic stimulus benefits include the value of the direct and indirect jobs created during the deployment phases of the DMP and are calculated to be $946 million. The total Societal Benefits are $1 billion in nominal dollars.

A. REDUCED GREENHOUSE GASES

Q. Please explain the methodology used to calculate the benefits associated with reduced GHG emissions.

A. The consumption of less electricity as quantified in the customer energy benefits discussed earlier in my testimony will also lead to lower emissions from the generation of electricity. Additionally, the increasing use of EVs that is accelerated through the deployment of EV charging stations and the intelligent EV charging program will also lead to lower overall net GHG emissions. The net GHG emission savings due to EVs is calculated by determining the gasoline emissions per mile that would have been generated per EV mile, less the GHG emissions generated to create the electricity powering the EVs. Increasing the automation of meter reading and the automation of the distribution system will further reduce DP&L's overall environmental impact by decreasing the number of DP&L utility personnel miles driven. The reduction in electricity required, as discussed above in the customer energy benefits section, fewer miles driven by DP&L utility vehicles, and fewer gas miles driven by consumers and fleets using EV were each translated to reduction in GHG emissions on an annual basis and captured in Workpaper WP-C "Societal Benefits." The estimate for tons of GHG emissions per MWH of electricity generated for the DP&L service territory was referenced from the DOE and used to convert MWH of avoided electricity to GHG savings. The total GHG benefit is calculated by taking the amount of reduced GHG emissions and multiplying it by the forecasted value of GHG emissions. Witness Augustine's testimony describes how the value of each ton of GHG (also referred to as the "Social Cost of Carbon") was derived for this analysis.

B. ECONOMIC IMPACT

Q. How many new jobs do you estimate will be created because of the investment in grid modernization and how did you derive that estimate?

A. Over a period of twenty years, DP&L anticipates creating over 900 direct jobs and over 4,000 indirect jobs. For purposes of this testimony, a job is defined as a resource working full time for one year. Direct jobs are jobs that result directly from people working on DP&L's DMP. Indirect jobs result from increased economic activity in the region due to DP&L's DMP investment.

Direct job calculation is based on estimates from DP&L and West Monroe Partners and the cost of those jobs are included in the DP&L DMP costs. An analysis was done to estimate the number of utility full-time equivalents ("FTE"), contractor FTE, and vendor FTE that will be working over the deployment period of DP&L DMP to arrive at 900 direct jobs. These jobs are expected to be high-paying jobs which would enable growth in the median income in Ohio.

The 4,000 indirect jobs calculation is based on regional economy-wide jobs impact as determined by Bureau of Economic Analysis ("BEA") Regional Input-Output Modeling System II (RIMS II). The RIMS II approach estimates the number of indirect jobs (such as restaurants, hotels, construction, etc.) based on a capital multiplier that is specific to the Dayton, OH region. The BEA is a United States government organization that is responsible for the creation of official economic statistics, which provide a comprehensive and up-to-date picture of the United States economy and are used to aid in the decision making by businesses, policy makers, and households. The local and state impact of the DP&L DMP direct and indirect jobs will have a positive impact on the overall state economy in Ohio.

Q. What is your estimate of the total economic impact of the jobs and capital investment associated with DP&L DMP?

A. Over a period of twenty years, DP&L anticipates a total economic benefit of approximately $946 million in nominal dollars. The economic impact calculation is based on regional economy wide impact as determined by BEA RIMS II approach. The RIMS II approach estimates the economic impact based on capital multiplier that is specific to the Dayton, OH region. The economic impact, similar to the indirect jobs impact, benefits the overall United States economy in addition to Ohio's state economy.

Given the magnitude of the investments proposed by this application, the total economic impact associated with the proposed investment is a relevant consideration when considering the DP&L DMP. The RIMS II approach captures the additional impact to the local economy in the DP&L service territory beyond the benefits captured in the utility and customer benefits.

IV. ANALYTICS CENTER OF EXCELLENCE ("CoE")

Q. What is DP&L proposing regarding analytics?

A. DP&L is proposing an investment in a Data Analytics System ("DAS") and to establish an Analytics "CoE" as part of the DMP. The Analytics CoE will be responsible for collecting, prioritizing, and then defining the initial analytics use cases based on data collected from relevant Operational Technology ("OT") systems, including but not limited to AMI, MDMS, and ADMS. Workpaper WP-7.2 provides a breakdown of this proposed investment, including approximately $9.6 million in capital costs in nominal dollars and $30.7 million in O&M costs in nominal dollars for the proposed initiatives over a twenty-year period.

Q. Why is an Analytics CoE needed at DP&L?

A. DP&L's DMP includes technologies that will provide large quantities of data to DP&L that were not previously available. This data can be used to optimize operations, improve customer and employee experiences, lower costs, and drive reliability benefits for DP&L's customers. To properly utilize such data, an Analytics CoE is needed to provide a focused effort across the company to capture the value possible from the data enabled by the new infrastructure investments from the DMP. The Analytics CoE along with the resulting analytics tools will deliver new insights to utility operations, integrating the data from the different Information and Operational Technology systems into the DAS, and providing the different departments with training and support to create the custom analytics needed to improve the monitoring of the grid performance, identify customer issues quicker, and more efficiently enable the utility personnel to identify the solutions to these issues.

Without a dedicated focus on analytics, many of the benefits associated with grid modernization could go unrealized. DP&L envisions working with the Commission and internal and external stakeholders to prioritize the use of analytics delivered through the Analytics CoE to drive maximum value to all stakeholders.

Q. What are the different roles considered as part of the Analytics CoE?

A. The Analytics CoE is planned to consist of Information Technology ("IT") roles, backend data management roles, data analysts, and data scientists.

The IT roles will be responsible for IT infrastructure and administration, including data security and access controls to ensure that data is utilized in line with regulatory and security standards. These responsibilities may span from network monitoring, server administration, database and data center maintenance, as well as other computational infrastructure necessary to support the goals of the CoE.

The backend and data management roles will be responsible for managing the data cluster, load data from disparate sources, and implement software solutions as applicable. The plan requires developers trained to extract, transform, and load data into a unified framework so that data from different assets and sources can be used accordingly.

The data analyst roles will be responsible to analyze and interpret complex data to drive business outcomes, including cost efficiencies, revenue management, optimized asset management, as well as customer benefits. The data scientists and data analysts will also interact with other initiatives to drive improved outcomes, such as leveraging data to optimize DER approval processes and placement while maintaining reliable service.

Q. Please provide an example of how the Analytics CoE will interface with the Grid Modernization investments proposed by this Application.

A. Managing distribution transformer utilization has been a challenge for decades across utilities. Without tools to monitor transformer load, DP&L must rely on statistical models using estimated load profiles to establish sizing guidelines. Changing weather patterns, aging infrastructure and increasing adoption of electric vehicles and distributed generation are quickly making this approach ineffective and obsolete. Utilizing the data gathered in an Enterprise Asset Management ("EAM") system, along with data from smart meters, will provide DP&L the ability to perform analytics for "TLM".

TLM will utilize aggregated smart meter interval data to the transformer to calculate loss-of-life and predict transformer utilization more accurately and on a scale not possible with DP&L's current infrastructure. Predictive analytics will help to preserve equipment and prevent outages. Near-real-time measurements will provide up-to-date loading details and unanticipated load increases. Historical data can provide a loading history on each transformer to evaluate higher than expected loss-of-life and optimal sizing for replacement, or even strategic moving of underutilized transformers. Transformers experiencing loading above the nameplate rating or excessive loss-of-life can be detected and reported easily to allow for a proactive corrective response by DP&L.

Q. Please explain the timeline for the Analytics CoE.

A. DP&L plans for the Analytics CoE to be established in Year 2 after Commission approval of DP&L's DMP. The Analytics CoE infrastructure will continue to be developed and implemented until Year 5, after which time the Analytics CoE will operate to continually improve operations and deliver benefits to DP&L's customers after full implementation of the DMP.

Q. Please explain the different costs for the Analytics CoE.

A. Workpaper WP-7.2 depicts the Capital and O&M costs for a twenty-year period broken out by major cost categories for the Analytics CoE. Capital costs include the solution implementation costs and hardware and software purchases. O&M costs include hardware and software maintenance, and maintenance labor associated with the ongoing support of the system.

Q. How were the Analytics CoE "Hardware and Software Purchases" calculated?

A. Workpaper WP-7.2 "Analytics CoE Capital and O&M" depicts the Hardware & Software Purchases required to support the Analytics CoE system implementation. Hardware purchases include components such as servers, routers, work stations, printers, and storage, for production, development, test, and disaster recovery environments. The hardware costs were driven by the DP&L IT department philosophy of standardization of platforms, open systems, and open standards. Industry best practices were used to ensure that the servers and storage estimates will support the full DP&L DMP capability.

Software purchases to support the Analytics CoE system implementations include analytics tools, database software licenses, and end user data query tools. The software purchase costs were estimated based on an industry analysis across several vendors. This vendor-neutral approach represents a blended cost of reputable industry-established software packages used in creating analytics to support the AMI system, smart meters, enhanced SCADA, and asset management the new DP&L DMP assets. The software purchases will support the creation and execution of descriptive analytics, predictive analytics, as well as machine learning to drive insights to improve customer management, operations, employee experience, and improved reliability of equipment through condition-based maintenance.

Q. How were the Analytics CoE "Solution Implementation Costs" calculated?

A. Workpaper WP-7.2 "Analytics CoE Capital and O&M" depicts the Solution Implementation Costs that represent the effort required to implement the data and analytic solutions that will be the focus for the Analytics CoE. This effort is comprised of both internal and external capitalized labor costs. Capitalized labor costs are calculated by applying a blended labor rate to the estimated number of days required to implement the solution that will support enhanced customer management, a more efficient digital worker, condition-based maintenance of the distribution system assets, and streamlined distribution operations. The number of estimated work days to implement the system is estimated based on analysis of the specific analytics use cases that will support the benefits realization of the DMP.

Q. How were the Analytics CoE "Maintenance Labor" costs calculated?

A. Maintenance Labor includes the incremental DP&L labor costs needed to maintain the systems and continuously improve the use case solutions in the Analytics CoE. The calculations for maintenance labor were based on a fully-loaded hourly rate multiplied by the number of FTEs required to support the system. This total number of additional resources is necessary to support the increase in IT infrastructure, databases and associated equipment, and to provide ongoing application support. A summary of these costs is reflected in Workpaper WP-7.2 "Analytics CoE Capital and O&M."

Q. How were the "System Maintenance" costs calculated?

A. System Maintenance includes both software and hardware components for the Analytics CoE. Software components include the fees payable to the software company to provide maintenance and support needed to maintain current system functionality. Hardware components include the fees payable to hardware vendors to provide maintenance and support needed to maintain the servers and storage systems. These System Maintenance O&M costs are depicted in Workpaper WP-7.2 "Analytics CoE Capital and O&M."

V. CONCLUSION

Q: Please summarize your testimony.

A: The DMP will transform DP&L's distribution grid, which will enable DP&L to provide significant customer and societal benefits that are not available from DP&L's existing system. The customer benefits are projected to be $1.2 billion, which includes $517 million in savings associated with reductions in energy usage and demand, additional savings of $246 million associated with the adoption of EVs, and $455 million in improved reliability benefits. The societal benefits are projected to be $999 million, through the reduction of greenhouse gases and economic development benefits. In addition, an Analytics CoE will help to optimize operations, customer service and equipment reliability.

Q. Does this conclude your direct testimony?

A. Yes.

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