there is strong justification for the proposed utility EV program which helps jumpstart and seed the market as necessary to achieve the adoption levels that deliver the benefits quantified.

10 Appendix A: Additional Details On Analysis Methodology

Section 4 provided a high level summary of the scope, assumptions, and methodology for the study. Additional details are provided below:

1. Analysis Window: The benefit-cost analysis covers the period 2019-2035. This analysis window is considered appropriate since a) the proposed utility program will be implemented primarily in 2019, but with operating impact thereafter, b) many of the new EVs put into service during the program period will remain in operation over this window, c) many of the customers directly impacted by the utility program will help stimulate additional EV adoption over time (word of mouth, consumer familiarity, growing industry scale and lower costs, etc.), and d) some of the assets implemented by the program – especially public charging infrastructure – will have an operating life through 2035 at least.

2. PEV Adoption: The PEV adoption forecast is based on a) the historical BEV and PHEV sales rates in Delaware, b) extrapolation of sales at 40% for BEVs and 30% for PHEVs, and c) retirement of both BEVs and PHEVs after eight years in service. The overall size of the light duty fleet is not projected to deviate significantly from historical trends as a result of electrification. The assumption of 40% and 30% growth rates is based on comparing key market condition benchmarks for Delaware with other EV adoption states. BEV sales growth year/year averaged 63.3% (2016-2017), and PHEV sales growth averaged 50.0%. Longer term, BEV sales are expected to strengthen as battery prices decline and PHEVs lose their price advantage over BEVs. The PEV forecast assumes continued availability of current incentives, and supportive utility programs that reduce adoption barriers for consumers. The statewide forecast for the DPL-fraction of Delaware was assumed to be 70%, scaled by electricity consumption of the state vs the DPL territory as determined from EIA form 861 and 861S for 2016. This percentage was scaled up slightly to account for the fact that New Castle is within the DPL territory, consistent with population distribution for the state.

3. Savings Basis: Savings will be computed as the difference between total costs WITH EV adoption (as per the adoption profile above) relative to a baseline of "no EVs", which essentially means assuming no additional EVs sold beyond what is already in the market. This method provides an appropriate method of quantifying the impact of EV adoption overall.

4. The overall market simulation is applied against PJM overall, as induced by DPL-DE load. Those consumption results are then scaled to the DPL-DE territory based on the fraction of DPL volume in Delaware. This fraction is computed based on the baseline DPL consumption for 2019 – 2022 (from Aurora) compared with the utility forecast for DPL-DE over the same period. Based on this analysis, 42.62% of PDPL consumption is in Delaware, and this is assumed to be constant over the analysis period.

5. Capacity and Transmission costs based on a forecast by Gabel Associates using data provided by PJM on current and projected capacity costs. Other PJM cost factors taken from PJM references[16].

6. Discount Rate: All Present Value calculations are based on a discount rate of 5.5%.

7. Drive Patterns: Travel statistics, especially regarding average miles traveled per day, are based on the Light Duty Vehicle (LDV) fraction of total VMT[17], including passenger cars, crossovers, SUVs, minivans, and pickup trucks, divided by the number of vehicles in the applicable weight classes, based on publicly available sources[18].

8. Statistics For Traditional Vehicles (Internal Combustion Engines): Existing traditional vehicle performance will be based on the national fleet average (MPG), beginning at 22.1 MPG in 2019[19], and growing by 0.2 MPG annually through the analysis period. MPG for the fueled miles of PHEVs will be based on the average of MPG quoted for PHEVs currently on sale in the U.S. (39.0 MPG, flat through the analysis period).

9. PEV Statistics: Efficiency parameters for PEVs are based on the sales weighted average (YTD 2018) of specifications for vehicles currently on sale in the U.S[20]. This assumes 3.6 miles/kwhr for BEVs in 2019, and 2.63 miles/kwhr for PHEVs in 2019. The BEV efficiency changes slightly over time reflecting duel impacts from a) improving powertrain design, and b) increased penetration of heavier vehicles and form factors. The BEV factor plateaus at 3.9 miles/kwhr in 2025, and the PHEV factor is constant over the period.

10. Charging Segmentation: The same six-segment EVSE segmentation model developed for the ChargEVC-NJ study was used[21].

11. Charge Scheduling: Managed charging will be assumed, based on the same methodologies used in the ChargEVC-NJ study[22]. This profile accounts for charging through all six segments, but forces residential charging to be between 10PM and 7AM. The same schedule is assumed for all years in the analysis window, and for both private and multi-family residents. All days are assumed to be equal regarding both travel and charging (i.e. no distinction for seasonality or day-of-week variations).

12. Cost of Gasoline: $/gallon data for each territory from the price tracking website gasbuddy.com, with extrapolation through 2035 based on EIA projections[23]. The EIA growth rate is used through 2025, but only HALF the EIA growth rate was used from 2026 to 2035 to reflect reduced gasoline prices that are expected to result from EV adoption and reduced petroleum demand.

13. Infrastructure Tax Adders: An operating expense for EV drivers is added that is equivalent to the federal and Delaware gas tax to ensure that infrastructure funding is continued long term. Based on the current gas taxes for Delaware ($0.230/gallon for Delaware, plus $0.184/gallon federal), that rate is $0.0186/mile for an average vehicle (in 2019), declining slightly over time as MPG increases.

14. Vehicle Emissions: Emissions per gallon of gasoline were taken from the 2013 update of the federal MOVES database[24], based on E10 gasoline blend.

15. Economic Value Of Reduced CO_2 Emissions: To determine the economic value of reduced CO_2 emissions, the analysis used the "Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866" produced by the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, as updated August 2016. Specifically, the analysis used the "3% Average" case which represents a mid-point of the three primary CO_2 cost scenarios. This analysis, when adjusted to nominal dollars in each year of emissions, provides an economic estimate of the value of avoided CO_2 emissions.

16. Economic Value Of Reduced NOx and SO_2 Emissions: To quantify the benefits of SO_2 and NOx reductions, Gabel reviewed the Environmental Protection Agency (EPA) benefit-cost-analysis associated with the Cross-State Air Pollution Rule (CSAPR), which replaced the Clean Air Interstate Rule as of May 1, 2017 [source: https://www.epa.gov/csapr/presentation-proposed-air-pollution-transport-rule]. EPA's analysis is a very comprehensive assessment of the social costs associated with power plant emissions and the health benefits created by the reduction of those emissions. SO_2 and NOx contribute to ground-level ozone and acid rain and are precursors to the formation of airborne particulate matter, i.e. PM2.5. PM2.5 is too small for human lungs to filter out and causes a wide variety of respiratory illnesses resulting in health care costs, lost workdays, and premature death. Based on this analysis of emissions reductions and their associated health and social benefits, Gabel calculated a $/ton benefits value for both SO_2 and NOx.

17. EV Driver Savings: All EV drivers operating expense savings will be based on the average costs for electricity (plus the gasoline tax replenishment adder), the projected gasoline costs, average vehicle MPG and efficiency, and maintenance costs (for EVs vs. traditional vehicles) as estimated in an independent study by AAA[25].

18. Vehicle Charging Electricity Costs: The model computes the average cost of electricity, across all segments, for each year of the study period, based on the aggregate load curve. When computing vehicle charging costs at home, the residential rate for electricity is used, which is typically several cents/kwhr higher than the overall average. The residential adjustment is based on the most recent data from EIA comparing average electricity rates and residential rates[26].

19. Federal Vehicle Purchase Premium: The vehicle purchase premium for PEVs compared with traditional vehicles is based on a California study on that topic (San Diego Gas and Electric Company, Filing to the California Public Utilities Commission on April 11, 2014, Chapter Six, direct testimony of J.C. Martin). The premium for BEVs and PHEVs in 2018 is assumed to be $9,660 and $8,979 respectively, and declines relatively linearly to zero in 2031.

20. Non-Utility Charging Infrastructure Investments: Vehicle charging infrastructure requirements are based on factors for Delaware from the DOE National Infrastructure study,

September 2017, specifically for Delaware. Both workplace and public L2 plug-count were based on the overall PEV sales rate (BEVs and PHEVs), while public DCFC plug-count was proportional to BEV sales. The factors used were 0.03000, 0.02200, and 0.00387 plugs per relevant vehicle (workplace, public L2, and public DCFC respectively), held constant over the analysis period. Residential L2 chargers were assumed to be needed for 100% of new BEV sales, and 25% of new PHEV sales (many PHEVs, with smaller batteries, can be charged easily overnight with a standard L1 charger, as included with the vehicle).

21. Utility EV program costs include all programs proposed, in aggregate.

End Notes and References

[1] EV sales taken from the Auto Alliance Advance Technology Vehicle Sales Dashboard: Statistics compiled by the Alliance of Automobile Manufacturers using information provided IHS Markit, Data last updated 4/25/18, retrieved May 2018 from https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/.

[2] EVs are assumed to retire from the fleet after eight years, consistent with most EV warranties being between eight and ten years. Note that although many EVs are leased for shorter periods (typically three years), those vehicles usually remain in the fleet as a used car and are therefore counted as still being in service.

[3] The forecasted blended growth rate of 34.9% is close to the Navigant base case CAGR for Delaware of 37% (through 2027).

[4] American Community Survey for Delaware, 2012-2016.

[5] Delaware Housing Fact Sheet, 2016, from the Delaware State Housing Authority.

[6] Federal Highway Administration, State Statistical Abstracts, for the state of Delaware 2015.

[7] Delaware's 2010 Greenhouse Gas Emissions Inventory, Final Report, prepared by the Division of Air Quality, published February 2014, Delaware Department of Natural Resources and Environmental Control.

[8] Detailed physical infrastructure impact studies were completed for a utility in New Jersey as part of the ChargEVC market opportunity assessment (Electric Vehicles in New Jersey – Costs and Benefits, ChargEVC, principle investigator Mark Warner, Gabel Associates Inc and Energy Initiatives Group LLC, January 26, 2018), and also specifically for the utility infrastructure on Long Island (Electric Vehicles On Long Island – Costs and Benefits, Principle Investigator: Mark Warner, Gabel Associates Inc. and Energy Initiatives Group LLC, May 4, 2018).

[9] Revised and Prepared Direct Testimony of J.C. Martin, Chapter 6, on behalf of San Diego Gas & Electric Company, Application for approval the company's electric Vehicle-Grid Integration Pilot Program, Filed April 11, 2014, Table 6-6.

[10] As a cross-check on these vehicle purchase premium assumptions, prices for the 2018 Hyundai Ioniq were compared. This vehicle is unique in that the EXACT SAME VEHICLE is available in three different drivetrains: basic hybrid (with no plug), a plug-in hybrid (with 28 miles of electric range), and a pure battery electric vehicle (with 118 miles of electric range). This particular vehicle makes it easy to provide a strong apples-to-apples comparison between vehicles that have identical features and differ only by drivetrain. The Ioniq Plug-In Hybrid has an MSRP premium of between $800 and $2,750 depending on trim level, compared with the non-plug-in hybrid. The pure battery electric has an MSRP of between $5,000 and $7,300, depending on trim level, compared with the non-plug-in hybrid. These data points, based on a real vehicle for sale in U.S. market in 2018, substantiates the numbers from the California study (as projected into 2018 and beyond), after accounting for the relatively modest electric range of the Ioniq compared to the average EV range assumed in the analysis (40 miles for the PHEV, at least 200 miles for the BEVs).

[11] National Plug-In Electric Vehicle Infrastructure Analysis, US DOE, Office Of Energy Efficiency and Renewable Energy, September 2017.

[12] California Standard Practice Manual, Economic Analysis Of Demand Side Programs And Projects, California PUC, October 2001. This reference can be found at the online reference below:
http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/CPUC_STANDARD_PRACTICE_MANUAL.pdf

[13] Revised and Prepared Direct Testimony of J.C. Martin, Chapter 6, on behalf of San Diego Gas & Electric Company, Application for approval the company's electric Vehicle-Grid Integration Pilot Program, Filed April 11, 2014.

[14] California Transportation Electrification Assessment, Phase 2: Grid Impacts, October 23, 2014

[15] Cost-Benefit Analysis of Plug-In Electric Vehicle Adoption in the AEP Ohio Service Territory, E3 Consulting, April 2017.

[16] State of the Market Report for PJM, by the Independent Market Monitor, March 08, 2018, Volume 1: Introduction

[17] Federal Highway Authority, Vehicle Miles Traveled by functional system, by State (Table VM-2), years 2007 – 2016.

[18] Federal High Administration, Table MV1, Vehicle Registrations 2016

[19] On-Road Fuel Economy of Vehicles in the United States: 1923 – 2015, Michael Sivak and Brandon Schoettle, University of Michigan, Report No SWT-2017-5, March 2017

[20] PEV performance statistics based on an analysis by Gabel Associates of all PEVs for sale in the US market as of the end of 2017, based on specifications published by vehicle manufacturers. All range specifications are based on EPA ratings for each vehicle.

[21] Electric Vehicles In New Jersey, Costs and Benefits, Prepared for ChargEVC by Gabel Associates Inc, Mark Warner, January 26, 2018

[22] Real world time-of-day charging distributions for each of the charging segments was collected from industry partners in the ChargEVC coalition. This information was augmented by research from UC Davis, Institute of Transportation Studies, Working Paper – UCD-ITS-WP-13-01, "California Statewide Charging Assessment Model of Plug-In Electric Vehicles: Learning from Statewide Travel Surveys:, January 2013, Michael A Nicholas, Gil Tal, Justin Woodjack.

[23] EIA 2018 Energy Outlook, forecast of nominal price of motor gasoline use in the transportation sector (national average). This information was scaled from national average pricing to state-specific pricing using information from the EIA State Profiles, Table E16, Motor Gasoliine Price and Expenditure Estimates, Ranked by State, 2015.

[24] Updated Emission Factors of Air Pollutants from Vehicle Operations in GREET Using MOVES, Hao Cai, Argonne National Laboratory, Energy Systems Division, September 2013.

[25] Your Driving Costs, American Automobile Association, 2017 Edition

[26] Energy Information Agency, Electric Power Monthly, published February 2018 with data through December 2017, Table 5.6.B.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF DELAWARE

IN THE MATTER OF THE APPLICATION OF DELMARVA POWER & LIGHT COMPANY FOR APPROVAL OF A PROGRAM FOR PLUG IN VEHICLE CHARGING (Filed October 19, 2017)	))))	PSC DOCKET NO. 17-1094

AMENDMENT TO FINDINGS AND RECOMMENDATIONS OF THE HEARING EXAMINER

DATED July 12, 2018

Mark Lawrence
Senior Hearing Examiner

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF DELAWARE

IN THE MATTER OF THE APPLICATION OF DELMARVA POWER & LIGHT COMPANY FOR APPROVAL OF A PROGRAM FOR PLUG IN VEHICLE CHARGING	))))	PSC DOCKET NO. 17-1094

(Filed October 19, 2017)

Mark Lawrence, having been appointed to act as the Hearing Examiner in this matter by PSC Order No. 9184 dated February 1, 2018, submits the following report to the Commission.

I. APPEARANCES

On behalf of the Applicant Delmarva Power and Light Company ("Delmarva", "DPL" or "the Company"):

By: DRINKER BIDDLE & REATH LLP
THOMAS P. MC GONIGLE, ESQ.

LINDSAY B. ORR, ESQ.
Assistant General Counsel

On behalf of the Public Service Commission Staff ("Staff" or "Commission Staff"):

By: ROBERT WILLARD, ESQ.
DEPUTY ATTORNEY GENERAL

Connie McDowell
Senior Regulatory Policy Administrator

Amy Porter
Public Utilities Analyst III

On behalf of the Delaware Department of Natural Resources & Environmental Control ("DNREC"):

By: RALPH DURSTEIN III, ESQ.
DEPUTY ATTORNEY GENERAL

On behalf of the Division of the Public Advocate ("DPA" or "Public Advocate"):

By: REGINA A. IORII, ESQ.
DEPUTY ATTORNEY GENERAL

ANDREW SLATER
PUBLIC ADVOCATE

On behalf of the Caesar Rodney Institute ("CRI"):

By: DAVID T. STEVENSON, DIRECTOR
CENTER FOR ENERGY COMPETITIVENESS

On behalf of the Sierra Club:

By: JOSHUA BERMAN, ESQ.

KENNETH T. KRISTLE, ESQ.
PROFESSOR OF LAW, DIRECTOR, ENVIRONMENTAL & NATURAL RESOURCES LAW CLINIC, WIDENER UNIVERSITY DELAWARE LAW SCHOOL

1. Based upon the Public Advocate's argument, the parties are legally entitled to twenty (20) days to file a response to the proposed Findings and Recommendations dated July 11, 2018. Thus, the parties' response deadline is July 31, 2018.

2. For the last twenty (20) years, straight forward discovery disputes like this before the Commission have been done exclusively through Interlocutory Appeals. This streamlined process has worked well because it has: a) moved cases along; and b) avoided protracted litigation by litigious parties.

DATED: July 12, 2018

Respectfully submitted,

Mark Lawrence
Senior Hearing Examiner