November 6, 2019

Ms. Lisa Felice
Acting Executive Secretary
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

Via E-Filing

RE: MPSC Case No. U-20561

Dear Ms. Felice:

The following is attached for paperless electronic filing:

Direct Testimony of David L. Gard on behalf of Michigan Environmental Council, Natural Resources Defense Council, Sierra Club, and Citizens Utility Board of Michigan;

Exhibits MEC-75 through MEC-84;

Proof of Service.

Sincerely,

Tracy Jane Andrews
cn=Tracy Jane Andrews, o=Olson Bzdok & Howard, ou, email=tjandrews@envlaw.com, c=US
2019.11.06 11:25:53 -05'00'

Tracy Jane Andrews
tjandrews@envlaw.com

xc: Parties to Case No. U-20561

STATE OF MICHIGAN

MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority.	)	Case No. U-20561
	)	ALJ Sharon L. Feldman

DIRECT TESTIMONY OF DAVID L. GARD

ON BEHALF OF

**MICHIGAN ENVIRONMENTAL COUNCIL,
NATURAL RESOURCES DEFENSE COUNCIL, SIERRA CLUB,
AND CITIZENS UTILITY BOARD OF MICHIGAN**

NOVEMBER 6, 2019

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, position, and business address.

A. My name is David L. Gard. I am a Senior Consultant of 5 Lakes Energy LLC, a Michigan limited liability corporation, located at Suite 710, 115 W Allegan Street, Lansing, Michigan 48933.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Michigan Environmental Council ("MEC"), Natural Resources Defense Council ("NRDC"), Sierra Club ("SC"), and the Citizens Utility Board of Michigan ("CUB").

Q. Please summarize your work experience in the field of electric utility regulation.

A. I have worked in the area of energy policy and utility regulation for over seventeen years. For more than a decade I directed the energy program of a statewide environmental nonprofit organization in Michigan. To the present I have actively engaged in a number of utility-related technical workgroups at MPSC and other state agencies. At 5 Lakes Energy, I was instrumental in developing and applying an open-source integrated resource planning tool that optimizes the hourly dispatch of capacity resources based on plant-specific parameters, location marginal price, and other factors. I tailored this model to the electric systems in Michigan and nine other states. Later I supported the revision of this tool to more accurately estimate and dispatch Michigan's potential cogeneration resource. Earlier in my career I served as an engineering officer in the U.S. Navy. In this role I was responsible for the operation and maintenance of a 600 pounds per square inch (PSI) steam power plant which included three turbogenerators rated at a combined 7.5 Megawatts. This

shipboard experience informed my general knowledge of electricity generating equipment and plant operations and maintenance. My resume is provided as Exhibit MEC-75 (DG-1).

Q. Please summarize your educational background.

A. I hold two master's degrees from the University of Michigan in business administration and resource policy and behavior, and a bachelor's degree in mechanical engineering from Northwestern University.

Q. Please summarize your professional development coursework in the field of electric utility regulation.

A. I completed the following EUCI courses: *Electric Cost-of-Service: Essential Concepts for a Changing Industry*, July 15-16, 2019; *Natural Gas Physical & Financial Markets*, May 9, 2018; *Introduction to the Natural Gas Industry, Infrastructure and Regulations*, May 8, 2018; and *Evolution of Electricity Markets: Disruptive Innovation & Economic Impacts*, January 29-30, 2018.

Q. Have you testified before this Commission or as an expert in any other proceeding?

A. I prepared written testimony based on my review of electric and gas utility energy efficiency potential studies in cases D.P.U. 18-110 through D.P.U. 18-119 before the Commonwealth of Massachusetts Department of Public Utilities.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the production cost allocation analysis I performed using the Probability of Dispatch (POD) method and to present my results.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

- Exhibit MEC-75 (DG-1): Resume of David Gard.
- Exhibit MEC-76 (DG-4): Assignment of Resources to Plant Categories
- Exhibit MEC-77 (DG-6): 2018 Hourly Production by Plant Category (excerpt)
- Exhibit MEC-78 (DG-7): 2018 Total System Hourly Production Costs (excerpt)
- Exhibit MEC-79 (DG-9): 2018 Ludington Plant Hourly Production Costs (excerpt)
- Exhibit MEC-80 (DG-11): 2018 MISO Hourly Net Costs (excerpt)
- Exhibit MEC-81 (DG-14): Hourly Load Profiles by COS Class (excerpt)
- Exhibit MEC-82 (DG-15): Response to MECNRDCSCDE-7.17d
- Exhibit MEC-83 (DG-16): Production Cost Allocation to COS Classes (excerpt)
- Exhibit MEC-84 (DG-17): Summary of COS Cost Allocation Factors

II. SUMMARY OF THE PROBABILITY OF DISPATCH METHOD

Q. Please provide an overview of the analysis you conducted.

A. I conducted a Probability of Dispatch (POD) cost of service analysis. This is an embedded cost study method described in the NARUC Electric Utility Cost Allocation Manual which assigns production-related costs to specific hours based on plant operating profiles.[1] These costs are then allocated to customer classes in proportion to their hourly demand throughout

[1] See Exhibit MEC-80 (DJ-11).

the year.

POD is widely considered to be a valid and equitable way to allocate production costs because it captures the dynamic nature of system costs and matches these costs to different types of customers based on their variable loads. In other words, POD clarifies cost causation by linking electricity generation costs to how the system is being utilized. Historically, POD has seen limited application largely because it is a data-intensive exercise. In particular, it requires hourly production and load information which is not always available. In this case, a POD analysis was possible because I had access to hourly production and load data from DTE Electric.

I accomplished my POD analysis in two main steps. First, I obtained annual production costs and converted these into hourly costs based on system dispatch across the 8,760 hours in test year 2018. Second, I allocated hourly production costs to customer classes in proportion to their hourly load during the test year.

Q. Did you modify your preferred methodology for this analysis?

A. Yes, I did. Ideally the POD cost allocation method would be applied using plant-level production cost data. As MEC witness Boothman explains in his testimony, the company failed to provide this information. Therefore, I modified the approach by aggregating production costs into several plant categories and then allocating the costs to customer classes. This procedure is described in my testimony.

III. DEVELOPMENT OF HOURLY PRODUCTION COSTS

Q. Describe how you identified capacity resources and assigned them to plant categories.

A. I developed a list of capacity resources for the company based on information obtained through discovery.[2,3] The resulting list appears in my Exhibit MEC-76 (DG-4): Assignment of Resources to Plant Categories. I then followed the classification scheme used by the company to assign certain capacity resources to the plant categories "Fossil," "Nuclear," "Peaker," and "Hydro."[4]

Q. How did you reclassify capacity resources labeled as "Other" in Exhibit MEC-n (DG-5), and why?

A. I relabeled wind and solar capacity resources listed under "Company Owned Generation Resources" as provided by DTE (Response to MECNRDCSC-2.3) from "Other" to "REP Resource" to reflect their role in the company's renewable energy plan (REP). I relabeled capacity resources listed under "Long Term Power Purchase Agreements" in the same exhibit from "Other" to the more descriptive "Non-REP PPA." My purpose in doing so was to align my plant categories with the aggregated production cost data developed by MEC witness Boothman and discussed in his testimony.

Q. Describe how you developed hourly production figures for each plant category.

A. I incorporated 2018 hourly production data from the company's spreadsheet "U-20561 Att. 5.26 - 2-18" and the company's non-wind resources list (Response to MECNRDCSC-2.5) for those resources listed in my Exhibit MEC-76 (DG-4). After sorting the capacity

[2] DTE Discovery Response: MECNRDCSCDE-2.3 2018 DTE Resources
[3] DTE Discovery Response: MECNRDCSCDE-2.5 2018 Generation for Non-Wind PURPA and Solar
[4] DTE Discovery Response: MECNRDCSCDE 7.13a.

resources into the six plant categories (namely, "Fossil," "Nuclear," "Peaker," "Hydro," "Non-REP PPA," and "REP Resource"), I aggregated hourly production data for each category. These results are shown in my Exhibit MEC-77 (DG-6): 2018 Hourly Production by Plant Category.[5]

Q. Were there anomalies in the solar generation data you received from the company?

A. Yes, there were.

Q. Please identify these anomalies and explain how you addressed them.

A. I identified four negative values for solar generation in the non-wind resources (Response to MECNRDCSC-2.5). Two of these, in hours 15 and 17 on November 30, 2018, seemed large enough to potentially skew results. I replaced these questionable values with more reasonable estimates in line with adjacent hours. I also assigned a value of zero in place of two small negative solar production values found in hours 21 and 22 on December 26, 2018. As a result of these changes, total system production in 2018 increased slightly from 46,488,235,102 kWh to 46,493,979,806 kWh.

Q. How did you use the hourly production results aggregated by plant category?

A. The next step in my POD analysis was to calculate and apply production cost allocation factors for the plant categories "Fossil," "Nuclear," "Peaker," and "Non-REP PPA." For each of these, I divided total hourly production in the test year by the category's annual revenue requirement obtained from MEC witness Boothman.[6] The four resulting

[5] Exhibit MEC-77 (DG-6) provides a sample of hourly production data by plant category. Including data for all 8,760 hours in the test year would have made the exhibit excessively large without adding substantive information. My filed workpapers contain data and calculations for each and every hour of the test year. Note that I have followed a similar approach for other exhibits I created which also reflect 8,760-hour data sets.
[6] See Exhibit MEC-70 (KGB-2).

production cost allocation factors (presented in dollars per kilowatt-hour) appear in my Exhibit MEC-78 (DG-7): 2018 Total System Hourly Production Costs. My filed workpapers contain the underlying calculations.

For each of the four plant categories, I then applied the cost allocation factor to the 8,760 values in the hourly production profile to yield 8,760 hourly production costs for the category in the test year. These results are presented in my Exhibit MEC-77 (DG-6).

Q. Did you develop hourly production costs for the "REP Resource" plant category in the same manner?

A. Yes, I followed similar logic in calculating hourly production costs for the "REP Resource" plant category. The only difference is that, as explained by MEC witness Boothman in his testimony, company-owned renewables were eliminated from the cost of service study. This implies an annual revenue requirement of zero, a production cost allocation factor of zero, and therefore no hourly costs realized in the test year for the "REP Resource" category. This result appears in my Exhibit MEC-78 (DG-7).

Q. Why did you take a different approach in developing hourly production costs for the "Hydro" plant category?

A. DTE's response to MECNRDCSC-7.13 identifies the company's ownership stake in the Ludington Pumped Storage (LPS) facility as the only capacity resource in the cost of service study's "Hydro" plant category.[7] Given the unique operating characteristics of pumped storage technology, I applied a different, somewhat more complicated methodology to develop the hourly cost profile for this category.

[7] I interpret the terms "hydro" and "hydraulic" interchangeably in my testimony, exhibits, and filed workpapers.

Q. Please explain your methodology.

A. LPS consists of six similar units, each capable of operating in two modes. One mode generates energy when water flows downhill to spin a turbine. The other mode pumps water uphill to a large impoundment to "recharge" the system (typically during periods of off-peak demand). To reflect this characteristic, the spreadsheet "U-20561 Att. 5.26 - 2-18 Data" reports hourly production values for LPS as positive (generating mode, or delivering electricity to the grid) and negative (pumping mode, or consuming electricity). The six units of LPS operate independently and in either mode simultaneously. I decided to treat the arithmetic sum of the six units as a single capacity resource during each hour of the test year. This result appears in my Exhibit MEC-77 (DG-6) as a single column of hourly production values under the plant category "Hydro."

The annual production cost for LPS has two components. One is the cost associated with pumping water uphill to recharge the system. I calculated this by multiplying each negative hourly production value for LPS by the corresponding hourly locational marginal price (LMP) obtained through discovery.[8] The sum of these hourly pumping costs for the entire test year is the first cost component for LPS.

Q. How did you derive the second component of LPS annual production cost?

A. I obtained the second cost component from MEC witness Boothman. It is the annual revenue requirement reported for the "Hydraulic" plant category in his Exhibit MEC-70 (KGB-2).

[8] DTE Discovery Response: MECNRDCSCDE-4.5d

Q. What was the next step in your methodology?

A. Adding these two components gave me the total annual production cost for the "Hydro" plant category. I then calculated and applied a production cost allocation factor for "Hydro" much as I did for other plant categories. An important distinction is that I used only the hourly generation (positive) values in the "Hydro" hourly production profile to perform this allocation. Doing so ensured that production costs are assigned only to those hours when LPS is delivering electricity to end users, and in proportion to the amount of energy delivered. My Exhibit MEC-79 (DG-9): 2018 Ludington Plant Hourly Production Costs illustrates this cost allocation for "Hydro" and my filed workpapers include the underlying calculations. The final step was to import the resulting hourly cost profile labeled "Hourly LPS Production Cost ($)" in my Exhibit MEC-79 (DG-9) into the column labeled "Hydro" in my Exhibit MEC-78 (DG-7).

Q. In addition to "Hydro," your Exhibit MEC-78 (DG-7) has another column with imported hourly cost data, namely "MISO Net Imports." Please explain this.

A. Similar to the situation with "Hydro" category, developing hourly costs for the "MISO Net Imports" category involved some unique steps. First, I obtained through discovery the hourly real-time net MISO purchases and sales for the test year.[9] In this data set, purchases from MISO (i.e., imported electricity) are reported as positive and sales to MISO (i.e., exported electricity) are reported as negative.

[9] DTE Discovery Response: MECNRDCSCDE-4.5b, 2018 Hourly Net MISO Purchases and Sales.

Q. Did you consider the effect of line loss on MISO imports and exports?

A. Yes, I did. Given my assumption that generation and exports share the same point of measurement in the system, I did not adjust MISO exports for line loss. For MISO imports, I assumed that load is effectively measured downflow from transmission; therefore, I adjusted imports back to generation by adding in transmission losses. This involved organizing the data from DTE's response to MECNRDCSC-4.5b into two separate hourly profiles—one for purchases and the other for sales. This is illustrated in my Exhibit MEC-80 (DG-11): 2018 MISO Hourly Net Costs. I then multiplied each hourly purchase (i.e., import) by the transmission line loss factor obtained through discovery.[10] These results appear in my Exhibit MEC-80 (DG-11) in the column labeled "Imports Adjusted for Line Loss (MWh)."

Q. What was the next step in developing hourly production costs for the "MISO Net Imports" category?

A. The next step was to estimate the economic value of hourly purchases and sales provided by DTE in response to MECNRDCSC-4.5b (2018 Hourly Net MISO Purchases and Sales). To do this I multiplied each hourly purchase (adjusted for line loss) and sale by the corresponding LMP obtained from DTE).[11] These results (in dollars) are shown in the column labeled "MISO Hourly Cost (+) or Rev (-)" in my Exhibit MEC-80 (DG-11) and comprise the hourly production net costs for the "MISO Net Imports" category. This procedure reflects the logic that utility customers should share the cost to import electricity when needed, and similarly benefit when electricity exports earn revenue.

[10] Exhibit MEC-60 (DJ-3): DTE Discovery Response: MECNRDCSCDE-1.8b Line Loss Study 1999; see page labeled "12-CTP Average, 1999"
[11] DTE Discovery Response: MECNRDSC-4.5d Hourly Gross Settled Load MWh and LMP.

Q. Did these hourly production net costs equal the "Total MISO" annual revenue requirement provided by MEC witness Boothman in his Exhibit MEC-70 (KGB-2)?

A. No. My calculations for MISO-related hourly costs reflect 2018 data while MEC witness Boothman developed his annual revenue requirement using projections for 2021. To address this discrepancy, I scaled the shape of my hourly cost profile to his annual revenue requirement of $64,526,624. These results are shown in my Exhibit MEC-80 (DG-11) and the underlying calculations are included in my workpapers.

Q. How did you incorporate the resulting MISO hourly net cost profile?

A. I imported these hourly results, scaled to the projected annual revenue requirement, into the column labeled "MISO Net Imports" in my Exhibit MEC-78 (DG-7). At this point the column labeled "Total System Hourly Costs" in the same exhibit properly represented the total hourly production costs to be allocated to the various customer classes.

IV. ALLOCATION OF HOURLY COSTS TO CUSTOMER CLASSES

Q. Describe the second main step of your POD analysis, namely the allocation of hourly production costs to customer classes.

A. Through discovery I obtained the 2018 hourly load by cost of service class, using the cost of service classes included in Witness Brasil's Exhibit A-17 Schedule G1.2, Allocation Schedule 100.[12] This information became the basis for my Exhibit MEC-81 (DG-14): Hourly Load Profiles by COS Class which presents load data for each COS class side-by-side across all hours in the test year.

[12] DTE Discovery Response: MECNRDCSCDE-2.1b 2018 TSA by COS Class

Q. Did the hourly load data you received from the company align with their production data?

A. Not entirely. The information provided by DTE in response to MECNRDCSC-2.1b (TSA by COS Class) included 8,759 hours of load data whereas the company's hourly data for production and MISO trade discussed previously in my testimony included entries for all 8,760 hours in the test year. The load data gap occurs at Hour 3 on March 11, 2018.

Q. Did this pose a problem for your analysis?

A. Ideally there would be complete alignment between hourly load and production data. Short of a more satisfactory resolution to this issue, I forced alignment by following the company's suggestion in its response to a discovery request.[13] That is, I entered a null value in Hour 3 of March 11, 2018 and doubled the entry in Hour 3 of November 4, 2018.

Q. Did you consider line losses associated with the various COS classes?

A. Yes, I did. Using information provided by DTE in its 1999 line loss study (Exhibit MEC-60n (DJ-3)), I assigned a line loss factor to each of the fifteen customer classes based on their service type of primary or secondary. These line loss factors and adjusted hourly loads appear in my Exhibit MEC-81 (DG-14).

Q. What was the next step in your methodology?

A. My Exhibit MEC-83 (DG-16): Hourly Production Cost Allocation to COS Classes shows the spreadsheet I developed to allocate the "Total System Hourly Costs" imported from my Exhibit MEC-78 (DG-7) to customers by COS class. The full spreadsheet with formulae embedded is provided in my filed workpapers.

[13] Exhibit MEC-82 (DG-15): DTE Discovery Response to MECNRDCSCDE-7.17d

Adjusted hourly loads from my Exhibit MEC-81 (DG-14) were then used to compute load shares for each COS class during each hour of the test year. These results appear in my Exhibit MEC-83 (DG-16) in the columns labeled "Hourly Load Ratios." For each COS class, its 8,760 hourly load ratios were then multiplied by the corresponding hourly system cost. The sum of these 8,760 products for each COS class equals that class's portion of annual production cost for the test year. This is the ultimate objective of the POD method.

Q. Please summarize your final results.

A. By definition, the ratio of a COS class's portion of annual production cost by the total annual production cost for the system is the annual production cost allocator for that COS class. Results of this simple calculation for all fifteen COS classes are shown in my Exhibit MEC-84 (DG-17): Summary of COS Class Allocation Factors. At the request of MEC witness Jester, the names of the COS classes in this exhibit have been slightly modified to match those used in witness Lacey's Exhibit A-16, Schedule F1.1.

V. RATE CLASS SHARES OF PEAKER USAGE

Q. Describe the additional POD analysis you conducted to allocate Peaker costs.

A. I applied the POD methodology described in previous sections of my testimony to allocate the annual production cost only of the "Peaker" plant category. I did this by replacing the "Total System Hourly Costs" column entries shown in my Exhibit MEC-83 (DG-16) with the "Peaker" hourly cost profile shown in my Exhibit MEC-78 (DG-7). The resulting Peaker cost allocators for each COS class appear in my Exhibit MEC-84 (DG-17).

Q. Why did you conduct this additional analysis?

A. MEC witness Jester asked me to calculate these Peaker-only cost allocators as a potential alternative to 4CP for allocating Equivalent Peaker costs.

V. RECOMMENDATIONS AND CONCLUSION

Q. Please summarize your recommendations to the Commission.

A. On behalf of MEC, NRDC, SC, and CUB and regarding the Commission's consideration of the Company's overall performance, I recommend that:

1. The Commission consider requiring utility companies to report plant-level investment and expense data in future rate cases.
2. The Commission consider requiring utility companies to submit comprehensive hourly load data in future rate cases that consist of accurate load entries for each of the 8,760 hours in the year.

Q. Does that complete your testimony?

A. Yes, it does.

David L. Gard

810 Knoll Road, East Lansing, MI 48823 ● Mobile: 517-896-2960 ● E-mail: dgard@5lakesenergy.com

STATEMENT OF PURPOSE

I seek to apply my interdisciplinary skills, knowledge, and experience in advancing clean energy policies and sustainable practices by organizations in the public, private and nonprofit sectors.

PROFESSIONAL ROLES AND EDUCATION

2014— **5 Lakes Energy LLC.** *Senior Consultant*. Lansing, MI.

- As executive director of the Michigan Energy Efficiency Contractors Association (MEECA), builds partnerships and provides member services to strengthen the efficiency industry.
- Prepared written testimony on the methodology and implementation of electric and gas utility energy efficiency potential studies.
- Conducts research and modeling with the STEER software tool in support of cost-effective compliance with federal emissions standards by various states.
- Performs upgrades to the STEER software tool to incorporate more recent data as these become available from U.S. Energy Information Association, NREL, and other agencies.
- Engages in policy development and education in support of expanded use of Combined Heat and Power (CHP) systems and technologies in Michigan.

2013—2014 **Oberlin Project.** *Executive Director.* Oberlin, OH.

- Directed a globally recognized project between the City of Oberlin and Oberlin College to dramatically reduce carbon emissions and strengthen local resilience; budget of $650,000.
- Developed a two-pronged strategy: (1) Transform Oberlin's housing stock with new affordable zero-energy homes, and extensive energy retrofits to local housing; (2) Expand the regional food economy by increasing capacity of growers and other suppliers, and aggregating the buyers of local produce.
- Convened a diverse table of stakeholders to integrate workforce training and job placement into the housing transformation and regional food economy strategic efforts.

2002—2013 **Michigan Environmental Council.** *Energy Program Director.* Lansing, MI.

- Oversaw program with $250,000 budget to develop and advance clean energy policies for a statewide environmental nonprofit with over 60 member organizations. Advised members on a range of policy and advocacy matters.
- Organized and managed diverse coalitions of advocates from environmental and public health nonprofits, interfaith groups, labor unions, companies, and other interests.
- Developed and implemented strategic communications in support of both general and issue-specific education campaigns.
- Represented MEC by engaging elected and appointed public officials, delivering prepared testimony, participating in technical workgroups, and speaking to a wide range of civic, academic, and other audiences.
- Served on the Steering Committee of RE-AMP, a large network of nonprofits and foundations working to reduce carbon emissions in the Midwest. Hired and directly managed the RE-AMP network coordinator housed at MEC.
- Received GLREA Appreciation Award (2013).

David L. Gard

PROFESSIONAL ROLES AND EDUCATION (CONTINUED)

1998—2002 **University of Michigan, Erb Institute.** *Dual-degree Graduate Program.* Ann Arbor, MI.

MBA, Ross School of Business and MS, School of Natural Resources and Environment.

- Interdisciplinary curriculum: business strategy, corporate sustainability, industrial ecology, life cycle assessment (LCA), system dynamics, energy technologies, natural resource policy, general ecology, and other topics.
- Certificate from the Tauber Institute for Global Operations in supply chain management and manufacturing operations.
- Completed two summer internships: (1) Implemented lean production in a Steelcase Inc. manufacturing facility; received 2nd Prize in annual *Spotlight* competition; and (2) Reported directly to Vice President of Environmental Policy and Product Strategy at Cummins Inc.
- For Master's thesis, applied LCA methodology in early study of the Internet's energy usage. Research published in the *Journal of Industrial Ecology*.
- Received $25,000 grant from AT&T Foundation and awarded 3M Prize for Outstanding Achievement in Industrial Ecology.

1995—1998 **Dematic (formerly Mannesmann Dematic).** *Senior Design Engineer.* Grand Rapids, MI.

- Responsible for the design, procurement, and commissioning of large conveyor systems for retail warehousing and airline baggage handling. Largest project was $16 million.
- Diagnosed and solved post-installation technical problems at multiple job sites.
- Played a central role in achieving the company's first ISO 9001 quality assurance certification.

1991—1995 **U.S. Navy, assigned to USS Mount Whitney.** *Division Officer (Lieutenant).* Norfolk, VA.

- Led two engineering divisions in the safe operation and maintenance of critical equipment used for shipboard power generation, main propulsion, and desalination of seawater.
- Responsible for the training and supervision of 45 boiler and machinery technicians.
- Organized and evaluated firefighting and other emergency response drills.
- Qualified as Officer of the Deck (Underway) and Command Duty Officer (In port).
- Managed the security of confidential communication materials for U.S. Second Fleet.

1987—1991 **Northwestern University.** *Undergraduate Student.* Evanston, IL.

BS in Mechanical Engineering

- Academic: Naval Reserve Officers Training Corps full tuition scholarship
- Service and Activities: Residence Hall Advisor for two years; Lacrosse Club

CURRENT SERVICE ROLES

- **Michigan Energy Options**. *President of the Board of Directors*. East Lansing, MI.
- **Center for Sustainable Systems, University of Michigan**. *External Advisory Board Member*. Ann Arbor, MI.
- **Haven House.** *Weekly volunteer*, homeless shelter for families with children. East Lansing, MI.

Assignment of Capacity Resources to Plant Categories

Capacity Resource	Plant Category
Belle River Peakers_11	Peaker
Belle River Peakers_121	Peaker
Belle River Peakers_122	Peaker
Belle River Peakers_13	Peaker
Belle River_1.DEMO	Fossil
Belle River_2.DEMO	Fossil
Colfax Peakers_11	Peaker
Dean Peakers_12	Peaker
Dean Peakers_34	Peaker
Delray Peakers_11	Peaker
Delray Peakers_12	Peaker
Fermi Peakers_112	Peaker
Fermi Peakers_113	Peaker
Fermi Peakers_114	Peaker
Fermi_2	Nuclear
Greenwood Peakers_111	Peaker
Greenwood Peakers_112	Peaker
Greenwood Peakers_12	Peaker
Greenwood_1	Fossil
Hancock Peakers_111	Peaker
Hancock Peakers_112	Peaker
Hancock Peakers_113	Peaker
Hancock Peakers_114	Peaker
Hancock Peakers_121	Peaker
Hancock Peakers_122	Peaker
Monroe Peakers_11	Peaker
Monroe_1	Fossil
Monroe_2	Fossil
Monroe_3	Fossil
Monroe_4	Fossil
Northeast Peakers_111	Peaker
Northeast Peakers_112	Peaker
Northeast Peakers_113	Peaker
Northeast Peakers_114	Peaker
Northeast Peakers_12	Peaker
Northeast Peakers_131	Peaker
Northeast Peakers_132	Peaker
Oliver Peakers_11	Peaker
Placid Peakers_12	Peaker
Putnam Peakers_11	Peaker
Renaissance Peakers_1	Peaker
Renaissance Peakers_2	Peaker
Renaissance Peakers_3	Peaker
Renaissance Peakers_4	Peaker
River Rouge Peakers_11	Peaker

River Rouge_3	Fossil
Slocum Peakers_11	Peaker
St Clair Peakers_11	Peaker
St Clair Peakers_12	Peaker
St Clair_1	Fossil
St Clair_2	Fossil
St Clair_3	Fossil
St Clair_6	Fossil
St Clair_7	Fossil
Superior Peakers_111	Peaker
Superior Peakers_112	Peaker
Superior Peakers_113	Peaker
Superior Peakers_114	Peaker
Trenton Channel_9	Fossil
Wilmot Peakers_11	Peaker
Ludington_1	Hydro
Ludington_2	Hydro
Ludington_3	Hydro
Ludington_4	Hydro
Ludington_5	Hydro
Ludington_6	Hydro
Gratiot_2	REP Resource
Brookfield_1	REP Resource
McKinley_1	REP Resource
Minden_1	REP Resource
Pinnebog_	REP Resource
Sigel_1	REP Resource
Pine River_1	REP Resource
Total Solar	REP Resource
Gratiot_1	Non-REP PPA
Garden Peninsula_1	Non-REP PPA
Pheasant_1	Non-REP PPA
Stoney Corners_2	Non-REP PPA
Turtle_1	Non-REP PPA
Tuscola_1	Non-REP PPA
Tuscola_2	Non-REP PPA
Ann Arbor - Barton Dam	Non-REP PPA
Ann Arbor Landfill	Non-REP PPA
Ann Arbor - Superior Dam	Non-REP PPA
Blue Water Renewables, Inc. - Smith Creek	Non-REP PPA
Charter Township Ypsilanti - Ford Lake Dam	Non-REP PPA
L'Anse Warden Electric Company, LLC	Non-REP PPA
Michigan Waste Energy	Non-REP PPA
Riverview Energy Systems	Non-REP PPA
STS French Landing Dam	Non-REP PPA
Sumpter Energy: City Sands/Carleton Farms	Non-REP PPA
Sumpter Energy Associates: Pine Tree Acres Lar	Non-REP PPA
Turbine Power Limited Partnership - Arbor Hills	Non-REP PPA
WM Renewable Energy, LLC: Eagle Valley	Non-REP PPA

2018 Hourly Production by Plant Category

		Fossil	Nuclear	Peaker	Hydro	Non-REP PPA	REP Resource	Total Plant Category Hourly Production
Hour	Month_Day_Hour	kWh	kWh	kWh	kWh	kWh	kWh	kWh
1	1_1_1	3,193,508	652,814	355,469	(412,958)	286,075	288,913	4,363,821
2	1_1_2	3,138,113	653,939	355,374	(814,997)	290,659	267,725	3,890,813
3	1_1_3	3,083,463	654,582	354,660	(812,606)	341,092	274,545	3,895,736
4	1_1_4	3,067,241	651,953	355,088	(810,314)	373,768	317,616	3,955,352
5	1_1_5	3,112,909	651,291	355,202	(807,746)	386,764	337,881	4,036,301
6	1_1_6	3,167,236	655,411	354,828	(409,518)	373,328	340,028	4,481,313
7	1_1_7	3,180,710	659,657	354,963	(4,446)	331,002	358,100	4,879,986
8	1_1_8	3,218,413	660,031	354,924	-	327,787	358,424	4,919,579
9	1_1_9	3,375,704	660,034	354,523	-	379,399	353,210	5,122,870
10	1_1_10	3,491,391	652,364	354,564	24,751	376,643	364,593	5,264,306
11	1_1_11	3,515,983	670,879	354,201	493,838	397,473	387,371	5,819,745
12	1_1_12	3,520,096	728,466	352,789	274,431	420,223	409,540	5,705,545
13	1_1_13	3,521,245	792,017	371,298	5,517	400,916	392,147	5,483,140
14	1_1_14	3,520,769	870,498	352,218	-	387,250	373,956	5,504,691
15	1_1_15	3,519,449	925,026	352,203	-	348,383	360,267	5,505,328
16	1_1_16	3,516,032	940,788	354,217	-	354,055	326,896	5,491,988
17	1_1_17	3,512,278	1,019,400	408,101	18,792	377,326	324,924	5,660,821
18	1_1_18	3,510,863	1,105,970	684,512	306,092	380,240	351,243	6,338,920
19	1_1_19	3,521,680	1,153,730	705,589	809,755	389,531	354,178	6,934,463
20	1_1_20	3,499,632	1,154,900	653,308	756,058	354,239	357,476	6,775,613
21	1_1_21	3,469,072	1,153,660	653,918	752,333	308,198	325,457	6,662,638
22	1_1_22	3,368,084	1,156,170	695,185	529,859	304,522	363,272	6,417,092
23	1_1_23	3,251,286	1,153,880	688,917	4,383	303,496	370,683	5,772,645
24	1_1_24	3,160,131	1,155,160	424,797	(487,980)	275,219	362,679	4,890,006
25	1_2_1	3,155,466	1,154,980	410,851	(816,270)	306,567	364,856	4,576,450
26	1_2_2	3,158,035	1,154,080	374,747	(815,873)	335,703	373,796	4,580,488
27	1_2_3	3,055,351	1,153,960	387,433	(814,068)	341,075	369,439	4,493,190
28	1_2_4	3,033,774	1,154,520	388,875	(812,241)	401,131	374,354	4,540,413
29	1_2_5	3,047,108	1,154,360	401,673	(808,879)	393,173	382,284	4,569,719
30	1_2_6	3,180,443	1,155,940	556,737	(804,964)	446,636	395,442	4,930,234
31	1_2_7	3,273,409	1,154,630	525,227	74,233	470,252	405,831	5,903,582
32	1_2_8	3,338,660	1,153,700	586,390	617,108	481,872	424,528	6,602,258
33	1_2_9	3,502,523	1,152,830	731,039	776,567	493,989	427,950	7,084,898
34	1_2_10	3,534,221	1,152,690	754,889	789,452	497,720	425,682	7,154,654
35	1_2_11	3,563,961	1,045,060	755,647	552,633	487,899	430,940	6,836,140
36	1_2_12	3,509,421	1,021,650	597,408	297,920	495,549	437,228	6,359,176
37	1_2_13	3,427,932	1,053,940	556,545	4,801	502,980	441,425	5,987,623
38	1_2_14	3,503,407	1,089,530	545,431	-	504,367	445,322	6,088,057

2018 Total System Hourly Costs

					Imported Data			Imported Data	
		Fossil	Nuclear	Peaker	Hydro	Non-REP PPA	REP Resource	MISO Net Imports	Total System Hourly Costs
Production Cost Allocation Factors:		0.061	0.064	0.098	N/A	0.155	0.000	N/A	
Hour	Month_Day_Hour	$	$	$	$	$	$	$	$
1	1_1_1	196,357	42,097	34,839	-	44,272	-	5,786	323,351
2	1_1_2	192,951	42,169	34,830	-	44,982	-	10,135	325,067
3	1_1_3	189,591	42,211	34,760	-	52,787	-	7,981	327,329
4	1_1_4	188,593	42,041	34,801	-	57,843	-	6,513	329,793
5	1_1_5	191,401	41,998	34,813	-	59,855	-	5,344	333,411
6	1_1_6	194,742	42,264	34,776	-	57,775	-	342	329,899
7	1_1_7	195,570	42,538	34,789	-	51,225	-	(5,369)	318,753
8	1_1_8	197,888	42,562	34,785	-	50,727	-	(4,957)	321,007
9	1_1_9	207,560	42,562	34,746	-	58,715	-	(7,390)	336,193
10	1_1_10	214,673	42,068	34,750	2,881	58,288	-	(6,827)	345,833
11	1_1_11	216,185	43,262	34,715	57,480	61,512	-	(17,474)	395,679
12	1_1_12	216,438	46,975	34,576	31,942	65,033	-	(13,052)	381,912
13	1_1_13	216,508	51,073	36,390	642	62,045	-	(8,197)	358,462
14	1_1_14	216,479	56,134	34,520	-	59,930	-	(6,538)	360,525
15	1_1_15	216,398	59,650	34,519	-	53,915	-	(6,124)	358,358
16	1_1_16	216,188	60,667	34,716	-	54,793	-	(5,250)	361,113
17	1_1_17	215,957	65,736	39,997	2,187	58,394	-	(6,567)	375,704
18	1_1_18	215,870	71,318	67,088	35,628	58,845	-	(32,728)	416,021
19	1_1_19	216,535	74,398	69,153	94,251	60,283	-	(109,165)	405,456
20	1_1_20	215,179	74,474	64,029	88,001	54,821	-	(21,303)	475,202
21	1_1_21	213,300	74,394	64,089	87,568	47,696	-	(9,791)	477,256
22	1_1_22	207,091	74,556	68,134	61,673	47,127	-	(24,395)	434,185
23	1_1_23	199,910	74,408	67,519	510	46,968	-	(10,215)	379,100
24	1_1_24	194,305	74,490	41,634	-	42,592	-	1,671	354,692
25	1_2_1	194,018	74,479	40,267	-	47,444	-	3,645	359,852
26	1_2_2	194,176	74,421	36,728	-	51,953	-	985	358,262
27	1_2_3	187,862	74,413	37,972	-	52,784	-	1,593	354,623
28	1_2_4	186,536	74,449	38,113	-	62,078	-	590	361,765
29	1_2_5	187,355	74,439	39,367	-	60,846	-	1,396	363,404
30	1_2_6	195,554	74,541	54,565	-	69,120	-	(107)	393,672
31	1_2_7	201,270	74,456	51,476	8,640	72,775	-	(9,849)	398,769
32	1_2_8	205,282	74,396	57,471	71,828	74,573	-	(34,510)	449,041
33	1_2_9	215,357	74,340	71,648	90,388	76,448	-	(25,323)	502,859
34	1_2_10	217,306	74,331	73,985	91,888	77,026	-	(24,531)	510,006
35	1_2_11	219,135	67,391	74,059	64,324	75,506	-	(30,978)	469,437
36	1_2_12	215,781	65,881	58,551	34,676	76,690	-	(11,876)	439,703
37	1_2_13	210,771	67,963	54,546	559	77,840	-	(904)	410,774
38	1_2_14	215,412	70,258	53,457	-	78,055	-	(2,801)	414,380
39	1_2_15	217,334	73,679	54,432	-	77,391	-	(4,230)	418,606
40	1_2_16	217,401	74,351	54,456	-	77,183	-	(4,485)	418,906
41	1_2_17	217,474	74,468	54,579	1,591	77,675	-	(4,278)	421,509
42	1_2_18	217,704	74,390	56,861	32,502	76,647	-	(8,563)	449,541

2018 Hourly Production Cost Profile for Ludington Pumped Storage

Hour	Month_Day_Hour	LPS Generation (kWh)	LPS Hourly Production Cost ($)
1	1_1_1	-	-
2	1_1_2	-	-
3	1_1_3	-	-
4	1_1_4	-	-
5	1_1_5	-	-
6	1_1_6	-	-
7	1_1_7	-	-
8	1_1_8	-	-
9	1_1_9	-	-
10	1_1_10	24,751	2,881
11	1_1_11	493,838	57,480
12	1_1_12	274,431	31,942
13	1_1_13	5,517	642
14	1_1_14	-	-
15	1_1_15	-	-
16	1_1_16	-	-
17	1_1_17	18,792	2,187
18	1_1_18	306,092	35,628
19	1_1_19	809,755	94,251
20	1_1_20	756,058	88,001
21	1_1_21	752,333	87,568
22	1_1_22	529,859	61,673
23	1_1_23	4,383	510
24	1_1_24	-	-
25	1_2_1	-	-
26	1_2_2	-	-
27	1_2_3	-	-
28	1_2_4	-	-
29	1_2_5	-	-
30	1_2_6	-	-
31	1_2_7	74,233	8,640
32	1_2_8	617,108	71,828
33	1_2_9	776,567	90,388
34	1_2_10	789,452	91,888
35	1_2_11	552,633	64,324
36	1_2_12	297,920	34,676
37	1_2_13	4,801	559
38	1_2_14	-	-
39	1_2_15	-	-
40	1_2_16	-	-

Calculation of LPS Cost Factor

Cost Item	Amount ($)	Notes
Pumping costs	35,477,740	Source: 'LPS Hourly Pumping Cost' tab
Ownership costs	77,946,354	Source: Witness Karl Boothman
2018 Total Cost	**113,424,094**	

LPS Cost Factor ($/kWh)	**0.116**

2018 MISO Hourly Cost Calculation

				Line Loss Factor:	0.0194				*Total MISO Rev Req ($):*	64,526,624
Hour	Month_Date_Hour	MWh	RT LMP ($/MWh)	Imports (MWh)	Imports Adjusted for Line Loss (MWh)	Hourly Cost ($)	Exports (MWh)	Hourly Revenue ($)	MISO Hourly Cost (+) or Rev (-)	Total MISO Rev Req (Scaled)
1	1_1_1	460	31.06	460	469	14,560	0	-	14,560	5,786
2	1_1_2	798	31.35	798	814	25,505	0	-	25,505	10,135
3	1_1_3	669	29.47	669	682	20,084	0	-	20,084	7,981
4	1_1_4	535	30.08	535	545	16,391	0	-	16,391	6,513
5	1_1_5	430	30.68	430	438	13,448	0	-	13,448	5,344
6	1_1_6	23	36.25	23	24	861	0	-	861	342
7	1_1_7	(294)	45.99	0	0	-	-294	(13,512)	(13,512)	(5,369)
8	1_1_8	(250)	49.93	0	0	-	-250	(12,473)	(12,473)	(4,957)
9	1_1_9	(445)	41.75	0	0	-	-445	(18,597)	(18,597)	(7,390)
10	1_1_10	(419)	40.97	0	0	-	-419	(17,181)	(17,181)	(6,827)
11	1_1_11	(830)	52.98	0	0	-	-830	(43,974)	(43,974)	(17,474)
12	1_1_12	(658)	49.93	0	0	-	-658	(32,844)	(32,844)	(13,052)
13	1_1_13	(407)	50.74	0	0	-	-407	(20,628)	(20,628)	(8,197)
14	1_1_14	(444)	37.02	0	0	-	-444	(16,453)	(16,453)	(6,538)
15	1_1_15	(436)	35.36	0	0	-	-436	(15,410)	(15,410)	(6,124)
16	1_1_16	(406)	32.51	0	0	-	-406	(13,212)	(13,212)	(5,250)
17	1_1_17	(430)	38.44	0	0	-	-430	(16,526)	(16,526)	(6,567)
18	1_1_18	(679)	121.27	0	0	-	-679	(82,360)	(82,360)	(32,728)
19	1_1_19	(1,144)	240.1	0	0	-	-1144	(274,712)	(274,712)	(109,165)
20	1_1_20	(1,037)	51.72	0	0	-	-1037	(53,609)	(53,609)	(21,303)
21	1_1_21	(1,031)	23.89	0	0	-	-1031	(24,640)	(24,640)	(9,791)
22	1_1_22	(923)	66.5	0	0	-	-923	(61,391)	(61,391)	(24,395)
23	1_1_23	(544)	47.26	0	0	-	-544	(25,706)	(25,706)	(10,215)
24	1_1_24	98	42.28	98	99	4,205	0	-	4,205	1,671
25	1_2_1	195	46.04	195	199	9,174	0	-	9,174	3,645
26	1_2_2	68	35.79	68	69	2,478	0	-	2,478	985
27	1_2_3	89	44.29	89	90	4,008	0	-	4,008	1,593
28	1_2_4	37	39.29	37	38	1,484	0	-	1,484	590
29	1_2_5	90	38.17	90	92	3,513	0	-	3,513	1,396
30	1_2_6	(7)	37.56	0	0	-	-7	(269)	(269)	(107)
31	1_2_7	(602)	41.19	0	0	-	-602	(24,785)	(24,785)	(9,849)
32	1_2_8	(971)	89.47	0	0	-	-971	(86,844)	(86,844)	(34,510)
33	1_2_9	(1,310)	48.66	0	0	-	-1310	(63,726)	(63,726)	(25,323)
34	1_2_10	(1,284)	48.08	0	0	-	-1284	(61,732)	(61,732)	(24,531)
35	1_2_11	(846)	92.18	0	0	-	-846	(77,955)	(77,955)	(30,978)
36	1_2_12	(369)	80.96	0	0	-	-369	(29,886)	(29,886)	(11,876)
37	1_2_13	(35)	64.88	0	0	-	-35	(2,276)	(2,276)	(904)
38	1_2_14	(141)	50.15	0	0	-	-141	(7,048)	(7,048)	(2,801)
39	1_2_15	(285)	37.33	0	0	-	-285	(10,645)	(10,645)	(4,230)
40	1_2_16	(332)	34.01	0	0	-	-332	(11,287)	(11,287)	(4,485)
41	1_2_17	(276)	39.05	0	0	-	-276	(10,765)	(10,765)	(4,278)
42	1_2_18	(189)	114.15	0	0	-	-189	(21,548)	(21,548)	(8,563)
43	1_2_19	(160)	298.44	0	0	-	-160	(47,621)	(47,621)	(18,924)

2018 Hourly Load by COS Class--Unadjusted and Adjusted for Line Losses

Source: MECNRDCSCDE-2.1b 2018 TSA by COS Class

		Comb. Alt. Metal Mltg. & Process Heat		Commercial OPL		General Service		Interruptible Primary Supply		Interruptible Rider	
		Line Loss Factor:	1.07468	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.07468	*Line Loss Factor:*	1.07468
Hour	Month_Day_Hour	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)
1	1_1_1	15,178	16,311	6,494	7,224	685,201	762,212	56,803	61,045	64,860	69,704
2	1_1_2	15,319	16,463	6,494	7,224	673,956	749,704	56,829	61,073	80,391	86,395
3	1_1_3	14,984	16,103	6,494	7,224	664,431	739,108	56,768	61,007	78,814	84,700
4	1_1_4	14,819	15,926	6,494	7,224	658,631	732,656	57,188	61,459	81,011	87,061
5	1_1_5	14,745	15,846	6,494	7,224	663,482	738,052	57,798	62,115	82,420	88,576
6	1_1_6	14,263	15,328	6,494	7,224	673,825	749,557	58,811	63,204	83,160	89,371
7	1_1_7	14,214	15,275	6,494	7,224	689,293	766,764	60,016	64,498	93,204	100,164
8	1_1_8	14,504	15,588	5,412	6,020	700,692	779,444	61,490	66,082	90,244	96,983
9	1_1_9	13,643	14,662	-	-	666,324	741,213	60,696	65,229	86,212	92,651
10	1_1_10	14,540	15,626	-	-	672,416	747,990	60,143	64,635	92,359	99,256
11	1_1_11	14,891	16,003	-	-	691,769	769,519	60,223	64,721	89,308	95,978
12	1_1_12	15,924	17,114	-	-	697,651	776,061	61,173	65,741	82,669	88,843
13	1_1_13	16,338	17,558	-	-	699,351	777,952	60,120	64,610	77,541	83,332
14	1_1_14	16,058	17,257	-	-	696,250	774,504	60,228	64,726	76,171	81,860
15	1_1_15	16,653	17,896	-	-	694,781	772,869	61,165	65,734	79,719	85,673
16	1_1_16	15,942	17,132	-	-	692,944	770,825	60,698	65,231	72,390	77,796
17	1_1_17	15,985	17,179	-	-	702,810	781,800	60,236	64,734	82,737	88,916
18	1_1_18	16,489	17,720	4,113	4,575	758,728	844,004	61,836	66,455	93,143	100,100
19	1_1_19	16,996	18,265	6,494	7,224	763,714	849,550	62,080	66,716	93,712	100,711
20	1_1_20	19,901	21,387	6,494	7,224	750,247	834,569	62,584	67,257	93,328	100,298
21	1_1_21	19,728	21,202	6,494	7,224	733,755	816,223	60,171	64,665	86,292	92,736
22	1_1_22	20,565	22,101	6,494	7,224	714,054	794,308	59,994	64,475	111,639	119,976
23	1_1_23	23,764	25,539	6,494	7,224	690,360	767,951	59,575	64,024	106,881	114,863
24	1_1_24	26,529	28,511	6,494	7,224	672,035	747,567	58,433	62,797	115,185	123,787
25	1_2_1	29,404	31,599	6,494	7,224	660,392	734,615	59,688	64,145	125,022	134,359
26	1_2_2	30,010	32,251	6,494	7,224	654,803	728,397	60,644	65,174	134,839	144,910
27	1_2_3	30,132	32,382	6,494	7,224	651,819	725,078	61,037	65,595	131,249	141,051
28	1_2_4	31,268	33,603	6,494	7,224	655,088	728,715	62,739	67,424	125,302	134,660
29	1_2_5	34,363	36,929	6,494	7,224	676,756	752,818	64,543	69,363	132,943	142,871
30	1_2_6	44,651	47,986	6,494	7,224	739,489	822,602	68,943	74,092	144,928	155,752
31	1_2_7	50,353	54,113	6,494	7,224	859,080	955,634	75,722	81,377	157,468	169,228
32	1_2_8	54,880	58,979	5,412	6,020	985,508	1,096,271	82,001	88,125	177,480	190,735
33	1_2_9	58,249	62,600	-	-	1,059,719	1,178,823	84,646	90,968	216,659	232,840
34	1_2_10	59,319	63,749	-	-	1,136,768	1,264,532	87,133	93,640	175,451	188,554
35	1_2_11	60,571	65,094	-	-	1,190,202	1,323,971	89,296	95,965	199,181	214,057
36	1_2_12	62,542	67,213	-	-	1,199,938	1,334,802	88,025	94,599	255,741	274,840
37	1_2_13	62,019	66,651	-	-	1,186,629	1,319,997	87,998	94,570	257,604	276,843
38	1_2_14	64,174	68,967	-	-	1,187,453	1,320,913	87,354	93,878	264,588	284,348
39	1_2_15	63,819	68,585	-	-	1,167,611	1,298,841	86,446	92,903	254,268	273,257
40	1_2_16	61,143	65,709	-	-	1,128,268	1,255,076	87,545	94,083	242,441	260,547
41	1_2_17	61,571	66,169	-	-	1,063,682	1,183,232	83,545	89,785	248,703	267,277
42	1_2_18	60,285	64,787	4,113	4,575	1,022,851	1,137,811	78,066	83,896	244,676	262,949
43	1_2_19	60,217	64,714	6,494	7,224	968,472	1,077,320	78,384	84,238	267,561	287,543
44	1_2_20	60,544	65,066	6,494	7,224	922,646	1,026,344	78,506	84,369	164,285	176,555
45	1_2_21	61,345	65,926	6,494	7,224	879,340	978,171	78,127	83,962	186,944	200,905
46	1_2_22	61,588	66,187	6,494	7,224	835,139	929,002	77,649	83,449	194,046	208,538
47	1_2_23	61,120	65,685	6,494	7,224	791,789	880,780	76,004	81,680	182,556	196,190
48	1_2_24	61,882	66,504	6,494	7,224	758,117	843,323	71,983	77,359	139,134	149,525
49	1_3_1	63,286	68,012	6,494	7,224	737,539	820,432	74,100	79,634	148,648	159,749
50	1_3_2	62,480	67,147	6,494	7,224	725,946	807,537	72,968	78,417	151,172	162,461
51	1_3_3	60,647	65,176	6,494	7,224	716,334	796,844	72,992	78,443	148,183	159,249
52	1_3_4	62,290	66,942	6,494	7,224	712,690	792,791	73,306	78,781	146,960	157,936
53	1_3_5	62,625	67,302	6,494	7,224	730,486	812,587	74,918	80,513	139,422	149,834
54	1_3_6	65,204	70,074	6,494	7,224	790,827	879,709	79,863	85,827	160,961	172,982
55	1_3_7	69,807	75,021	6,494	7,224	915,890	1,018,829	85,330	91,703	181,326	194,868

Large General Service		Primary Supply		Residential		Residential OPL		Schools - Primary		Schools - Secondary	
Line Loss Factor:	1.11239	*Line Loss Factor:*	1.07468	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.07468	*Line Loss Factor:*	1.11239
Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)
190,073	211,435	1,179,165	1,267,229	2,083,474	2,317,640	1,742	1,938	63,493	68,235	22,524	25,055
186,683	207,664	1,174,242	1,261,938	1,962,219	2,182,757	1,742	1,938	63,085	67,796	22,624	25,166
184,561	205,304	1,171,161	1,258,627	1,848,579	2,056,344	1,742	1,938	63,183	67,902	22,856	25,425
183,509	204,134	1,171,313	1,258,790	1,789,979	1,991,159	1,742	1,938	63,514	68,257	22,846	25,414
185,125	205,931	1,177,566	1,265,510	1,760,535	1,958,405	1,742	1,938	63,827	68,594	23,450	26,086
190,153	211,525	1,192,152	1,281,186	1,748,817	1,945,371	1,742	1,938	65,742	70,652	24,665	27,438
196,870	218,997	1,211,530	1,302,010	1,795,611	1,997,424	1,742	1,938	68,312	73,413	25,897	28,808
205,554	228,657	1,229,402	1,321,217	1,835,785	2,042,112	1,452	1,615	69,598	74,796	26,055	28,984
205,676	228,793	1,222,842	1,314,167	1,942,555	2,160,883	-	-	67,552	72,597	24,881	27,677
210,799	234,492	1,235,886	1,328,185	2,077,555	2,311,056	-	-	66,906	71,903	24,438	27,184
216,503	240,837	1,251,093	1,344,529	2,179,466	2,424,421	-	-	66,969	71,971	24,300	27,031
217,846	242,330	1,246,529	1,339,623	2,226,610	2,476,864	-	-	66,819	71,809	23,940	26,631
217,907	242,398	1,245,734	1,338,769	2,272,590	2,528,011	-	-	67,044	72,051	23,557	26,204
217,025	241,416	1,240,096	1,332,710	2,274,870	2,530,548	-	-	66,688	71,668	23,390	26,019
216,231	240,534	1,241,872	1,334,618	2,263,584	2,517,993	-	-	66,526	71,494	23,370	25,996
215,416	239,627	1,247,835	1,341,027	2,277,984	2,534,012	-	-	66,193	71,136	23,096	25,692
218,032	242,537	1,251,187	1,344,629	2,376,471	2,643,568	-	-	65,999	70,928	22,670	25,218
232,538	258,673	1,275,550	1,370,812	2,629,617	2,925,165	1,103	1,227	68,201	73,295	23,663	26,323
234,272	260,603	1,271,478	1,366,436	2,738,626	3,046,425	1,742	1,938	68,005	73,084	23,896	26,582
229,079	254,826	1,272,427	1,367,455	2,703,949	3,007,852	1,742	1,938	67,510	72,552	23,515	26,158
224,694	249,948	1,270,848	1,365,758	2,635,854	2,932,103	1,742	1,938	66,347	71,302	23,196	25,803
219,513	244,184	1,277,131	1,372,511	2,515,007	2,797,674	1,742	1,938	65,505	70,397	22,743	25,299
209,991	233,592	1,269,805	1,364,638	2,292,285	2,549,920	1,742	1,938	64,223	69,019	22,260	24,762
202,114	224,830	1,247,455	1,340,618	2,108,076	2,345,007	1,742	1,938	62,232	66,879	21,849	24,305
196,497	218,581	1,289,720	1,386,040	1,884,763	2,096,595	1,742	1,938	63,471	68,211	21,925	24,389
192,333	213,950	1,290,169	1,386,523	1,789,188	1,990,279	1,742	1,938	63,250	67,974	22,138	24,626
190,690	212,122	1,294,650	1,391,338	1,702,366	1,893,698	1,742	1,938	63,312	68,040	22,450	24,973
191,571	213,102	1,311,967	1,409,949	1,672,606	1,860,594	1,742	1,938	63,780	68,543	22,498	25,027
201,024	223,617	1,353,096	1,454,149	1,664,376	1,851,439	1,742	1,938	64,344	69,149	23,164	25,767
216,037	240,318	1,421,487	1,527,648	1,734,817	1,929,797	1,742	1,938	67,564	72,610	24,681	27,455
240,840	267,909	1,517,054	1,630,352	1,815,791	2,019,871	1,742	1,938	73,578	79,073	27,092	30,137
263,032	292,595	1,597,873	1,717,206	1,882,247	2,093,796	1,452	1,615	77,640	83,438	28,717	31,944
269,936	300,275	1,639,536	1,761,982	1,896,750	2,109,930	-	-	79,215	85,131	28,768	32,001
277,275	308,438	1,663,565	1,787,804	1,910,736	2,125,488	-	-	80,624	86,646	29,161	32,438
283,100	314,918	1,684,862	1,810,692	1,916,655	2,132,071	-	-	81,389	87,467	29,285	32,577
283,355	315,202	1,613,669	1,734,183	1,920,616	2,136,478	-	-	81,845	87,957	28,959	32,214
282,701	314,475	1,607,847	1,727,926	1,896,378	2,109,516	-	-	82,460	88,618	28,577	31,789
282,755	314,534	1,610,022	1,730,264	1,884,444	2,096,240	-	-	83,124	89,332	28,244	31,419
279,870	311,325	1,600,713	1,720,259	1,882,584	2,094,172	-	-	81,467	87,551	27,805	30,930
275,928	306,940	1,575,782	1,693,466	1,927,838	2,144,511	-	-	76,606	82,327	26,982	30,015
274,047	304,847	1,556,736	1,672,998	2,071,123	2,303,901	-	-	73,693	79,196	25,834	28,738
284,391	316,354	1,554,545	1,670,643	2,413,342	2,684,583	1,103	1,227	71,738	77,096	26,165	29,106
285,805	317,927	1,549,422	1,665,138	2,626,998	2,922,252	1,742	1,938	69,479	74,668	26,035	28,961
281,050	312,637	1,603,500	1,723,254	2,653,005	2,951,181	1,742	1,938	67,631	72,682	25,737	28,629
274,778	305,661	1,588,857	1,707,518	2,604,162	2,896,849	1,742	1,938	66,114	71,051	25,131	27,956
263,636	293,266	1,567,063	1,684,096	2,488,598	2,768,297	1,742	1,938	64,400	69,210	24,479	27,230
247,352	275,153	1,533,950	1,648,509	2,297,333	2,555,535	1,742	1,938	62,735	67,421	23,895	26,580
233,011	259,199	1,481,732	1,592,391	2,130,548	2,370,004	1,742	1,938	59,704	64,163	23,237	25,848
224,112	249,300	1,483,374	1,594,156	1,925,355	2,141,750	1,742	1,938	61,605	66,206	23,073	25,667
218,082	242,592	1,462,793	1,572,039	1,834,915	2,041,145	1,742	1,938	61,681	66,288	23,304	25,923
214,539	238,652	1,458,401	1,567,319	1,782,789	1,983,161	1,742	1,938	61,442	66,030	23,558	26,206
214,843	238,989	1,456,584	1,565,366	1,753,524	1,950,607	1,742	1,938	61,648	66,252	23,580	26,230
221,134	245,988	1,478,110	1,588,499	1,765,632	1,964,075	1,742	1,938	62,499	67,166	24,145	26,858
235,084	261,506	1,534,650	1,649,262	1,825,136	2,030,267	1,742	1,938	67,540	72,584	26,028	28,954
255,832	284,585	1,614,916	1,735,522	1,930,044	2,146,965	1,742	1,938	72,843	78,283	29,286	32,578

Space Heating		Street Lighting		Time-of-Day		Traffic and Signal Lights			
Line Loss Factor:	1.11239	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.11239	*Line Loss Factor:*	1.11239		
Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	Load (kWh)	Adjusted Load (kWh)	2018 Total Load (kWh)	2018 Total Adjusted Load (kWh)
72,706	80,878	40,383	44,921	28,530	31,737	6,794	7,557	4,517,420	4,973,122
72,170	80,281	40,383	44,921	27,843	30,972	6,794	7,557	4,390,774	4,831,851
70,688	78,632	40,383	44,921	27,210	30,268	6,794	7,557	4,258,647	4,685,061
70,355	78,262	40,383	44,921	27,001	30,036	6,794	7,557	4,195,581	4,614,796
70,551	78,480	40,383	44,921	27,071	30,114	6,794	7,557	4,181,982	4,599,348
70,679	78,622	40,383	44,921	26,806	29,819	6,794	7,557	4,204,487	4,623,712
72,421	80,561	40,383	44,921	27,031	30,069	6,794	7,557	4,309,811	4,739,624
73,573	81,842	33,652	37,434	26,201	29,145	6,794	7,557	4,380,406	4,817,476
76,533	85,135	-	-	26,480	29,456	6,794	7,557	4,400,188	4,840,021
78,294	87,093	-	-	26,966	29,996	6,794	7,557	4,567,095	5,024,974
78,938	87,810	-	-	26,653	29,648	6,794	7,557	4,706,908	5,180,024
77,401	86,100	-	-	25,830	28,733	6,794	7,557	4,749,185	5,227,406
76,689	85,308	-	-	25,580	28,454	6,794	7,557	4,789,243	5,272,205
75,344	83,812	-	-	25,137	27,962	6,794	7,557	4,778,052	5,260,040
74,212	82,553	-	-	24,897	27,695	6,794	7,557	4,769,804	5,250,613
74,504	82,878	-	-	25,263	28,103	6,794	7,557	4,779,058	5,261,016
76,877	85,518	-	-	26,426	29,396	6,794	7,557	4,906,222	5,401,979
80,767	89,845	25,576	28,450	28,371	31,559	6,794	7,557	5,306,490	5,845,759
81,843	91,042	40,383	44,921	29,893	33,253	6,794	7,557	5,439,928	5,994,306
81,391	90,538	40,383	44,921	31,147	34,648	6,794	7,557	5,390,490	5,939,180
79,795	88,764	40,383	44,921	31,341	34,863	6,794	7,557	5,287,433	5,825,007
77,866	86,618	40,383	44,921	30,562	33,997	6,794	7,557	5,169,991	5,693,180
74,343	82,698	40,383	44,921	29,024	32,286	6,794	7,557	4,897,924	5,390,934
72,749	80,925	40,383	44,921	28,269	31,447	6,794	7,557	4,670,338	5,138,312
68,917	76,663	40,383	44,921	26,691	29,691	6,794	7,557	4,481,901	4,926,529
68,134	75,792	40,383	44,921	26,357	29,319	6,794	7,557	4,387,278	4,820,834
66,846	74,359	40,383	44,921	25,770	28,666	6,794	7,557	4,295,733	4,718,944
66,862	74,377	40,383	44,921	25,679	28,565	6,794	7,557	4,284,772	4,706,198
66,874	74,390	40,383	44,921	25,535	28,405	6,794	7,557	4,362,429	4,790,538
68,899	76,642	40,383	44,921	26,064	28,993	6,794	7,557	4,612,974	5,065,536
70,914	78,885	40,383	44,921	26,237	29,186	6,794	7,557	4,969,542	5,457,405
73,164	81,387	33,652	37,434	25,868	28,775	6,794	7,557	5,295,718	5,815,879
73,989	82,305	-	-	25,584	28,459	6,794	7,557	5,439,846	5,972,871
73,797	82,091	-	-	25,167	27,996	6,794	7,557	5,525,790	6,068,935
72,413	80,552	-	-	24,314	27,047	6,794	7,557	5,638,061	6,191,968
70,960	78,935	-	-	23,357	25,983	6,794	7,557	5,635,802	6,189,964
68,228	75,897	-	-	22,425	24,946	6,794	7,557	5,589,661	6,138,783
66,585	74,068	-	-	21,924	24,388	6,794	7,557	5,587,460	6,135,908
65,899	73,306	-	-	21,658	24,092	6,794	7,557	5,538,933	6,082,777
66,933	74,455	-	-	22,227	24,725	6,794	7,557	5,498,486	6,039,413
71,137	79,132	-	-	23,736	26,404	6,794	7,557	5,560,601	6,109,236
77,958	86,719	25,576	28,450	26,581	29,568	6,794	7,557	5,898,184	6,485,324
81,541	90,705	40,383	44,921	28,746	31,977	6,794	7,557	6,098,072	6,707,084
83,114	92,455	40,383	44,921	30,725	34,178	6,794	7,557	6,026,155	6,628,992
82,691	91,985	40,383	44,921	30,946	34,424	6,794	7,557	5,933,848	6,526,049
81,387	90,534	40,383	44,921	30,396	33,813	6,794	7,557	5,743,795	6,315,263
79,115	88,007	40,383	44,921	29,084	32,353	6,794	7,557	5,440,347	5,979,534
78,518	87,343	40,383	44,921	28,712	31,939	6,794	7,557	5,121,990	5,629,240
75,128	83,572	40,383	44,921	27,215	30,273	6,794	7,557	4,898,847	5,380,393
74,176	82,513	40,383	44,921	26,895	29,918	6,794	7,557	4,769,824	5,237,619
73,610	81,883	40,383	44,921	26,948	29,977	6,794	7,557	4,694,856	5,154,581
73,286	81,523	40,383	44,921	26,813	29,826	6,794	7,557	4,660,936	5,116,882
74,076	82,401	40,383	44,921	27,038	30,077	6,794	7,557	4,715,496	5,176,941
75,301	83,764	40,383	44,921	27,303	30,371	6,794	7,557	4,943,309	5,426,940
77,368	86,064	40,383	44,921	27,654	30,762	6,794	7,557	5,315,708	5,836,820

MPSC Case No.:	U-20561
Requestor:	MECNRDCSC
Question No.:	MECNRDCSCDE-7.17d]
Respondent:	A. M. Brasil
Page:	1 of 1

Question: Reference DTE response to MECNRDCSEDE-4.1a.

d. Please provide a corrected file with 8760 hours of actual usage data for each class for the historical test year.

Answer: For Load Research purposes, an 8759 file was intentionally used, and is consistent with past practice. The purpose of this practice is to align the underlying hourly usage data in November with a 24-hour day by adding usages for both hours (hours ending 2 on 11/4/18) together and dividing by two. If 8760 hours are needed, then a null value can be inserted in hour ending 2 on March 11, 2018. and hour ending 2 on November 4, 2018 can be multiplied by two.

Attachments: *None*

2018 Hourly Production Cost Allocation to COS Classes

		Imported	Comb. Metal Mltg. & Process Heat		Commercial OPL		General Service		Interruptible Primary Supply		Interruptible Rider		Large General Service		Primary Supply	
Hour	Month_Day_Hour	Total System Hourly Costs ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)
1	1_1_1	323,351	0.00328	1,061	0.00145	470	0.15327	49,559	0.01227	3,969	0.01402	4,532	0.04252	13,747	0.25482	82,395
2	1_1_2	325,067	0.00341	1,108	0.00150	486	0.15516	50,437	0.01264	4,109	0.01788	5,812	0.04298	13,971	0.26117	84,898
3	1_1_3	327,329	0.00344	1,125	0.00154	505	0.15776	51,639	0.01302	4,262	0.01808	5,918	0.04382	14,344	0.26865	87,936
4	1_1_4	329,793	0.00345	1,138	0.00157	516	0.15876	52,359	0.01332	4,392	0.01887	6,222	0.04423	14,588	0.27277	89,958
5	1_1_5	333,411	0.00345	1,149	0.00157	524	0.16047	53,502	0.01351	4,503	0.01926	6,421	0.04477	14,928	0.27515	91,738
6	1_1_6	329,899	0.00332	1,094	0.00156	515	0.16211	53,480	0.01367	4,510	0.01933	6,377	0.04575	15,092	0.27709	91,412
7	1_1_7	318,753	0.00322	1,027	0.00152	486	0.16178	51,567	0.01361	4,338	0.02113	6,736	0.04621	14,728	0.27471	87,564
8	1_1_8	321,007	0.00324	1,039	0.00125	401	0.16180	51,937	0.01372	4,403	0.02013	6,462	0.04746	15,236	0.27425	88,038
9	1_1_9	336,193	0.00303	1,018	0.00000	-	0.15314	51,485	0.01348	4,531	0.01914	6,436	0.04727	15,892	0.27152	91,283
10	1_1_10	345,833	0.00311	1,075	0.00000	-	0.14885	51,479	0.01286	4,448	0.01975	6,831	0.04667	16,138	0.26432	91,409
11	1_1_11	395,679	0.00309	1,222	0.00000	-	0.14856	58,780	0.01249	4,944	0.01853	7,331	0.04649	18,396	0.25956	102,702
12	1_1_12	381,912	0.00327	1,250	0.00000	-	0.14846	56,699	0.01258	4,803	0.01700	6,491	0.04636	17,705	0.25627	97,872
13	1_1_13	358,462	0.00333	1,194	0.00000	-	0.14756	52,894	0.01225	4,393	0.01581	5,666	0.04598	16,481	0.25393	91,024
14	1_1_14	360,525	0.00328	1,183	0.00000	-	0.14724	53,085	0.01231	4,436	0.01556	5,611	0.04590	16,547	0.25336	91,344
15	1_1_15	358,358	0.00341	1,221	0.00000	-	0.14720	52,749	0.01252	4,486	0.01632	5,847	0.04581	16,417	0.25418	91,089
16	1_1_16	361,113	0.00326	1,176	0.00000	-	0.14652	52,909	0.01240	4,477	0.01479	5,340	0.04555	16,448	0.25490	92,047
17	1_1_17	375,704	0.00318	1,195	0.00000	-	0.14472	54,374	0.01198	4,502	0.01646	6,184	0.04490	16,868	0.24891	93,518
18	1_1_18	416,021	0.00303	1,261	0.00078	326	0.14438	60,065	0.01137	4,729	0.01712	7,124	0.04425	18,409	0.23450	97,555
19	1_1_19	405,456	0.00305	1,235	0.00121	489	0.14173	57,464	0.01113	4,513	0.01680	6,812	0.04348	17,627	0.22796	92,426
20	1_1_20	475,202	0.00360	1,711	0.00122	578	0.14052	66,775	0.01132	5,381	0.01689	8,025	0.04291	20,389	0.23024	109,412
21	1_1_21	477,256	0.00364	1,737	0.00124	592	0.14012	66,875	0.01110	5,298	0.01592	7,598	0.04291	20,479	0.23446	111,900
22	1_1_22	434,185	0.00388	1,686	0.00127	551	0.13952	60,577	0.01132	4,917	0.02107	9,150	0.04289	18,622	0.24108	104,673
23	1_1_23	379,100	0.00474	1,796	0.00134	508	0.14245	54,004	0.01188	4,502	0.02131	8,077	0.04333	16,427	0.25314	95,964
24	1_1_24	354,692	0.00555	1,968	0.00141	499	0.14549	51,604	0.01222	4,335	0.02409	8,545	0.04376	15,520	0.26091	92,541
25	1_2_1	359,852	0.00641	2,308	0.00147	528	0.14911	53,659	0.01302	4,685	0.02727	9,814	0.04437	15,966	0.28134	101,242
26	1_2_2	358,262	0.00669	2,397	0.00150	537	0.15109	54,131	0.01352	4,843	0.03006	10,769	0.04438	15,900	0.28761	103,040
27	1_2_3	354,623	0.00686	2,434	0.00153	543	0.15365	54,489	0.01390	4,929	0.02989	10,600	0.04495	15,941	0.29484	104,557
28	1_2_4	361,765	0.00714	2,583	0.00154	555	0.15484	56,016	0.01433	5,183	0.02861	10,351	0.04528	16,381	0.29959	108,383
29	1_2_5	363,404	0.00771	2,801	0.00151	548	0.15715	57,108	0.01448	5,262	0.02982	10,838	0.04668	16,963	0.30355	110,310
30	1_2_6	393,672	0.00947	3,729	0.00143	561	0.16239	63,929	0.01463	5,758	0.03075	12,104	0.04744	18,677	0.30158	118,722
31	1_2_7	398,769	0.00992	3,954	0.00132	528	0.17511	69,828	0.01491	5,946	0.03101	12,365	0.04909	19,576	0.29874	119,129
32	1_2_8	449,041	0.01014	4,554	0.00104	465	0.18850	84,643	0.01515	6,804	0.03280	14,727	0.05031	22,591	0.29526	132,585
33	1_2_9	502,859	0.01048	5,270	0.00000	-	0.19736	99,246	0.01523	7,659	0.03898	19,603	0.05027	25,280	0.29500	148,342
34	1_2_10	510,006	0.01050	5,357	0.00000	-	0.20836	106,266	0.01543	7,869	0.03107	15,845	0.05082	25,920	0.29458	150,239
35	1_2_11	469,437	0.01051	4,935	0.00000	-	0.21382	100,375	0.01550	7,275	0.03457	16,228	0.05086	23,875	0.29243	137,276
36	1_2_12	439,703	0.01086	4,774	0.00000	-	0.21564	94,818	0.01528	6,720	0.04440	19,523	0.05092	22,390	0.28016	123,188
37	1_2_13	410,774	0.01086	4,460	0.00000	-	0.21503	88,327	0.01541	6,328	0.04510	18,525	0.05123	21,043	0.28148	115,624
38	1_2_14	414,380	0.01124	4,658	0.00000	-	0.21528	89,206	0.01530	6,340	0.04634	19,203	0.05126	21,242	0.28199	116,851
39	1_2_15	418,606	0.01128	4,720	0.00000	-	0.21353	89,384	0.01527	6,393	0.04492	18,805	0.05118	21,425	0.28281	118,385
40	1_2_16	418,906	0.01088	4,558	0.00000	-	0.20781	87,055	0.01558	6,526	0.04314	18,072	0.05082	21,290	0.28040	117,462
41	1_2_17	421,509	0.01083	4,565	0.00000	-	0.19368	81,637	0.01470	6,195	0.04375	18,441	0.04990	21,033	0.27385	115,429
42	1_2_18	449,541	0.00999	4,491	0.00071	317	0.17544	78,869	0.01294	5,815	0.04055	18,227	0.04878	21,929	0.25760	115,803
43	1_2_19	457,600	0.00965	4,415	0.00108	493	0.16062	73,502	0.01256	5,747	0.04287	19,618	0.04740	21,691	0.24827	113,606
44	1_2_20	463,065	0.00982	4,545	0.00109	505	0.15483	71,695	0.01273	5,894	0.02663	12,333	0.04716	21,839	0.25996	120,377
45	1_2_21	433,700	0.01010	4,381	0.00111	480	0.14989	65,006	0.01287	5,580	0.03079	13,351	0.04684	20,313	0.26165	113,476
46	1_2_22	418,941	0.01048	4,391	0.00114	479	0.14710	61,628	0.01321	5,536	0.03302	13,834	0.04644	19,455	0.26667	111,719
47	1_2_23	408,830	0.01098	4,491	0.00121	494	0.14730	60,220	0.01366	5,585	0.03281	13,414	0.04602	18,813	0.27569	112,711
48	1_2_24	386,058	0.01181	4,561	0.00128	495	0.14981	57,836	0.01374	5,305	0.02656	10,255	0.04605	17,776	0.28288	109,208
49	1_3_1	362,836	0.01264	4,587	0.00134	487	0.15249	55,327	0.01480	5,370	0.02969	10,773	0.04633	16,812	0.29629	107,505
50	1_3_2	353,043	0.01282	4,526	0.00138	487	0.15418	54,432	0.01497	5,286	0.03102	10,951	0.04632	16,352	0.30014	105,964
51	1_3_3	349,040	0.01264	4,413	0.00140	489	0.15459	53,958	0.01522	5,312	0.03089	10,784	0.04630	16,160	0.30406	106,130
52	1_3_4	345,797	0.01308	4,524	0.00141	488	0.15494	53,577	0.01540	5,324	0.03087	10,673	0.04671	16,151	0.30592	105,787
53	1_3_5	349,243	0.01300	4,540	0.00140	487	0.15696	54,818	0.01555	5,431	0.02894	10,108	0.04752	16,595	0.30684	107,162
54	1_3_6	353,398	0.01291	4,563	0.00133	470	0.16210	57,286	0.01581	5,589	0.03187	11,264	0.04819	17,029	0.30390	107,399
55	1_3_7	384,714	0.01285	4,945	0.00124	476	0.17455	67,153	0.01571	6,044	0.03339	12,844	0.04876	18,757	0.29734	114,391
56	1_3_8	447,013	0.01331	5,948	0.00098	436	0.18950	84,711	0.01568	7,008	0.03482	15,565	0.04983	22,276	0.29303	130,987
57	1_3_9	431,243	0.01387	5,983	0.00000	-	0.20251	87,329	0.01605	6,924	0.03314	14,291	0.05075	21,887	0.29364	126,628
58	1_3_10	392,045	0.01394	5,466	0.00000	-	0.21279	83,422	0.01601	6,277	0.03507	13,748	0.05147	20,179	0.29454	115,474
59	1_3_11	389,790	0.01364	5,317	0.00000	-	0.21859	85,205	0.01586	6,181	0.03500	13,643	0.05148	20,065	0.29301	114,211
60	1_3_12	391,972	0.01414	5,543	0.00000	-	0.22065	86,489	0.01580	6,192	0.04613	18,083	0.05146	20,173	0.27994	109,729
61	1_3_13	395,662	0.01443	5,709	0.00000	-	0.21919	86,724	0.01483	5,868	0.04749	18,790	0.05151	20,381	0.28065	111,041
62	1_3_14	391,088	0.01461	5,712	0.00000	-	0.22056	86,259	0.01452	5,679	0.04717	18,449	0.05172	20,226	0.28110	109,937
63	1_3_15	386,371	0.01361	5,258	0.00000	-	0.21782	84,161	0.01557	6,015	0.04663	18,017	0.05157	19,924	0.28087	108,521

Residential		Residential OPL		Schools - Primary		Schools - Secondary		Space Heating		Street Lighting		Time-of-Day		Traffic and Signal Lights	
Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)	Hourly Load Ratios	Hourly Cost ($)
0.46603	150,692	0.00039	126	0.01372	4,437	0.00504	1,629	0.01626	5,259	0.00903	2,921	0.00638	2,063	0.00152	491
0.45174	146,847	0.00040	130	0.01403	4,561	0.00521	1,693	0.01662	5,401	0.00930	3,022	0.00641	2,084	0.00156	508
0.43892	143,669	0.00041	135	0.01449	4,744	0.00543	1,776	0.01678	5,494	0.00959	3,138	0.00646	2,115	0.00161	528
0.43147	142,297	0.00042	138	0.01479	4,878	0.00551	1,816	0.01696	5,593	0.00973	3,210	0.00651	2,146	0.00164	540
0.42580	141,966	0.00042	140	0.01491	4,972	0.00567	1,891	0.01706	5,689	0.00977	3,256	0.00655	2,183	0.00164	548
0.42074	138,801	0.00042	138	0.01528	5,041	0.00593	1,958	0.01700	5,610	0.00972	3,205	0.00645	2,128	0.00163	539
0.42143	134,332	0.00041	130	0.01549	4,937	0.00608	1,937	0.01700	5,418	0.00948	3,021	0.00634	2,022	0.00159	508
0.42390	136,074	0.00034	108	0.01553	4,984	0.00602	1,931	0.01699	5,453	0.00777	2,494	0.00605	1,942	0.00157	504
0.44646	150,097	0.00000	-	0.01500	5,043	0.00572	1,922	0.01759	5,914	0.00000	-	0.00609	2,046	0.00156	525
0.45991	159,053	0.00000	-	0.01431	4,949	0.00541	1,871	0.01733	5,994	0.00000	-	0.00597	2,064	0.00150	520
0.46803	185,191	0.00000	-	0.01389	5,498	0.00522	2,065	0.01695	6,707	0.00000	-	0.00572	2,265	0.00146	577
0.47382	180,959	0.00000	-	0.01374	5,246	0.00509	1,946	0.01647	6,290	0.00000	-	0.00550	2,099	0.00145	552
0.47950	171,882	0.00000	-	0.01367	4,899	0.00497	1,782	0.01618	5,800	0.00000	-	0.00540	1,935	0.00143	514
0.48109	173,445	0.00000	-	0.01363	4,912	0.00495	1,783	0.01593	5,745	0.00000	-	0.00532	1,917	0.00144	518
0.47956	171,855	0.00000	-	0.01362	4,880	0.00495	1,774	0.01572	5,634	0.00000	-	0.00527	1,890	0.00144	516
0.48166	173,933	0.00000	-	0.01352	4,883	0.00488	1,763	0.01575	5,689	0.00000	-	0.00534	1,929	0.00144	519
0.48937	183,858	0.00000	-	0.01313	4,933	0.00467	1,754	0.01583	5,948	0.00000	-	0.00544	2,044	0.00140	526
0.50039	208,173	0.00021	87	0.01254	5,216	0.00450	1,873	0.01537	6,394	0.00487	2,025	0.00540	2,246	0.00129	538
0.50822	206,061	0.00032	131	0.01219	4,943	0.00443	1,798	0.01519	6,158	0.00749	3,038	0.00555	2,249	0.00126	511
0.50644	240,662	0.00033	155	0.01222	5,805	0.00440	2,093	0.01524	7,244	0.00756	3,594	0.00583	2,772	0.00127	605
0.50336	240,234	0.00033	159	0.01224	5,842	0.00443	2,114	0.01524	7,273	0.00771	3,680	0.00599	2,856	0.00130	619
0.49141	213,362	0.00034	148	0.01237	5,369	0.00444	1,929	0.01521	6,606	0.00789	3,426	0.00597	2,593	0.00133	576
0.47300	179,315	0.00036	136	0.01280	4,854	0.00459	1,741	0.01534	5,815	0.00833	3,159	0.00599	2,270	0.00140	531
0.45638	161,873	0.00038	134	0.01302	4,617	0.00473	1,678	0.01575	5,586	0.00874	3,101	0.00612	2,171	0.00147	522
0.42557	153,143	0.00039	142	0.01385	4,982	0.00495	1,781	0.01556	5,600	0.00912	3,281	0.00603	2,169	0.00153	552
0.41285	147,908	0.00040	144	0.01410	5,051	0.00511	1,830	0.01572	5,633	0.00932	3,338	0.00608	2,179	0.00157	562
0.40130	142,309	0.00041	146	0.01442	5,113	0.00529	1,877	0.01576	5,588	0.00952	3,376	0.00607	2,154	0.00160	568
0.39535	143,024	0.00041	149	0.01456	5,269	0.00532	1,924	0.01580	5,717	0.00955	3,453	0.00607	2,196	0.00161	581
0.38648	140,448	0.00040	147	0.01443	5,246	0.00538	1,955	0.01553	5,643	0.00938	3,408	0.00593	2,155	0.00158	573
0.38097	149,976	0.00038	151	0.01433	5,643	0.00542	2,134	0.01513	5,956	0.00887	3,491	0.00572	2,253	0.00149	587
0.37012	147,591	0.00036	142	0.01449	5,778	0.00552	2,202	0.01445	5,764	0.00823	3,282	0.00535	2,133	0.00138	552
0.36001	161,661	0.00028	125	0.01435	6,442	0.00549	2,466	0.01399	6,284	0.00644	2,890	0.00495	2,222	0.00130	583
0.35325	177,636	0.00000	-	0.01425	7,167	0.00536	2,694	0.01378	6,929	0.00000	-	0.00476	2,396	0.00127	636
0.35022	178,616	0.00000	-	0.01428	7,281	0.00534	2,726	0.01353	6,899	0.00000	-	0.00461	2,353	0.00125	635
0.34433	161,641	0.00000	-	0.01413	6,631	0.00526	2,470	0.01301	6,107	0.00000	-	0.00437	2,051	0.00122	573
0.34515	151,765	0.00000	-	0.01421	6,248	0.00520	2,288	0.01275	5,607	0.00000	-	0.00420	1,846	0.00122	537
0.34364	141,158	0.00000	-	0.01444	5,930	0.00518	2,127	0.01236	5,079	0.00000	-	0.00406	1,669	0.00123	506
0.34163	141,567	0.00000	-	0.01456	6,033	0.00512	2,122	0.01207	5,002	0.00000	-	0.00397	1,647	0.00123	510
0.34428	144,117	0.00000	-	0.01439	6,025	0.00508	2,129	0.01205	5,045	0.00000	-	0.00396	1,658	0.00124	520
0.35509	148,748	0.00000	-	0.01363	5,710	0.00497	2,082	0.01233	5,164	0.00000	-	0.00409	1,715	0.00125	524
0.37712	158,958	0.00000	-	0.01296	5,464	0.00470	1,983	0.01295	5,460	0.00000	-	0.00432	1,822	0.00124	521
0.41395	186,086	0.00019	85	0.01189	5,344	0.00449	2,018	0.01337	6,011	0.00439	1,972	0.00456	2,050	0.00117	524
0.43570	199,375	0.00029	132	0.01113	5,094	0.00432	1,976	0.01352	6,189	0.00670	3,065	0.00477	2,182	0.00113	516
0.44519	206,153	0.00029	135	0.01096	5,077	0.00432	2,000	0.01395	6,458	0.00678	3,138	0.00516	2,387	0.00114	528
0.44389	192,515	0.00030	129	0.01089	4,722	0.00428	1,858	0.01410	6,113	0.00688	2,985	0.00527	2,288	0.00116	502
0.43835	183,643	0.00031	129	0.01096	4,591	0.00431	1,806	0.01434	6,006	0.00711	2,980	0.00535	2,243	0.00120	501
0.42738	174,726	0.00032	132	0.01128	4,610	0.00445	1,817	0.01472	6,017	0.00751	3,071	0.00541	2,212	0.00126	517
0.42102	162,537	0.00034	133	0.01140	4,400	0.00459	1,773	0.01552	5,990	0.00798	3,081	0.00567	2,190	0.00134	518
0.39807	144,433	0.00036	131	0.01231	4,465	0.00477	1,731	0.01553	5,636	0.00835	3,029	0.00563	2,042	0.00140	510
0.38971	137,584	0.00037	131	0.01266	4,468	0.00495	1,747	0.01575	5,562	0.00858	3,028	0.00571	2,017	0.00144	509
0.38474	134,289	0.00038	131	0.01281	4,471	0.00508	1,775	0.01589	5,545	0.00871	3,042	0.00582	2,030	0.00147	512
0.38121	131,821	0.00038	131	0.01295	4,477	0.00513	1,773	0.01593	5,509	0.00878	3,036	0.00583	2,016	0.00148	511
0.37939	132,499	0.00037	131	0.01297	4,531	0.00519	1,812	0.01592	5,559	0.00868	3,030	0.00581	2,029	0.00146	510
0.37411	132,209	0.00036	126	0.01337	4,727	0.00534	1,885	0.01543	5,455	0.00828	2,925	0.00560	1,978	0.00139	492
0.36783	141,510	0.00033	128	0.01341	5,160	0.00558	2,147	0.01474	5,673	0.00770	2,961	0.00527	2,028	0.00129	498
0.35693	159,554	0.00026	117	0.01359	6,075	0.00588	2,628	0.01406	6,284	0.00607	2,712	0.00484	2,165	0.00122	548
0.35043	151,119	0.00000	-	0.01360	5,866	0.00613	2,643	0.01397	6,024	0.00000	-	0.00470	2,025	0.00121	523
0.33705	132,140	0.00000	-	0.01392	5,457	0.00619	2,426	0.01336	5,236	0.00000	-	0.00446	1,750	0.00120	470
0.33367	130,062	0.00000	-	0.01404	5,471	0.00615	2,397	0.01306	5,091	0.00000	-	0.00432	1,686	0.00118	461
0.33338	130,674	0.00000	-	0.01421	5,570	0.00609	2,386	0.01286	5,042	0.00000	-	0.00415	1,628	0.00118	464
0.33372	132,039	0.00000	-	0.01426	5,644	0.00601	2,377	0.01262	4,995	0.00000	-	0.00411	1,625	0.00119	470
0.33246	130,022	0.00000	-	0.01426	5,578	0.00595	2,327	0.01242	4,856	0.00000	-	0.00404	1,579	0.00119	466
0.33609	129,854	0.00000	-	0.01426	5,509	0.00589	2,276	0.01246	4,813	0.00000	-	0.00403	1,559	0.00120	465

	2018 Production Cost Allocation Factors *Calculated using Probability of Dispatch Method*	
Cost of Service Class	**Total System**	**Peakers only**
R-1.1/R1.2 Metal Melt Process Heat	0.0129	0.0127
D-9 OPL Commercial	0.0006	0.0003
D-3/Other General Service	0.1757	0.1831
D-8 Interrupt Supply	0.0160	0.0154
R-10 Interrupt Supply	0.0398	0.0404
D-4 Lg Genl Service	0.0521	0.0516
D-11/Other Primary	0.3027	0.2841
D-1/Other Residential Service	0.3613	0.3752
D-9 OPL Residential	0.0002	0.0001
D-6.2 Primary Schools	0.0167	0.0178
D-3.2 Secondary Schools	0.0056	0.0060
D-2 Residential Space Ht	0.0074	0.0066
E-1 St Lgt D9 OPL E-2 Signals	0.0038	0.0020
D-1.2 TOU	0.0038	0.0035
E-1 St Lght and E-2 Signals	0.0014	0.0012
	1.0000	**1.0000**

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority	U-20561 ALJ Sharon Feldman

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PROOF OF SERVICE

On the date below, an electronic copy of the **Direct Testimony of David L. Gard on behalf of Michigan Environmental Council, Natural Resources Defense Council, Sierra Club, and Citizens Utility Board of Michigan and Exhibits MEC-75 through MEC-84** were served on the following:

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The statements above are true to the best of my knowledge, information and belief.

Date: November 6, 2019

By: ____ Digitally signed by Kimberly Flynn DN: cn=Kimberly Flynn, o=Olson Bzdok & Howard, P.C., ou, email=kimberly@envlaw.com, c=US Date: 2019.11.06 11:25:32 -05'00'

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