Guidehouse

Memorandum

To: Lynn Beck, Katie Smith, Roger Doherty, Michigan Public Service Commission (MPSC)

From: Will Supple, Neil Curtis, Stu Slote, Guidehouse

Date: 4/6/2021

Re: MI 2021 Energy Waste Reduction Potential Study Global Inputs Summary

This memo is a working document that outlines the assumptions and processes used to develop key market data inputs for the 2021 Michigan statewide energy waste reduction (EWR) potential study. The Guidehouse team completed several rounds of data requests and review from applicable Michigan utilities. The information received through the data request was used as the preferred source for model inputs, however, secondary sources such as U.S. Census Bureau (census) data and publicly available U.S. Energy Information Administration (EIA) data were used to estimate statewide input values after utility data gaps were identified. Please note that this document and the input values are subject to adjustment throughout the study period as new data and resulting modifications to modeling methodology may become relevant.

Technical Potential Market Characterization Inputs

Electric Energy Sales Forecast (kWh/year)

Guidehouse utilized sales forecasts from utilities and supplemented with MPSC filings for those utilities that did not provide data. Data granularity provided by the utilities varied but allowed for disaggregation at the sector level. For utilities that did not provide sector-level data, the average proportion of sales by sector from other utilities was applied. Average Compound Annual Growth Rates (CAGRs) across years with submitted data were used to estimate sales back to 2019 and projected ahead to 2040 for any missing years.

For the residential sector, census data and usage per home type from EIA's Residential Energy Consumption Survey (RECs)[1] were used to determine the fraction of housing types (single vs. multi-family). Census data was also used to determine the percentage of income eligible customers (percent of households below 200% of the federal poverty line). Commercial disaggregation to the segment level leveraged DTE, Consumers, and UPPCO 2019 FERC Form 1 data, which report customer counts and total annual energy sales by tariff. This data was used to calculate the average annual energy usage per customer for each tariff and classify as Small Commercial (<1,200 MWh/year) and Large Commercial (>1,200 MWh/year). The average segment sales proportion between DTE, Consumers, and UPPCO was applied statewide.

Gas Energy Sales Forecast (therms/year)

Gas sales were forecasted similarly to electric sales using utility data and data from MPSC filings where needed. For utilities that did not distinguish between commercial and industrial sector sales, data from MPSC Annual Report form P-522 was used for disaggregation. For SEMCO, which operates in both the Lower and Upper Peninsulas, Guidehouse allocated 95% of sales to the Lower Peninsula based on the proportion of overall sales attributable to each service territory.

For the residential sector, census data and usage per home type from EIA's RECs were used to determine the fraction of housing types (single vs. multi-family). Census data was also used to determine the percentage of income eligible customers (percent of households below 200% of the federal poverty line). For the commercial sector, Guidehouse utilized the same share of large vs. small commercial as the electric load since there was not analogous way to disaggregate gas sales in the data provided.

Peak Demand Forecast (kW)

Guidehouse applied peak factors to electricity sales forecasts, based on the MEMD's peak definition of 3-6pm on the three consecutive hottest weekdays in July. Peak factors are developed based on 8760 hourly data and 2019 sales from DTE (lower peninsula) and UMERC (upper peninsula). Data from these utilities provide the most comprehensive 8760 hourly data in their region and comprise the largest share of the peak demand in their region. All residential segments use the same peak factor. Where additional granularity is available, different peak factors were developed for the commercial and industrial subsegments.

End Use Allocations

End use breakout data received by utilities was high level and sparse. DTE provided detailed breakouts for the residential sector and Consumers provided some distributions for the main end uses such as heating. Because of the sparsely received end-use allocation data, national survey data from EIA (Residential Energy Consumption Survey (RECs)[2],

[1] https://www.eia.gov/consumption/residential/index.php
[2] https://www.eia.gov/consumption/residential/index.php

Commercial Building Energy Consumption Survey (CBECS)[3], and Manufacturing Energy Consumption Survey (MECS)[4]) was used as the basis to derive end use allocations estimate for the residential, commercial, and industrial sectors, respectively. Whenever possible, regional numbers were used to approximate Michigan specific values. End use allocations from EIA were compared to utility provided data and were deemed appropriate for use at the statewide level.

Residential Building Stock

The total number of residential households was primarily developed using utility customer count databases and supplemented by publicly available FERC and EIA form data. However, this customer tracking data lacked the granularity to develop customer segment level estimates. Therefore, census data was used to determine the fraction of housing types (single vs. multi-family) and percentage of low-income customers (below 200% of federal poverty line). Residential demolition rates are set to a standard 0.05% per year. This indicates an expected 200-year full building stock turnover. Demolished stock is available for new construction installation in the next modeled year.

Commercial and Industrial Building Stock

Utility data received through the data request process lacked enough information on commercial and industrial building stock by square footage to develop complete stock forecasts. Therefore, average building energy use intensities (EUIs) were sourced from EIA data and applied to the sales forecast to estimate total building square footage. Separate EUIs were calculated for commercial, and industrial. As noted above, commercial sales disaggregation to the segment level leveraged DTE, Consumers, and UPPCO 2019 FERC Form 1 data[5], which gives customer counts and total annual energy sales by tariff. Commercial demolition rates set to a standard 0.05% per year. This indicates an expected 200-year full building stock turnover. Demolished stock is available for new construction installation in the next modeled year. Industrial demolition rates are set to a standard 0.00%.

Space Heating and Water Heating Fuel Type Multipliers

Residential space heating and water heating electric and gas fuel splits were provided by Consumers, DTE, and I&M. Utility specific fuel split percentages were weighted by residential households for each utility to calculate the aggregate statewide percentage. Fuel splits are applied at the sector level as there is not enough information to support differences at the customer segment. Data for Lower Peninsula utilities was provided; therefore, these fuel split percentages are used as a proxy for Upper Peninsula splits. Commercial fuel multipliers were not provided during the data request process; therefore, these will be accounted for in measure characterization by adjusting densities. Current inputs should be viewed as draft, as Guidehouse is conducting primary survey research to support fuel type splits and will be adjusting this global input once the survey is complete.

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[3] https://www.eia.gov/consumption/commercial/
[4] https://www.eia.gov/consumption/manufacturing/index.php
[5] https://www.ferc.gov/industries-data/electric/general-information/electric-industry-forms/form-1-electric-utility-annual

Measure Density and Saturation

Measure densities and saturations will be sourced from a variety of resources, including the 2011 Michigan Baseline Reports and the 2016-2017 DTE Energy Baseline Study. Additionally, Guidehouse may adjust measure saturations based on assumed efficient adoption from the time of the applicable study based on historical program performance and regional trends. If measure gaps emerge for density or saturation, Guidehouse, will review sources from similar jurisdictions to benchmark values against similar recent studies.

Economic Potential Market Characterization Inputs

To calculate economic potential, Guidehouse requested detailed inputs from each of the utilities during the data request. The economic inputs data received was sparse compared to technical potential inputs. Therefore, Guidehouse requested DSMORE input data for each utility from its most recent evaluation to supplement received economic inputs. Guidehouse received DSMORE files from all but Alpena and MGU, and some of the data requires follow-up. Following is a summary of the DSMORE data received:

- Received and Complete
  - Consumers
  - NSP
- Follow-up needed on received data
  - DTE: Confirm that T&D avoided cost ($/kW) should be $0 (currently blank)
  - I&M: Confirm that T&D avoided cost ($/kW) should be $0 (currently blank)
  - UPPCO: Evaluation results received, but no input data.
  - SEMCO: Confirm that T&D avoided cost ($/kW) should be 0 (currently blank) & Avoided Market Prices are currently blank.
- Not received
  - Alpena
  - MGU

Electric Loadshapes

DTE and I&M provided electric loadshapes during the data request. DTE provided a suite of 8760 loadshapes for all sectors and many end-uses. I&M's loadshapes are only for major end uses, such as heating, cooling and lighting. Additionally, Guidehouse requested DSMORE input data for each utility from its most recent evaluation to supplement currently obtained economic inputs. Loadshapes are embedded into the DSMore model, which are identified in the input page, but are not extractable with the data provided. However, the loadshapes identified in the utility input tabs of the DSMore files provided mostly identified DTE loadshapes as the source for analysis.

Based on this information, Guidehouse utilized DTE loadshapes as the base for this analysis, weighting in I&M loadshapes where available. Loadshapes were analyzed as the percentage of annual load that is during on-peak and off-peak market price hours for each end-use. Guidehouse utilized PJM's definition of on vs off peak market prices, defined as follows: On-peak is a period of time when consumers typically use more electricity -- normally on weekdays, when many businesses are operating. PJM typically considers

weekdays from 7 a.m. to 11 p.m. on-peak, except for the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.[6]

Gas Loadshapes

No gas loadshapes were provided during the data request. If utilities are able to provide gas loadshapes, Guidehouse will analyze and incorporate this data in the same manner as the electric loadshapes above.

Electric Energy Avoided Costs

DTE and I&M provided electric energy avoided cost data during the data request. Additionally, Guidehouse received DSMORE input data from NSP and Consumers to supplement the electric energy avoided costs already provided. DSMore data provided by UPPCO and UMERC did not include the 'utility input' tab that is necessary to identify electric energy avoided costs. Guidehouse used the data from DTE, I&M and the DSMore files to analyze this data for loadshape periods common across available avoided cost information (on vs. off peak). This analysis is weighted based on utility sales as a percent of total for the upper and lower peninsula, creating two avoided cost streams.

Electric Demand Avoided Costs

DTE and I&M provided electric energy avoided cost data during the data request. Additionally, Guidehouse received DSMORE input data from NSP and Consumers to supplement the electric energy avoided costs already provided. DSMore data provided by UPPCO and UMERC did not include the 'utility input' tab that is necessary to identify electric energy avoided costs. Guidehouse used the data from DTE, I&M and the DSMore files to analyze this data for loadshape periods common across available avoided cost information (on vs. off peak). This analysis was weighted based on utility sales as a percent of total for the upper and lower peninsula, creating two avoided cost streams for this analysis. Gas Avoided Costs

DTE provided gas avoided cost data during the data request. Additionally, Guidehouse received DSMORE input data from NSP and Consumers to supplement the gas energy avoided costs already provided from DTE. This data was not provided for different loadshape periods, therefore Guidehouse summarized this data to create one gas avoided cost stream for both the upper and lower peninsula, weighted by gas sales in each region.

Electric Energy Retail Rates

Electric retail rates were not provided by utilities during the data request and the DSMore data provided very limited detail on rates. Guidehouse utilized data on the MPSC website[7] for residential, commercial, and industrial electric retail rates. The rates were weighted by sales within the upper and lower peninsulas to create weighted rates specific to each region.

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[6] https://www.pjm.com/Glossary

[7] Comparison of Average Electric Rates for MPSC-Regulated Electric Utilities in Michigan – February 1, 2021 https://www.michigan.gov/documents/mpsc/rates1_594951_7.pdf

Electric Demand Retail Rates

No information on electric demand rates was provided during the data request process. The MPSC average retail energy rates comparison file utilized for the electric energy retail rates above appears to be inclusive of all energy and demand charges, normalized to cents per kWh based on all sales. Therefore, specific demand retail rates are not necessary for this analysis.

Gas Retail Rates

Gas retail rates were not provided by utilities during the data request and the DSMore data provided very limited detail on rates. Guidehouse utilized data on the MPSC website[8] for gas retail rates for residential, commercial, and industrial. The rates were weighted by sales within the upper and lower peninsulas to create weighted rates specific to each region.

Discount Rates

I&M, DTE and MGU provided discount rates during the data request. Additionally, Guidehouse was able to summarize discount rates from DSMore input files for Consumers, NSP, and SEMCO. Guidehouse summarized this data across the upper and lower peninsula, weight based on utility sales as a percent of total in each region, which resulted in discount rates by cost test for both the upper and lower peninsulas.

Line Losses

Aplena, Consumers, MGU and DTE provided line loss assumptions and/or a line loss study. DTE and Consumer's provided detailed line loss studies with both average and marginal loss options. Guidehouse derived line loss assumptions for NSP, I&M, UMERC and SEMCO from the DSMore data each of those utilities provided. The DSMore data is much less granular than the line loss studies provided, with only one line loss apparently applied to all sectors, and the line losses appear to be averages and not marginal. To remain consistent between data sources, Guidehouse utilized the average line losses from the DTE and Consumers Line Loss Studies, and weighted the losses by utility sales data for the upper and lower peninsulas.

Reserve Margin

I&M and DTE provided reserve margins during the data request. I&M's reserve margins are for PJM and DTE's reserve margins are for MISO. Upon review of the PJM and MISO territory for Michigan, I&M is a part of PJM and the rest of the state is under MISO. Therefore, Guidehouse applied the MISO reserve margins to all the other utilities and created a weighted average statewide reserve margin.

Inflation

UMERC, Consumers, I&M, MGU and DTE provided inflation rates data during the data request. Guidehouse summarized this data across utilities and weighted the values based

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[8] Comparison of Average Electric Rates for MPSC-Regulated Electric Utilities in Michigan – February 1, 2021 https://www.michigan.gov/documents/mpsc/rates1_594951_7.pdf

on utility sales as a percent of total to approximate statewide inputs. Inflation rates were not available in the utility DSMore data.