



# Greenhouse Gas Emissions Reductions

2020 Energy Waste Reduction Portfolio

August 17, 2021





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# Summary of Emissions Reductions

DTE Energy (DTE) and Guidehouse undertook a robust modelling and analysis effort to more accurately quantify greenhouse gas (GHG) and air pollutant emissions reductions resulting from Energy Waste Reduction (EWR) program activity<sup>1</sup>.

- DTE's 2020 EWR Portfolio served over 1 million electric customers resulting in verified net electric savings of 770 GWh (1.67% of 2019 planned retail sales) and over 370,000 gas customers resulting in verified net gas energy savings of 2,240 MMCF (1.13% of 2019 planned retail sales).
- First-year emissions reductions were approximately 663,000 metric tons of CO<sub>2</sub>, 391 metric tons of NO<sub>x</sub> and 541 metric tons of SO<sub>2</sub>. Over the lifetime of the EWR measures, emissions reductions will be approximately 6.1M metric tons of CO<sub>2</sub>, 2,800 metric tons of NO<sub>x</sub> and 3,800 metric tons of SO<sub>2</sub>.

CO <sub>2</sub> Equivalency	2020 First-Year EWR Savings	2020 Lifetime EWR Savings
 Tree seedlings grown for 10 years	10,968,600	100,859,732
 Passenger vehicles driven for one year	144,265	1,326,561
 Railcars' worth of coal burned	3,659	33,646
 Homes' energy use for one year	79,882	734,545

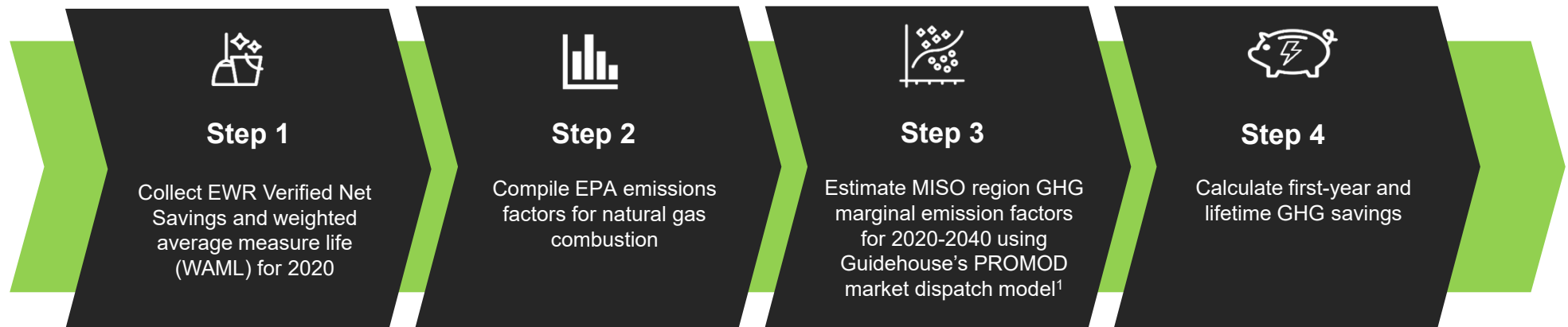
<sup>1</sup> EWR performance per current legislation is measured in MWh and MCF reduced and does not require tracking of emissions. This is not a proposal to change legislative requirements. Emissions reductions analysis is provided for informational purposes only to stakeholders.



Source: DTE Energy

# Methodology Summary

Guidehouse estimated emissions reductions from 2020 EWR activity, including both first-year and lifetime estimates, based on a variety of inputs from EWR reconciliation, EPA data, and modelling efforts for marginal emissions factors.



<sup>1</sup> Marginal emissions are based on the difference between two scenarios – one with, and one without projected EWR activity. PROMOD was used to dispatch MISO in these scenarios. Additional details can be found in the appendix.

# First-Year Verified Net Savings & WAML

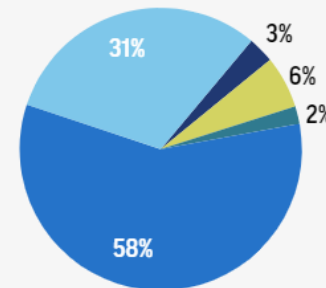
- Guidehouse compiled first-year verified net savings<sup>1</sup> as determined during 2020 reconciliation, as well as the fuel-specific weighted-average measure life (WAML).

<sup>1</sup> Verified net savings include pilots and education

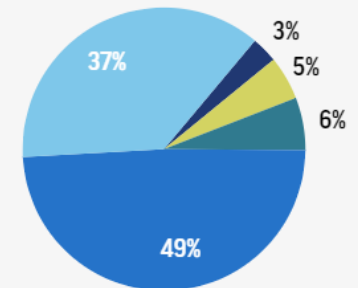


	Electric	Gas
Verified Net Savings	769,790 MWh	2,239,902 MCF
WAML	9.72 years	11.41 years

2020 DTE Electric Savings by Program Type (770 GWh)



2020 DTE Gas Savings by Program Type (2,240 MMcf)



■ Residential ■ Low-Income ■ Commercial & Industrial ■ Education ■ Pilots

Source: 2020 EWR Annual Report

# Electric Emissions Factors

- Guidehouse used PROMOD, a commercially-available production cost model, to forecast marginal MISO emission rates for 2020-2040.
- PROMOD simulates the hourly operation of the power system by dispatching on a least cost basis generation resources given transmission constraints to match hourly electricity demand.
- To determine marginal emissions factors, Guidehouse used the Reference Case for MISO as the starting point and ran the model twice: once with the EWR program (Reference Case) and once with the EWR program savings added back to the Reference Case.
- The Reference Case is the long-term view of the evolution of power markets (updated biannually) and includes inputs from DTE's 2019 IRP filing and generic capacity expansion across MISO.
- The two runs were then compared by taking the delta in total emissions and dividing by the EWR program savings on an annual basis to determine emissions reductions and a marginal emissions factor. Additional detail is shown in the appendix.

Program Year(s)	CO <sub>2</sub> (metric ton/MWh)	NO <sub>x</sub> (metric ton/MWh)	SO <sub>2</sub> (metric ton/MWh)
2020	0.70733	0.00051	0.00070
2021	0.73544	0.00047	0.00090
2022	0.71548	0.00050	0.00068
2023	0.67310	0.00035	0.00049
2024	0.63977	0.00037	0.00042
2025	0.62644	0.00037	0.00039
2026	0.56563	0.00030	0.00034
2027	0.57017	0.00033	0.00038
2028	0.54468	0.00031	0.00035
2029	0.53536	0.00030	0.00035
2030	0.51886	0.00026	0.00027
2031	0.52830	0.00027	0.00031
2032	0.50388	0.00025	0.00027
2033	0.50807	0.00024	0.00024
2034	0.51331	0.00026	0.00030
2035	0.49752	0.00024	0.00031
2036	0.49018	0.00023	0.00024
2037	0.45759	0.00019	0.00017
2038	0.43944	0.00016	0.00014
2039	0.40594	0.00014	0.00013
2040	0.41201	0.00016	0.00020



# Gas Emissions Factors

- Guidehouse sourced emissions factors for the stationary combustion of natural gas from the EPA Center for Corporate Climate Leadership<sup>1</sup>.
- CO<sub>2</sub> was the only pollutant analyzed for natural gas; emissions of other pollutants are comparatively small.

<b>Program Year(s)</b>	<b>CO<sub>2</sub> Emissions Rate (metric Ton/MCF)</b>
2020 & forward	0.05306

<sup>1</sup> Source: Environmental Protection Agency value, converted from mmBTU to MCF using a factor of 1.0; [https://www.epa.gov/sites/production/files/2021-04/documents/emission-factors\\_apr2021.pdf](https://www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf)

# First-Year & Lifetime Emissions Reductions

- First-year avoided emissions (FYAE) were calculated from both electric and gas savings, using Eq. 1, for each pollutant.

$$FYAE_{Fuel,Pollutant} = Savings_{Fuel} * Emissions\ Factor_{Fuel,Pollutant} \quad (1)$$

- Total First-Year Avoided Emissions (TFYAE) were then calculated by summing the electric and gas FYAE values for each pollutant, as shown in Eq. 2, below.

$$TFYAE_{Pollutant} = FYAE_{Gas,Pollutant} + FYAE_{Electric,Pollutant} \quad (2)$$

- Lifetime Avoided Emissions (LAE) were calculated from both electric and gas savings using Eq. 3. The lifetime calculation assumes the first-year savings occur in each subsequent year for the duration of the WAML.

$$LAE_{Fuel,Pollutant} = \sum_{i=0}^{WAML} (Emissions\ Factor_{Fuel,Year\ i,Pollutant} * Savings_{Fuel,Year\ 0}) \quad (3)$$

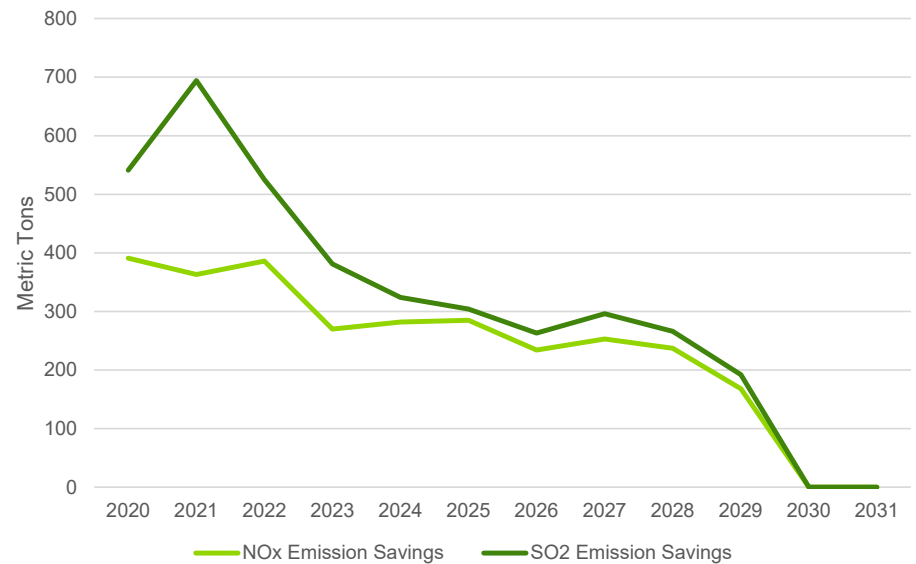
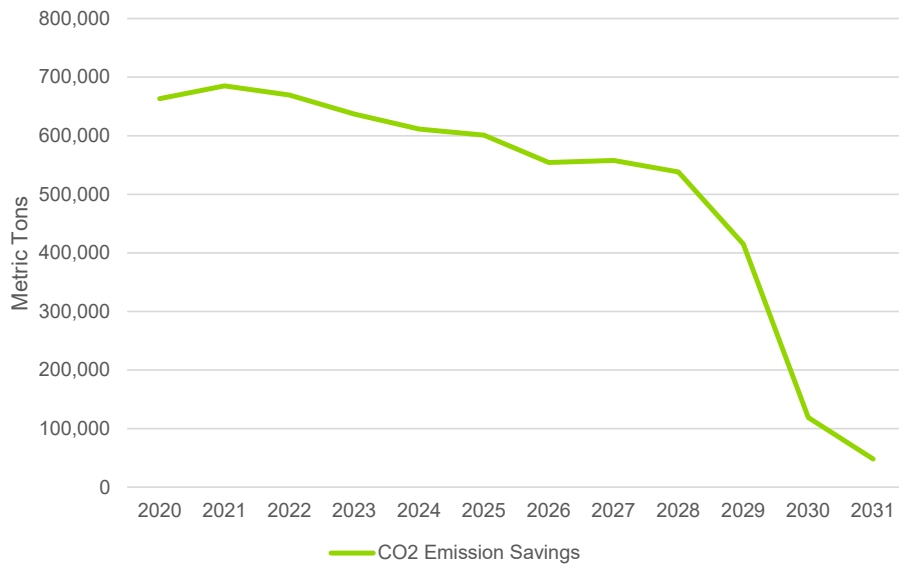
- Total Lifetime Avoided Emissions (TLAE) were then calculated by summing the electric and gas LAE values for each pollutant, as shown in Eq. 4, below.

$$TLAE_{Pollutant} = LAE_{Gas,Pollutant} + LAE_{Electric,Pollutant} \quad (4)$$



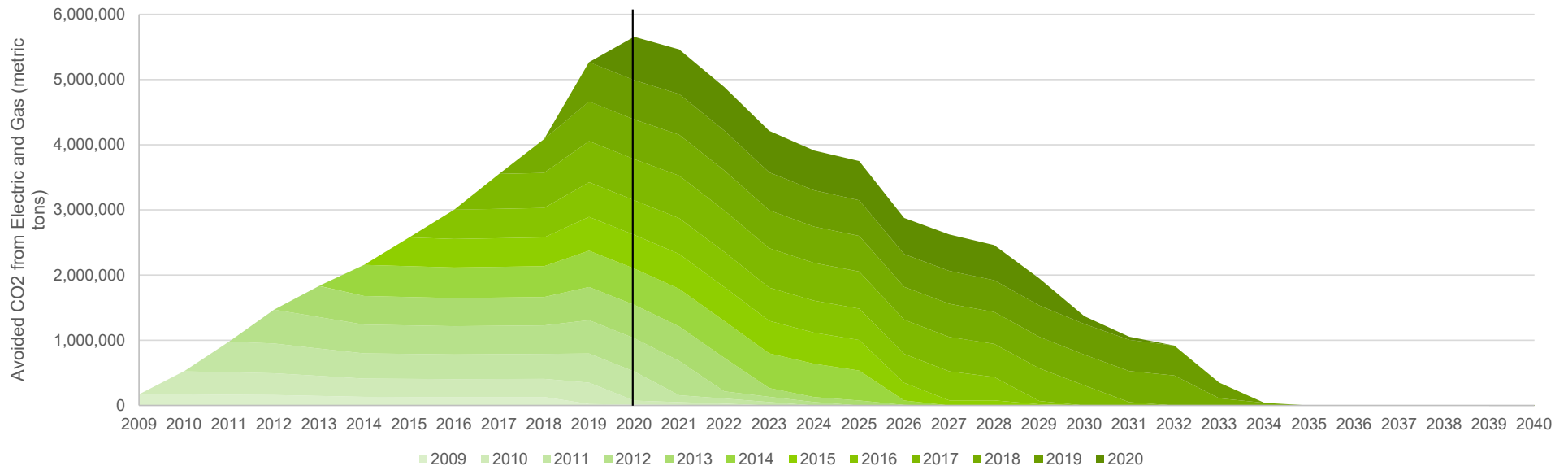
# First-Year & Lifetime Emissions Reductions

First-year CO<sub>2</sub> emissions reductions for the 2020 EWR portfolio are 663,348 metric tons and 6,099,694 metric tons over the lifetime of the measures.



# 2009-2020 Total Lifetime Savings

Guidehouse estimated lifetime emissions CO<sub>2</sub> savings since EWR programs began in 2009; in that time, more than 5.7 million electric customers and 3.7 million total gas customers participated in EWR programs. In total, DTE's EWR portfolio has resulted in over 67M metric tons of CO<sub>2</sub> emissions savings<sup>1</sup>, equivalent to one year of consumption for over 8 million homes. NO<sub>x</sub> and SO<sub>2</sub> savings are shown the appendix.



<sup>1</sup> Emissions reductions for program years 2009-2019 were estimated using the same overall methodology as 2020, except that marginal emissions factors for prior years were sourced from eGRID.

# Appendix



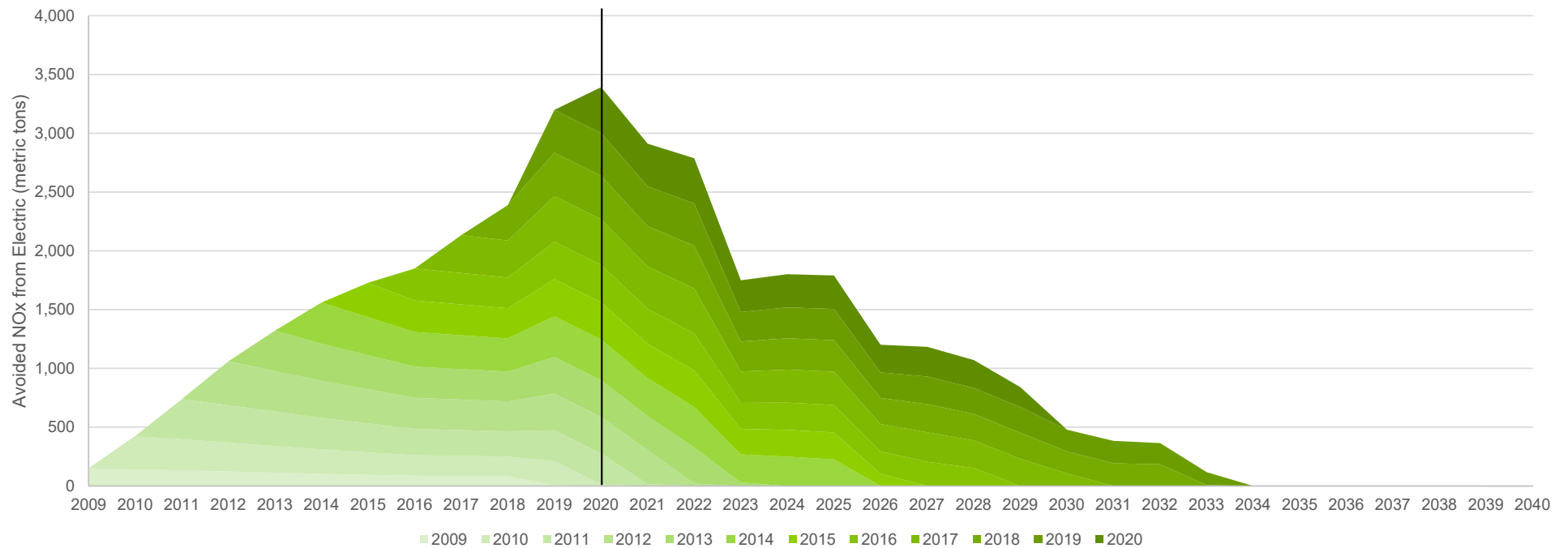
# Appendix: First-Year & Lifetime Emissions Reductions

First-year CO<sub>2</sub> emissions reductions for the 2020 EWR portfolio are 663,348 metric tons and 6,099,694 metric tons over the lifetime of the measures.

Program Year(s)	CO <sub>2</sub> Emission Savings (metric tons)	NO <sub>x</sub> Emission Savings (metric tons)	SO <sub>2</sub> Emission Savings (metric tons)
<b>2020 (first year)</b>	<b>663,348</b>	<b>391</b>	<b>541</b>
2021	684,984	363	694
2022	669,620	386	525
2023	636,995	270	381
2024	611,340	282	324
2025	601,077	285	304
2026	554,266	234	263
2027	557,760	253	296
2028	538,139	237	266
2029	415,063	168	192
2030	118,849	-	-
2031	48,252	-	-
<b>Lifetime</b>	<b>6,099,694</b>	<b>2,869</b>	<b>3,785</b>

# 2009-2020 Total Lifetime Savings

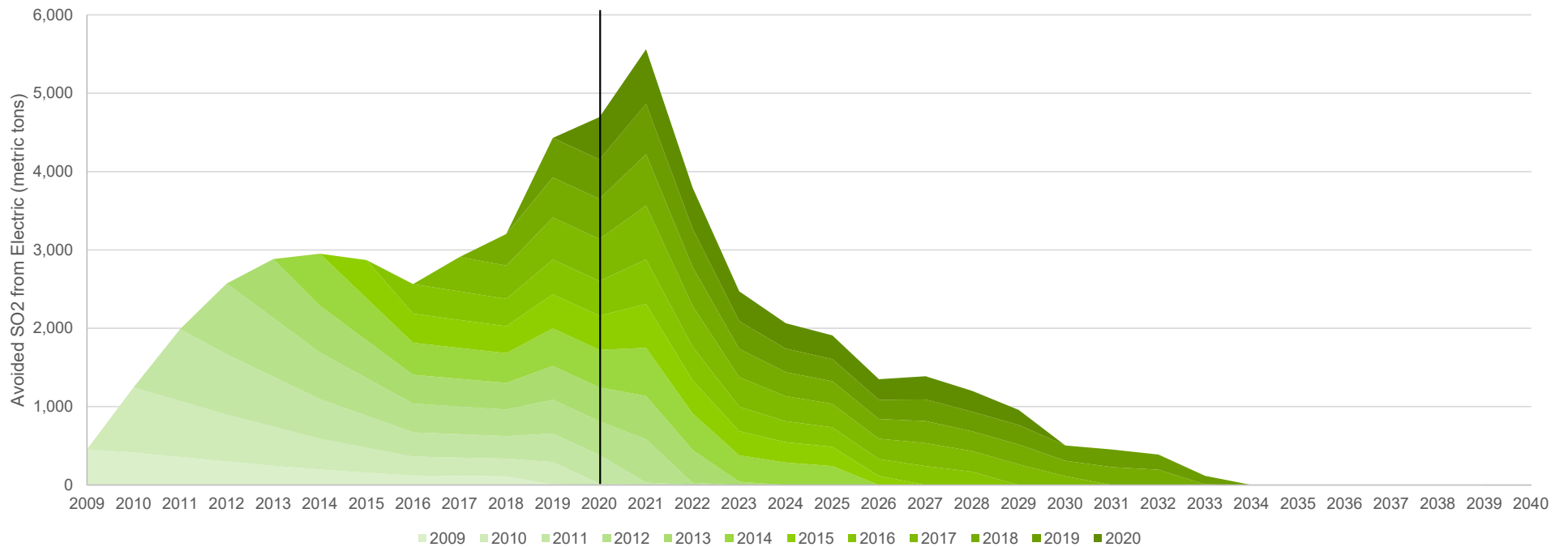
Guidehouse estimated lifetime NO<sub>x</sub> emissions savings since EWR programs began in 2009.



<sup>1</sup> Emissions reductions for program years 2009-2019 were estimated using the same overall methodology as 2020, except that marginal emissions factors for prior years were sourced from eGRID.

# 2009-2020 Total Lifetime Savings

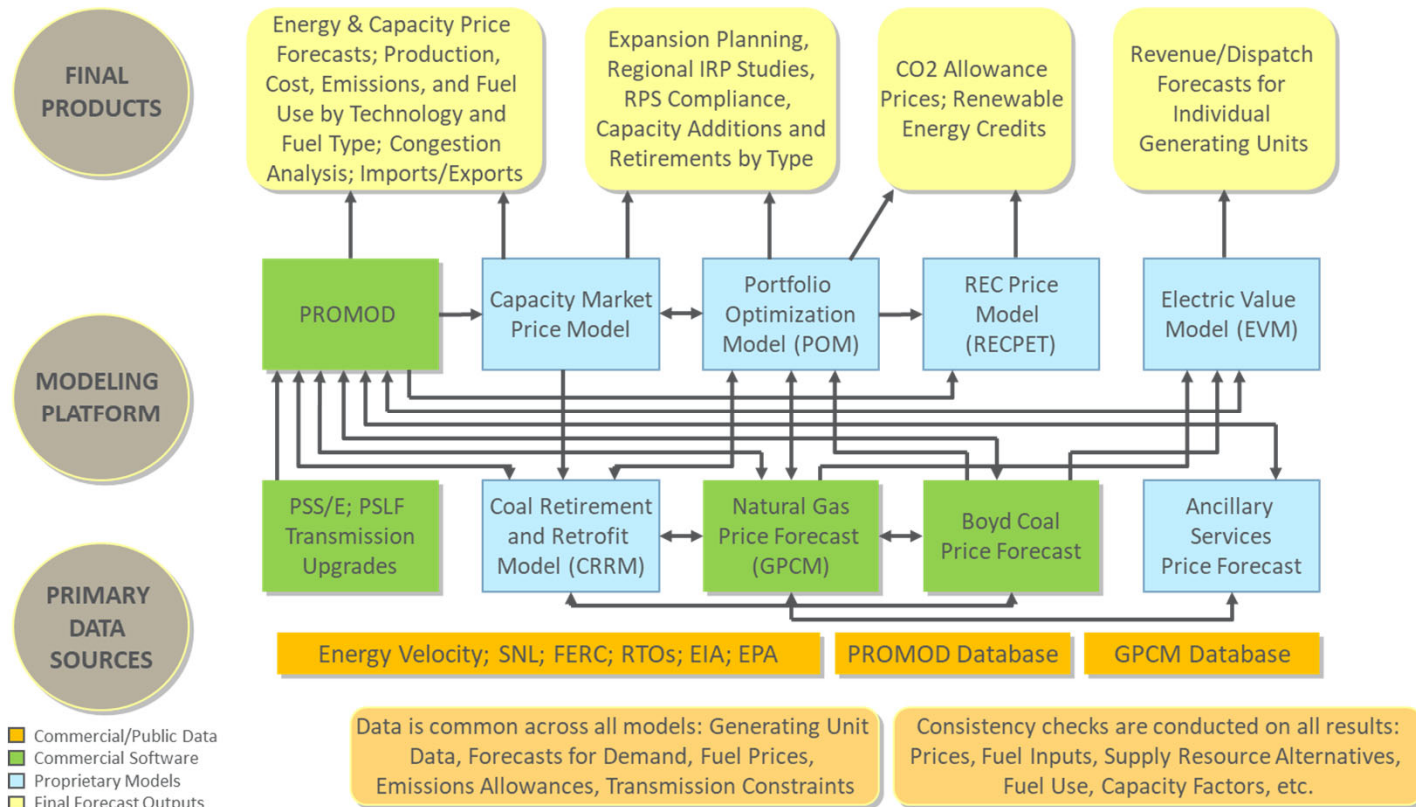
Guidehouse estimated lifetime SO<sub>2</sub> emissions savings since EWR programs began in 2009.



<sup>1</sup> Emissions reductions for program years 2009-2019 were estimated using the same overall methodology as 2020, except that marginal emissions factors for prior years were sourced from eGRID.

# Appendix: PROMOD Model

A diagram depicting the process and tools used in Guidehouse’s market modeling can be seen below.





# Appendix: Modeled Results MISO With EWR program

MISO Results with DTE's EWR Program. These set of results serve as a baseline for evaluating the impact of the EWR program.

Year	Total CO <sub>2</sub> Emissions (lbs)	Total NO <sub>x</sub> Emissions (lbs)	Total SO <sub>2</sub> Emissions (lbs)	Average CO <sub>2</sub> Emissions Rate (lbs/MWh)	Average NO <sub>x</sub> Emissions Rate (lbs/MWh)	Average SO <sub>2</sub> Emissions Rate (lbs/MWh)
2020	760,778,747,143	574,617,074	805,789,473	1,144	0.86	1.21
2021	758,423,680,559	572,663,980	803,439,785	1,128	0.85	1.16
2022	768,457,084,700	581,611,238	811,984,866	1,131	0.86	1.20
2023	772,172,112,496	579,264,763	796,696,948	1,125	0.84	1.16
2024	760,974,978,640	569,376,043	779,343,547	1,104	0.83	1.13
2025	771,791,125,767	579,883,699	804,708,933	1,109	0.83	1.16
2026	768,092,901,594	574,555,936	796,764,432	1,093	0.82	1.13
2027	764,587,250,185	569,706,435	812,608,238	1,081	0.81	1.15
2028	758,583,259,017	569,567,126	806,881,280	1,064	0.80	1.13
2029	766,252,343,080	574,420,092	815,351,775	1,067	0.80	1.14
2030	745,897,577,620	554,133,636	785,566,807	1,029	0.77	1.08
2031	736,760,035,380	541,560,773	756,509,666	1,007	0.74	1.03
2032	732,774,901,477	539,843,844	754,495,637	995	0.73	1.03
2033	723,901,515,411	527,592,448	735,314,487	973	0.71	0.99
2034	711,314,788,115	503,911,300	724,201,912	951	0.67	0.97
2035	709,364,044,298	498,609,716	716,744,706	938	0.66	0.95
2036	697,410,383,622	474,741,912	698,349,406	911	0.62	0.91
2037	683,777,745,587	455,323,405	646,216,984	883	0.59	0.84
2038	672,026,150,899	435,040,835	619,882,124	860	0.56	0.79
2039	664,055,524,391	417,070,200	606,206,389	842	0.53	0.77
2040	646,828,513,548	394,351,837	550,648,164	811	0.50	0.69

Source: Guidehouse

## Appendix: Modeled Results MISO Without EWR Program

MISO Results w/o DTE's EWR Program. As expected, there are more emissions once the EWR program is removed. The emission rate for both sets of runs decline over time as renewables are added and thermal, specifically coal, capacity retires.

Year	Total CO <sub>2</sub> Emissions (lbs)	Total NO <sub>x</sub> Emissions (lbs)	Total SO <sub>2</sub> Emissions (lbs)	Average CO <sub>2</sub> Emissions Rate (lbs/MWh)	Average NO <sub>x</sub> Emissions Rate (lbs/MWh)	Average SO <sub>2</sub> Emissions Rate (lbs/MWh)
2020	763,170,687,577	576,334,026	808,166,908	1,148	0.87	1.22
2021	762,454,857,778	575,250,503	808,380,612	1,134	0.86	1.20
2022	773,889,443,587	585,414,673	817,160,159	1,139	0.86	1.20
2023	778,511,290,668	582,562,107	801,357,782	1,134	0.85	1.17
2024	768,140,764,814	573,485,799	784,053,616	1,114	0.83	1.14
2025	779,860,461,224	584,645,949	809,789,477	1,121	0.84	1.16
2026	776,324,782,313	578,981,535	801,738,340	1,106	0.83	1.14
2027	773,552,745,968	574,866,281	818,656,921	1,094	0.81	1.16
2028	767,644,050,134	574,694,299	812,629,454	1,078	0.81	1.14
2029	775,705,679,392	579,797,080	821,475,311	1,081	0.81	1.15
2030	755,324,274,983	558,808,771	790,489,115	1,043	0.77	1.09
2031	746,509,670,140	546,469,107	762,310,217	1,021	0.75	1.04
2032	742,049,143,515	544,511,045	759,458,530	1,009	0.74	1.03
2033	733,009,434,829	531,969,978	739,680,292	986	0.72	1.00
2034	720,615,749,360	508,633,416	729,593,541	964	0.68	0.98
2035	718,169,840,177	502,792,257	722,162,426	950	0.67	0.96
2036	706,146,718,279	478,871,892	702,560,562	923	0.63	0.92
2037	691,974,268,985	458,656,482	649,188,049	895	0.59	0.84
2038	679,867,820,229	437,821,364	622,379,799	871	0.56	0.80
2039	671,311,546,955	419,642,374	608,456,635	852	0.53	0.77
2040	654,309,199,312	397,297,685	554,203,789	822	0.50	0.70

Source: Guidehouse