



**Customer Driven.
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AGENDA

Electric Utility Commission Resource Planning Working Group Meeting

Date: October 10, 2019

Time: 4:00 pm – 6:00 pm

Location: Town Lake Center, Room 100

Safety Moment (5 Min)

Resource Plan 2017 Studies – Q&A (40 Min)

- Potential Demand Side Management MW Savings
- Renewable, Carbon Free and **Battery Storage**

Overarching Goals (15 Min)

- Non Carbon Goals Discussion
- Net Zero Definition

Scenarios Brainstorming (45 Min)

Closing Remarks (15 Min)

REMINDER: October 24 meeting will be held in Room 126



City of Austin

Austin Energy

Town Lake Center • 721 Barton Springs Road • Austin, Texas 78704 - 1145

Follow-up Information from September 26, 2019 Meeting

1. Examples of residential DER programs (Green Mountain, California, Hawaii, Arizona)

Austin Energy has not done an exhaustive assessment of utilities providing energy storage systems as a product offering to customers but continues to monitor what is going on across the country. There are a hand full of utilities providing programs currently, including the following:

- Green Mountain Power <https://greenmountainpower.com/product/powerwall/>
- East Bay Community Energy/Sunrun <https://www.greentechmedia.com/articles/read/east-bay-power-purchaser-signs-distributed-capacity-contract-with-sunrun#gs.8cu9ja>
- Arizona Public Service- APS Storage Rewards Program - <https://www.aps.com/-/media/APS/APSCOM-PDFs/About/Sustainability-and-Innovation/Technology-and-Innovation/Storage-Rewards/StorageRewardsFAQ.ashx>
- Massachusetts Clean Energy Center/National Grid <https://www.masscec.com/blog/2019/04/30/get-paid-your-building%E2%80%99s-energy-storage-system>
- Liberty Utilities New Hampshire residential program <https://www.utilitydive.com/news/designing-liberty-utilities-new-hampshire-residential-storage-program/548940/>
- Long Island/NY Sun <https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage/Solar-Plus-Energy-Storage>
- SMUD <https://www.smud.org/en/Going-Green/Battery-storage/Homeowner>
- SRP <https://www.srpnet.com/electric/home/batterystorage/default.aspx>
- HECO <https://pv-magazine-usa.com/2019/09/04/hawaiian-homes-becoming-even-more-important-to-the-power-grid/> and <https://www.hawaiianelectric.com/products-and-services/customer-renewable-programs/private-rooftop-solar/customer-self-supply>

2. Number of residential customers with batteries.

We have approximately 55 batteries at residential homes. There was no data collection early on and even now it's a challenge for us to get data but improvements to the City's permit tracking system may assist with our tracking efforts.

3. What would the rate be on additional 50 MW blocks of solar?

The impact of each 50MW-ac block @ \$32.25M is roughly .003225/kWh

www.austinenergy.com

twitter.com/austinenergy / facebook.com/austinenergy / youtube.com/austinenergyvideos

4. Should we rethink/revisit how we calculate/consider carbon reduction – EMO to address

Information will be provided at next meeting.

5. What is the 50th percentile in PSA? – EMO to address

Information will be provided at next meeting.

6. Risk premium factors/calculation – EMO to address

Austin Energy performed sensitivity analysis around the load and the gas prices to understand their impact on Austin Energy portfolio. Sensitivities provide a structured framework to consider and analyze various options in a way that provides decision makers with valuable information about the robustness of those decisions. In addition to the sensitivity analysis, to address some of the idiosyncratic risk of fast power output fluctuation, Austin Energy reviewed the historic performance of existing renewable resources associated with high price periods and assumed those conditions would persist during the planning horizon. Please refer Section 5 of the report for detailed description of the risk analysis that was performed for the studies.

POTENTIAL DEMAND SIDE MANAGEMENT MW SAVINGS BY 2025, 2027 AND 2029 – AN ASSESSMENT OF PROJECTIONS AND MARKET CONDITIONS IMPACTING GOAL ACHIEVEMENT

Introduction

The purpose of this analysis is to provide a preliminary assessment of the potential Austin Energy Demand Side Management (DSM) megawatt (MW) savings by 2025, 2027, 2029. This analysis is to also include a feasibility assessment for achieving 300 MW (of the total MW goal) derived solely from demand response (DR) programs. This is a preliminary assessment to be followed by the more formal, third-party study currently underway by DNV-GL. It is anticipated that a brief, high level study will be available by the end of calendar year 2019 with a more robust report available mid-2020. The data provided here are projections only and may be impacted by factors unknown at the present time, but that may surface over the next 5 to 9 years.

This report will not be providing any analysis or estimates for renewable energy goals. The focus of this report is energy and demand reduction savings.

Executive Summary

Some key takeaways from this preliminary analysis of potential DSM megawatt savings are:

- Savings from 2020 to 2025 and beyond will be impacted by several factors including market conditions, budgets and changing technology.
 - Market conditions include current market penetration, historic market saturation and potential market transformation. The level of customer participation over the past 30 years, combined with current and new technologies, will impact and influence MW savings achievement through 2029.
- Building codes will be impacted by recent state legislation¹ impacting potential future MW savings that may be claimed as part of the Austin Energy Green Building program.
- The renter population in Austin impacts the reach of rebate programs. (Split incentive wherein the property owner provides any capital and tenant benefits from the improvements. Additionally, the competitive rental market and low occupancy rates in Austin create an added barrier to program adoption.)
- Returning program participants generate less MW savings than first time participants due to more efficient homes/measures.
- The Customer Energy Solutions (CES) analysis is supported by both the 2014 KEMA study and the AE Financial staff analysis.

¹ See Texas HB 2439, effective September 1, 2019.

- The estimated CES DSM MW savings forward to 2025, 2027 and 2029 are projected to be 1100, 1200 and 1350, respectively.
- This would assume DR savings of 200 MW by 2025 for nearly all models and by 2027 for all models.
- No model was shown to achieve 300 MW in DR by 2027 or 2029.
- Note that these are modeled goals. These will most likely change and adjust with input from the DNV-GL benchmarking project currently underway.

When looking at the CES analyses, the current estimates of the model along with the comparisons to the KEMA and AE Finance models, Austin Energy is expected to achieve the 900 MW goal by 2022. For 2027, analyses indicate that 1000 MW or greater can be achieved. For 2029, the goal could be set at 1100 or greater. It is recommended these estimates be used as placeholders, since the current study does not account for the variables that might impact the models, thus increasing the unpredictability of long-term goal setting. These remain predictions, dependent on budgets, resources, staffing and favorable market conditions. CES staff is committed to succeed at achieving the above goals.

In summary, the ability to reach 1100 MW by 2027 appears achievable. However, there remain unknown and unforeseen market and financial conditions which may impact and influence the achievement of these goals.

RENEWABLE, CARBON FREE AND BATTERY STORAGE STUDIES

Introduction

The 2027 Plan: Directives

On August 17, 2017, the City Council approved [Resolution No. 20170817-061¹](#), adopting the Working Group recommendations and providing additional direction. The Studies detailed in this report include:

Renewable Energy

- Construct a model that achieves both a 75% and an 80% renewable energy goal by 2027, including a consideration of the costs, benefits, risks and potential rate impacts.
- Construct a model that achieves a 100% carbon-free energy goal by 2030, including a consideration of the costs, benefits, risks and potential rate impacts.
- Assess the feasibility of achieving 100% renewable energy by 2035.

Emerging Technology and Energy Storage

- Study the costs, benefits, risks and potential rate impacts of achieving a more aggressive electric storage goal, such as 50 MW of electrical storage by 2027 and of achieving 100 MW of electrical storage by 2027.

Approach to the Studies

75% and 80% renewable energy goal by 2027

- Timing and capacity additions from optimization
- Ownership after PTC/ITC expires if economical

100% Carbon free energy goal by 2030

- Carbon free assumes no fossil generation
- Retire Sand Hill CC and Gas turbines in 2030
- Transmission upgrades with retirement of all the Gas units where known
- 65% renewable goal

100% renewable energy goal by 2035

- Timing and capacity additions from optimization
- In addition to 80% by 2027, equal increments are added in 2031, 2033 and 2035
- Ownership after PTC/ITC expires if economical

¹ The full resolution is available in Appendix A.

Executive Summary

In addition to meeting the goals of the Austin Climate Protection Plan, resource planning at Austin Energy is a continuous strategic initiative that supports several strategic goals for Austin Energy including Financial Health, Business Excellence and Environment.

Resource planning also sets high-level goals and strategies to manage customer demand. Reducing customer demand, especially during hours when prices are highest has the effect of lowering cost while lessening the environmental footprint of using energy. As a result, these programs allow the utility to maintain strategies that benefit all of our customers.

On August 17, 2017, the City Council approved [Resolution No. 20170817-061](#)², adopting the Working Group recommendations and providing additional direction. The resolution further directed Austin Energy to perform different studies targeting different renewable and storage goals. The studies encompass a 10-year planning horizon within the ERCOT Nodal market framework. The studies help provide information to assess the opportunities and risks for serving AE electric customers over the longer term.

In addition to meeting the goals and objectives adopted in the *2027 Plan*, the directives direct Austin Energy to perform studies that includes:

- Construct a model that achieves both a 75% and an 80% renewable energy goal by 2027, including a consideration of the costs, benefits, risks and potential rate impacts
- Construct a model that achieves a 100% carbon-free energy goal by 2030, including a consideration of the costs, benefits, risks and potential rate impacts
- Assess the feasibility of achieving 100% renewable energy by 2035
- Study the costs, benefits, risks and potential rate impacts of achieving a more aggressive electric storage goal, such as 50 MW of electrical storage by 2027 and of achieving 100 MW of electrical storage by 2027

The studies considered renewable generation across different geographical regions in ERCOT using optimization. Our studies recommend solar and to a lesser degree wind, ideally both located closer to the load centers. However, we note that Austin Energy renewable procurement is based on a request for proposals and considers prices, location and congestion amongst other factors and may deviate from the studies recommendations meaning a recommendation may not be commercially viable yet.

There is no question that solar and wind have and will continue to benefit the ERCOT market in the form of lower emissions and prices; however, absent large scale storage there is operational risk in the near-term that needs to be addressed. To that aim, ERCOT identified operational challenges associated with Intermittent Renewable Resources (IRR) among them; intermittency in energy supply making it difficult to predict available capacity for future hours and impacting regulation services, as

² The full resolution is available in Appendix A.

well as large and sudden ramps for managing variance. In addition, renewable capacity may not coincide with peak demand (so called California Duck-Curve).

AE’s current and future portfolios are affected by many factors including:

- Rapidly changing market environment
- Future is uncertain. The model assumes one knows everything it needs to make the best choice, i.e. “perfect information” which inherently makes model results less tenable
- Risks associated with intermittent resources
- Transmission limitations creating congestion from more penetration of renewable resources
- Ramp issues and duck curve
- Future market rule changes with a changing energy mix
- Future Federal policy changes
- Future PPA terms and costs

In short, there is a growing cone of uncertainty, which is difficult to quantify. However, Austin Energy is able to provide a range and we are confident the result can fall anywhere in the range under various uncertainties. The NPV for power supply adjustment cost (PSA) ranges are as follows:

Net Load Cost (\$million)	65%	75%	80%	100%	Carbon_Free
Low (5th Percentile)	\$4,170	\$4,208	\$4,227	\$4,267	\$4,224
High (95th Percentile)	\$6,681	\$6,667	\$6,660	\$6,658	\$6,825

Tables below provide PSA annual average nominal cost.

Table 6.5 - Renewable Studies PSA Average Annual Nominal Cost

Average Net Load Cost (\$million)	65%	75%	80%	100%
Low (5th Percentile)	\$410	\$414	\$417	\$423
High (95th Percentile)	\$685	\$683	\$682	\$681

Table 6.7 - Carbon Free Annual Average Nominal PSA

Average Net Load Cost (\$million)	Carbon_Free
Low (5th Percentile)	\$418
High (95th Percentile)	\$707

Table 4.3.2 below shows the expected 20-year nominal net revenues inclusive of capital cost for storage installed between 2023 and 2027.

Table 4.3.2 - Expected Net Revenue Inclusive of Capital Cost

Year Battery Installed	2023	2024	2025	2026	2027
2020					
2021					
2022					
2023	(\$216,119)				
2024	(\$285,734)	(\$251,729)			
2025	(\$263,086)	(\$229,080)	(\$199,429)		
2026	(\$265,389)	(\$231,382)	(\$201,732)	(\$173,405)	
2027	(\$416,954)	(\$382,945)	(\$353,298)	(\$324,970)	(\$296,558)
2028	(\$398,774)	(\$364,763)	(\$335,118)	(\$306,790)	(\$278,376)
2029	(\$232,831)	(\$198,819)	(\$169,175)	(\$140,847)	(\$112,431)
2030	(\$8,150)	\$25,863	\$55,506	\$83,834	\$112,251
2031	(\$222,441)	(\$188,426)	(\$158,786)	(\$130,458)	(\$102,039)
2032	(\$227,177)	(\$193,161)	(\$163,522)	(\$135,194)	(\$106,773)
2033	\$16,300	(\$197,990)	(\$168,353)	(\$140,025)	(\$111,602)
2034	\$11,375	\$21,208	(\$173,280)	(\$144,952)	(\$116,527)
2035	\$6,350	\$16,182	\$26,015	(\$149,978)	(\$121,551)
2036	\$1,226	\$11,056	\$20,890	\$30,594	(\$126,675)
2037	(\$4,001)	\$5,827	\$15,661	\$25,366	\$34,959
2038	(\$9,333)	\$494	\$10,329	\$20,034	\$29,626
2039	(\$14,772)	(\$4,946)	\$4,889	\$14,595	\$24,187
2040	(\$20,319)	(\$10,494)	(\$659)	\$9,047	\$18,639
Total	(\$2,549,829)	(\$2,173,103)	(\$1,790,062)	(\$1,463,148)	(\$1,152,869)

Table 4.3.2 shows that based on expected capital cost battery storage is currently uneconomical.

Table 4.3.3 shows the expected hourly energy and ancillary service revenues and charging cost over the battery life for 10MW/20MWH energy storage installed in 2023.

Table 4.3.3 - 10 MW/20 MWh Battery Storage Energy, Ancillary Revenues and Charging Cost
2023 Installation Year

Year	Total Energy Revenue	Total FRRSUP/RRS Revenue	Total FRRSDN Revenue	Total Charging Cost
2023	\$197,314	\$882,643	\$110,959	\$12,951
2024	\$145,736	\$817,387	\$116,018	\$11,970
2025	\$223,871	\$807,169	\$109,561	\$14,161
2026	\$232,340	\$820,536	\$112,687	\$19,016
2027	\$179,298	\$672,199	\$111,826	\$21,346
2028	\$203,833	\$725,653	\$122,349	\$25,773
2029	\$264,744	\$852,022	\$130,629	\$30,130
2030	\$405,968	\$940,887	\$131,335	\$36,603
Total	\$1,853,104	\$6,518,496	\$945,364	\$171,949

Figure 4.3.2 shows the ancillary services by energy revenue components and charging cost for a battery installed in 2023.

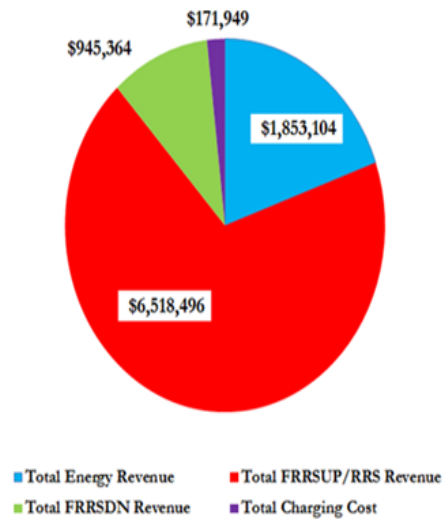


Figure 4.3.2 - 10 MW/20 MWh Battery Storage Energy, Ancillary Revenues and Charging Cost
2023 Installation Year

Table 4.3.3 and Figure 4.3.2 highlight the fact that Ancillary services provide the bulk of revenue for grid scale energy storage, whereas energy arbitrage provide limited revenues. Maximum revenue is achieved by selling FRRSUP and RRS combining for 70% of revenues, then energy revenue 20% and FRRSDN at 10% of revenues. This finding is consistent with a report published by PG&E

summarizing the potential revenues of energy storage in the CAISO market. Charging costs include the potential deployment of storage in real time to provide regulation down.

The following key themes have emerged from the Studies:

- When prices are low as in the 5th percentile, increasing the share of renewable resources increases the PSA
- When prices are high as in the 95th percentile, increasing the share of renewable resources is flat assuming resources are closer to load centers and available during high price periods
- Retiring all gas generation increases the PSA in both High and Low cases.
- Storage seems to add cost to the portfolio and would require further reduction in the cost to make it economical

The intermittent nature of energy production from renewable resources, and the much wider geographic footprint of power generation resources than is usual for an electric utility, a daily supply portfolio and risk management process involving production forecasting, supply balancing transactions, and seasonal, monthly and daily congestion (basis) hedging becomes paramount to the successful operation of a power supply portfolio of renewable resources. In conclusion, Austin Energy continues to remain the leader among its peer utilities in achieving a clean generation portfolio and providing for sound business decisions in a highly competitive electric market. Austin Energy will continue to strive to strike a balance between both objectives. Flexibility is key for achievement of the goals and maintenance of rate stability.

PSA Rate Impact

Figure 6.1.1 shows ranges of Electric revenue above or below the 2% affordability goal. From the 2% affordability goal measure, the studies seem to be affordable provided there is a 2% rate increase from 2012 rates. However, this result does not address the competitive measure of below 50th percentile from the rest of Texas, which is difficult to quantify.

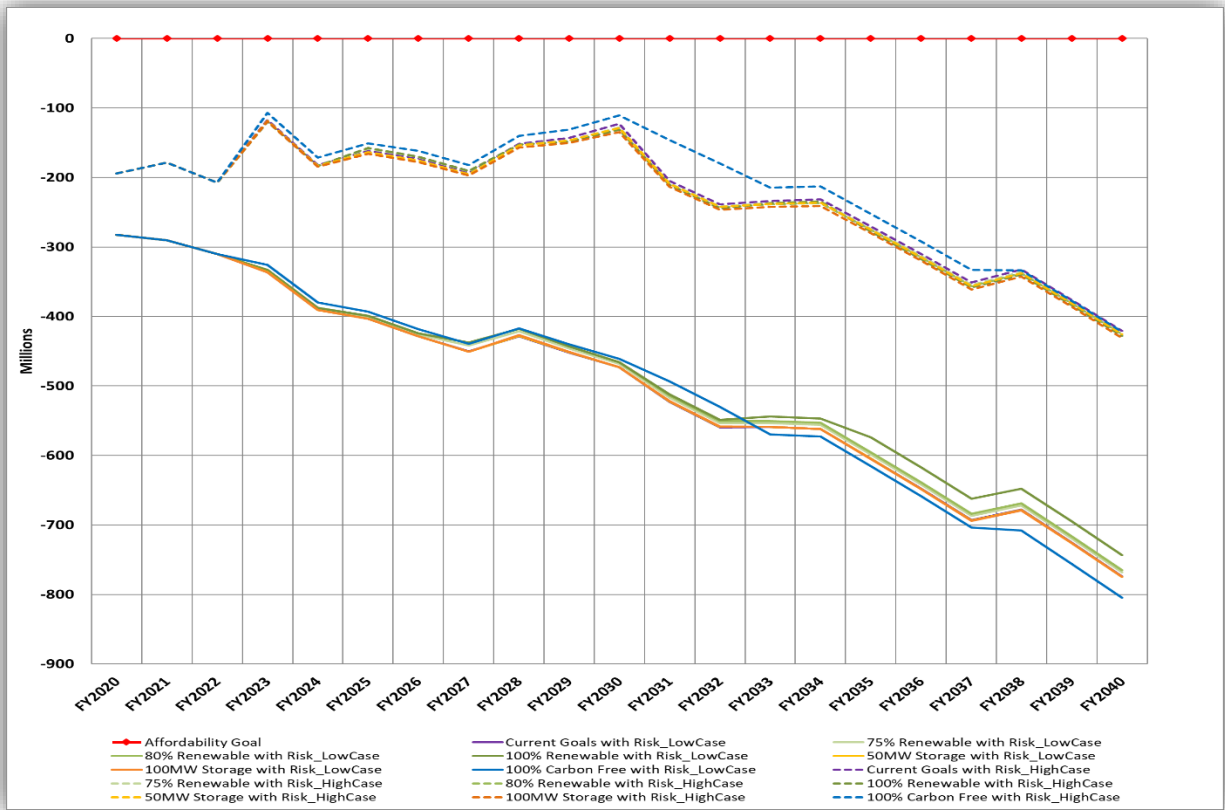


Figure 6.1.1 - Total Dollars above (below) the 2% Goal (High/Low Scenarios)

Figure 6.1.2 shows the system rates for all the studies under high and low cases.

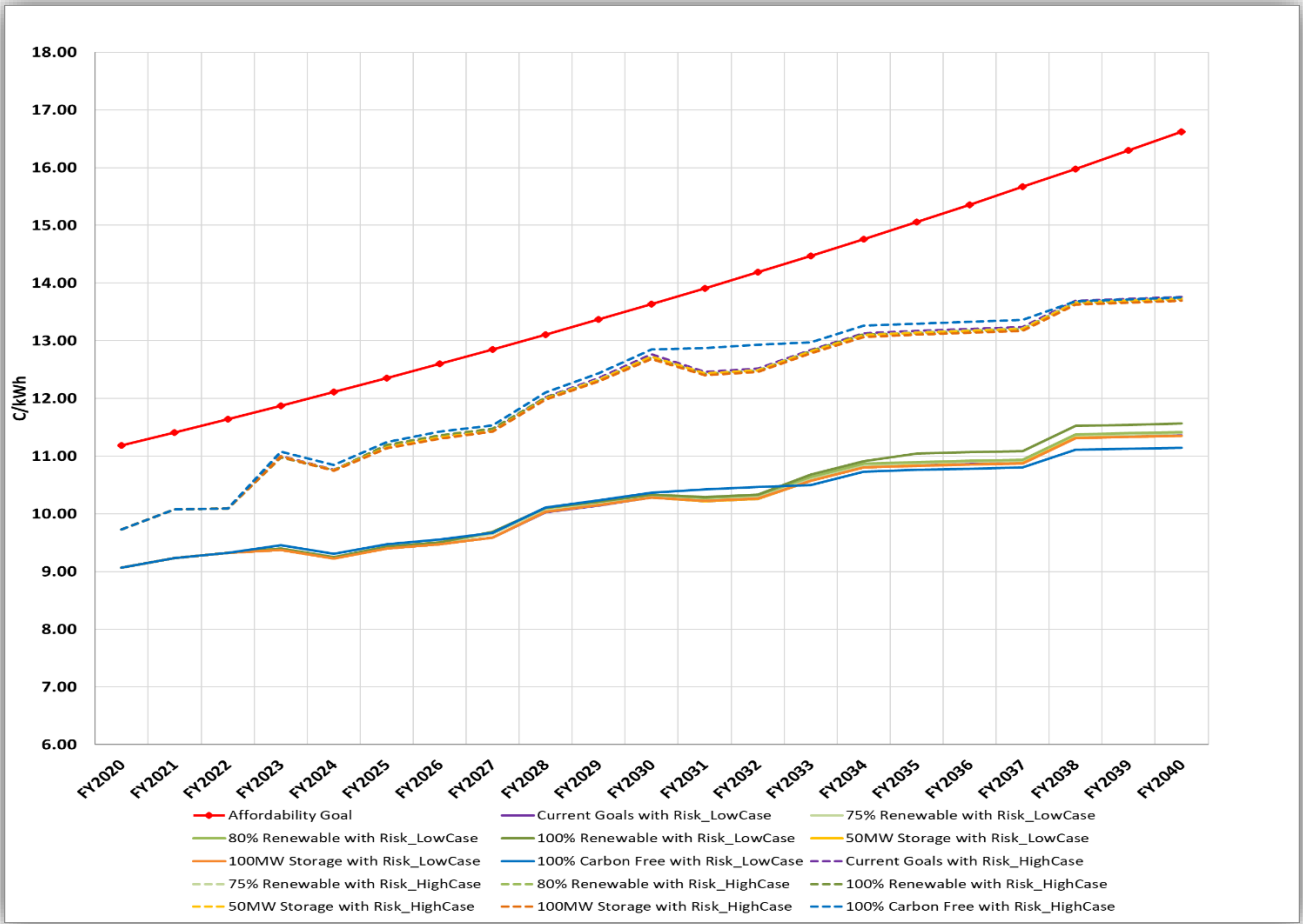


Figure 6.1.2 – Average System Rates above (below) the 2% Goal (High/Low Scenarios)

What is the Difference between Carbon Neutral, Zero Carbon & Negative Emissions?

We hear these terms all the time, but if you had to explain them to a friend over coffee, how well could you do it?

To communicate these concepts well, we need to understand them clearly ourselves.

Let's get into it.

Carbon Neutral vs. Zero Carbon

Carbon Neutral: Refers to achieving net zero carbon emissions by balancing a measured amount of carbon released with an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference. The key word to remember is "net." Think of it like breaking even. Whatever you're making or doing, you capture or offset as much carbon as you produce to make or do that thing. For example, a building with solar panels that sends renewable energy to the grid that is equal to the energy it uses from the grid can be considered "net zero" energy or carbon neutral.

Zero Carbon: This is a case when no carbon was emitted from the get-go, so no carbon needs to be captured or offset. For example, a household or commercial building that is off-grid, running entirely on solar, and using zero fossil fuels can label its energy "zero carbon".

What Does Negative Emissions Mean?

Negative Emissions: Refers to a number of technologies, the objective of which is the large-scale removal of carbon dioxide from the atmosphere. Negative emissions is the mystical unicorn. You can find which companies are exciting in this space in our post [The Rise of Carbon Capture](#). Paired with widespread renewable energy, negative emissions will be a key player in dodging (dipping, diving, ducking, and dodging) runaway climate change.

Source: <https://cleantechrising.com/whats-the-difference-between-carbon-neutral-zero-carbon-and-negative-emissions/>

Defining Zero Carbon

Carbon free means no carbon dioxide emissions. A state would be getting all of its electricity from renewable or clean sources like solar, wind or nuclear.

Carbon neutral means that a city or state is removing as much carbon dioxide from the atmosphere as it is putting in. The *net* amount of carbon emissions is zero. This can be achieved through carbon offsets like carbon sequestration or planting trees.

Source: <https://www.npr.org/2019/06/18/724343789/going-zero-carbon-is-all-the-rage-but-will-it-slow-climate-change>

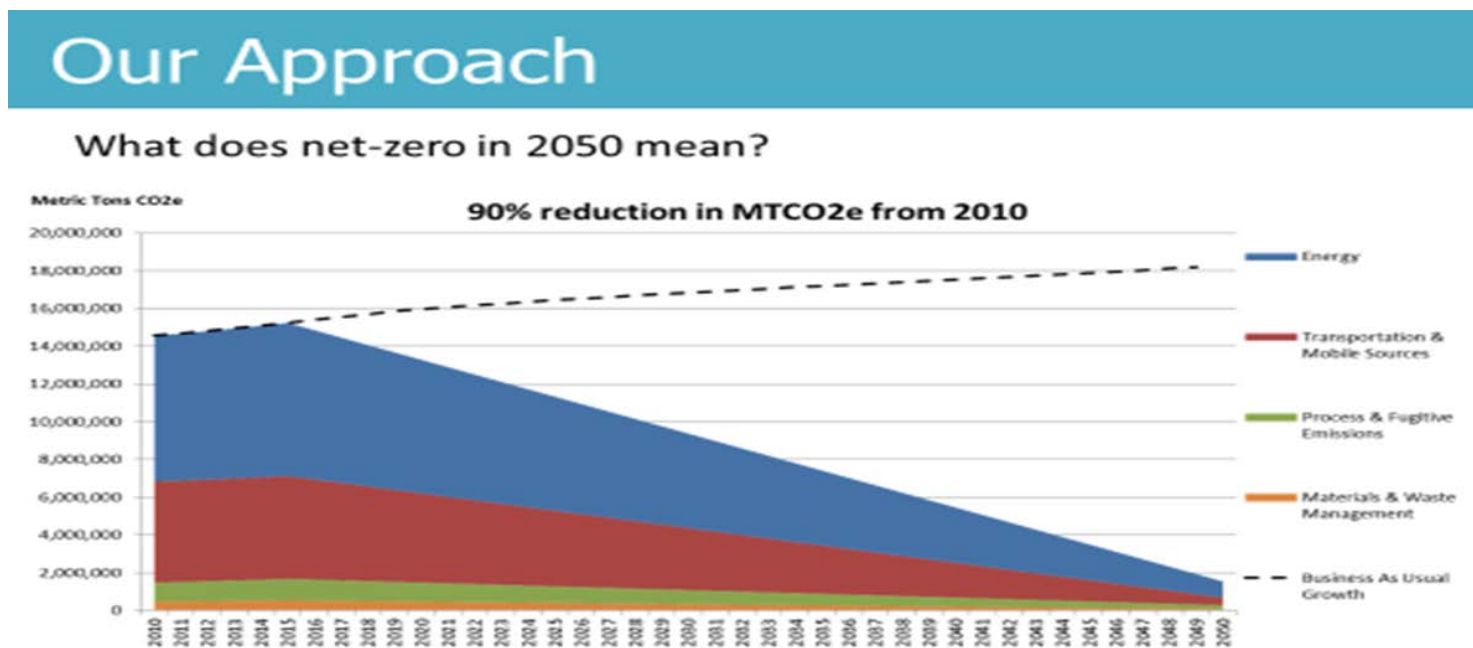
Climate positive, carbon neutral, carbon negative: What do they mean?

- **Carbon neutral** means that an activity releases net zero carbon emissions into the atmosphere.
- **Climate positive** means that an activity goes beyond achieving net zero carbon emissions to actually create an environmental benefit by removing additional carbon dioxide from the atmosphere.
- **Carbon negative** means the same thing as “climate positive.”
- **Carbon positive** is sometimes how organizations describe the previous two definitions. It’s mainly a marketing term, and understandably confusing—we generally avoid it.

Source: <https://www.fastcompany.com/40583176/climate-positive-carbon-neutral-carbon-negative-what-do-they-mean>

Joint Sustainability defining Net Zero:

Our definition for net zero community wide emissions by 2050 is that it’s at least a 90% reduction in total emissions.



	Time Frame 2030								Outcome
	<u>Load Purchase</u>	<u>Renewable Sales</u>	<u>STP Generation Sales</u>	<u>Gas Sales (DGT,SHGT,SHCC)</u>	<u>Coal Sales</u>	<u>Storage Purchase or Sale</u>	<u>Local Solar MW (1,2)</u>	<u>DSM MW (3)</u>	<u>Carbon Free %</u>
Current Goal	100%	65%	23%	Dispatched Economically	<i>None</i>	<i>10 MW</i>	373	900	88%
75% Renewable	100%	75%	23%	Dispatched Economically	<i>None</i>	<i>10 MW</i>	373	900	98%
80% Renewable	100%	80%	23%	Dispatched Economically	<i>None</i>	<i>10 MW</i>	373	900	103%
100% Renewable	100%	100%	23%	Dispatched Economically	<i>None</i>	<i>10 MW</i>	373	900	123%
Carbon Free	100%	65%	23%	<i>None</i>	<i>None</i>	<i>10 MW</i>	373	900	88%
Net Zero	100%	77%	23%	Dispatched Economically	<i>None</i>	<i>10 MW</i>	373	900	100%

- (1) Behind the meter reduces load, purchased from customers (VOS, CVOS)
- (2) In front of meter purchased from 3rd party (including Blackland and Webberville), sold to ERCOT
- (3) Reduces load, pay / incentivize customers