

Arizona Thrives: Projections for Arizona Carbon Emissions

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Introduction

Arizona State University (ASU), on behalf of Arizona Thrives, reviewed carbon emissions associated with electrical generation beginning in 2005 and projected through 2050 based on the actions and commitments made by Arizona's three largest electric utilities, representing more than 80% of the electricity consumed in the state. The three largest electric utilities - Arizona Public Service (APS), Salt River Project (SRP), and Tucson Electric Power (TEP) – provided their individual data to ASU to support Arizona Thrives' interest in understanding the cumulative impacts of the electric utilities' commitments to carbon emission reductions through 2050.

All three utilities have made ambitious commitments to reduce carbon emissions. These commitments have been made in response to changing demands from customers for clean energy, renewable energy becoming more cost competitive, natural gas displacement of coal for base energy, technology advances in battery storage and other factors.

Results

Carbon emissions associated with electrical generation are frequently expressed in terms of absolute quantity and carbon intensity (the emissions per megawatt hour of electricity used). The consistent measurement and projection of these two metrics collectively across all three utilities was a primary interest of Arizona Thrives.

This study found:

- Absolute Carbon emissions in Arizona as of 2019 have already declined by 26.6% (expected to be 32.4% In 2020) since 2005. Carbon Intensity over the same period declined by 28.3% (expected to be 36.9% in 2020).
- In 2030 an absolute carbon emissions reduction of 34.4%, and carbon intensity reduction of 53.6% from 2005 levels.
- In 2035 an absolute carbon emissions reduction of 62.2%, and a carbon intensity reduction of 75.8% from 2005 levels.
- In 2050 an absolute carbon emissions reduction of 89.3%, and a carbon intensity reduction of 94.3% from 2005 levels.

The electric utilities public commitments, Integrated Resource plans (IRP's) and operational and asset management plans, as of October 2020, indicate significant declines in emissions over future decades. This decline in absolute emissions and carbon intensity occurs despite accelerating load growth and existing coal contracts. A rapid reduction in carbon emissions in 2031 is associated with planned coal plant closures.

Methods

Arizona State University reviewed information provided by each electrical utility (TEP, APS, and SRP) to produce the cumulative historical data and projections for electricity loads and carbon emissions,

representing over 80% of electricity consumed in the State of Arizona. Each Utility provided information on their individual historic and projected electricity load and associated carbon emissions, as well as, relevant details of their current commitments for reducing carbon emissions into the future. The information and data based on these internal operational and management plans was current as of October 2020 but does not reflect the impact of the coronavirus pandemic, which started in March 2020, or policy decisions made after October of 2020, including decisions by the Arizona Corporation Commission (ACC) to reduce carbon emissions.¹

Electricity load in this study includes all electrical generation to meet retail load, as well as distributed generation produced on each utilities grid. This approach will account for more than 80% of electricity and carbon emissions associated with powering Arizona's electric customers. Electricity load includes losses in transmission lines during delivery to customers, distributed generation within the systems of all three utilities and other minor factors. Imported electricity from power plants physically located outside of Arizona (such as Four Corners) is included in this study, while exported (out of state) electricity generation is not included. Wholesale electricity sales within the state to smaller utilities is also excluded. The absolute carbon emissions and carbon intensity figures in this study will be lower than data sources that rely solely on the physical locations of power plants (such as the Energy Information Administration²).

All three utilities have internal operational and asset management plans in place that are adjusted on a rolling basis (usually 5 years) that reflect emissions reduction goals. This study reflects the current IRPs of TEP and APS³ and similar internal processes of SRP. Where APS's IRP includes three potential scenarios through 2035, the average of these three scenarios was used in this study. SRP and TEP provided only one scenario for the future. All three utilities regard future plans as dependent upon ongoing assessments of the needs of Arizona customers and the progression of various technology options.

Load and Energy Efficiency

Historical load data was provided by APS, TEP, and SRP. In 2005, electrical load was 69.5 million megawatt hours (MWh) and has risen to only 71.1 Million MWh as of 2019. All utilities expect electricity demand to increase in the coming years producing load growth. Each utility has a unique service area and projects future growth based on various local assumptions of the way in which Arizona's electrical needs will evolve. Energy efficiency measures or slower than expected economic growth have the potential to reduce the rate of load growth, however, faster than expected electrification or economic growth could increase demand for electricity. Historical electrical demand and expected future demand growth are shown in Figure 1. Historical load is known and illustrated as a line, future load is the average over three time-periods. The first period includes the six-year time period of 2020-2025, and the other two periods cover the five-year timeframes of 2026-2030 and 2031-2035. Figure 1 also includes an estimated electrical load for 2050.

¹ Pearce, Kyla (2020, November 19) Carbon free Energy required by 2050 under Arizona Corporation Commission proposal. *Cronkite News*.

² EIA 2017 "Arizona Energy Summary information"

³ Lockwood, Barbara et al. (2020, 26 June) Arizona Public Service Company Integrated Resource Plan. *APS*; Yockey, Jeffrey et al. (2020, 26 June) Tucson Electric Power 2020 Integrated Resource Plan. *TEP*

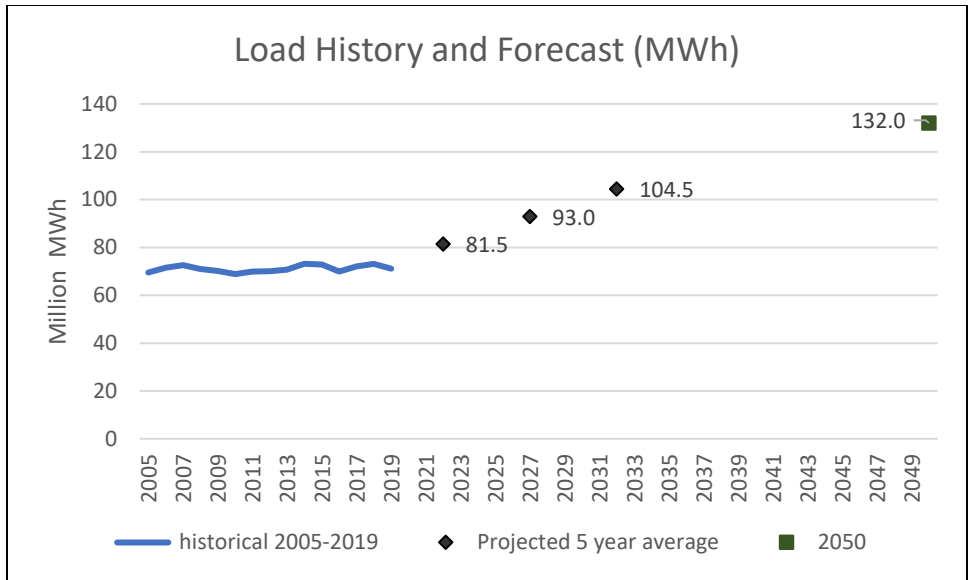


Figure 1

Electricity demand reflects not only the energy used but also energy efficiency efforts. This study includes the cumulative impact of energy efficiency programs dating back to 2005 for SRP and APS, and to 2011 for TEP. Each utility has a unique methodology to calculate their energy efficiency contribution. Nevertheless, the current impact of energy efficiency efforts reported by the utilities is now equivalent to over 13 million MWh annually as shown in Figure 2 along with historical load. The cumulative impact of energy efficiency alongside load and future load estimates are shown in Figures 3.

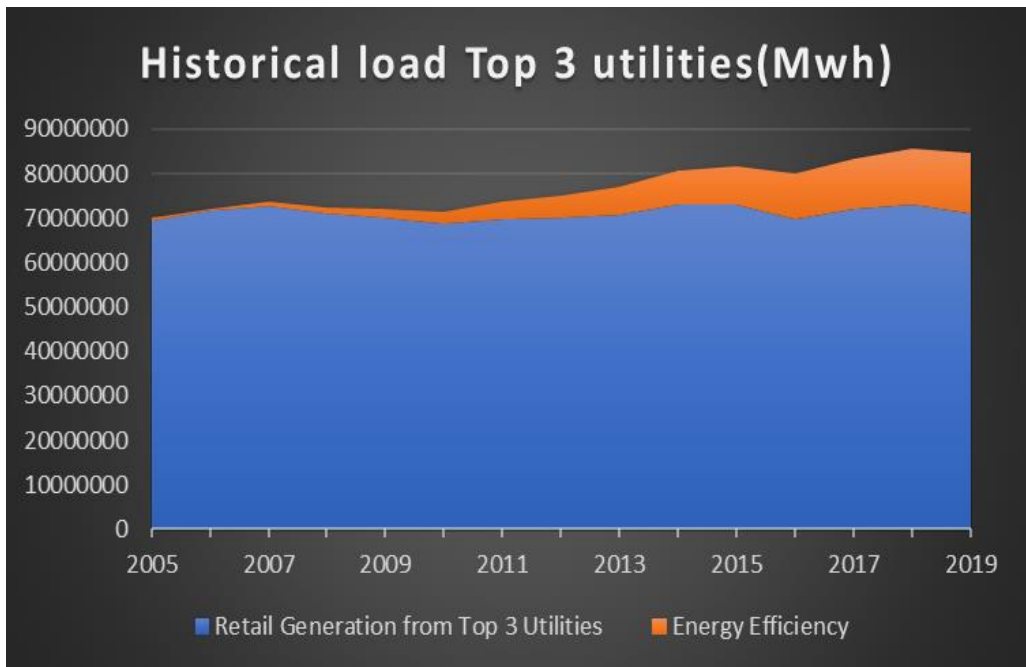


Figure 2

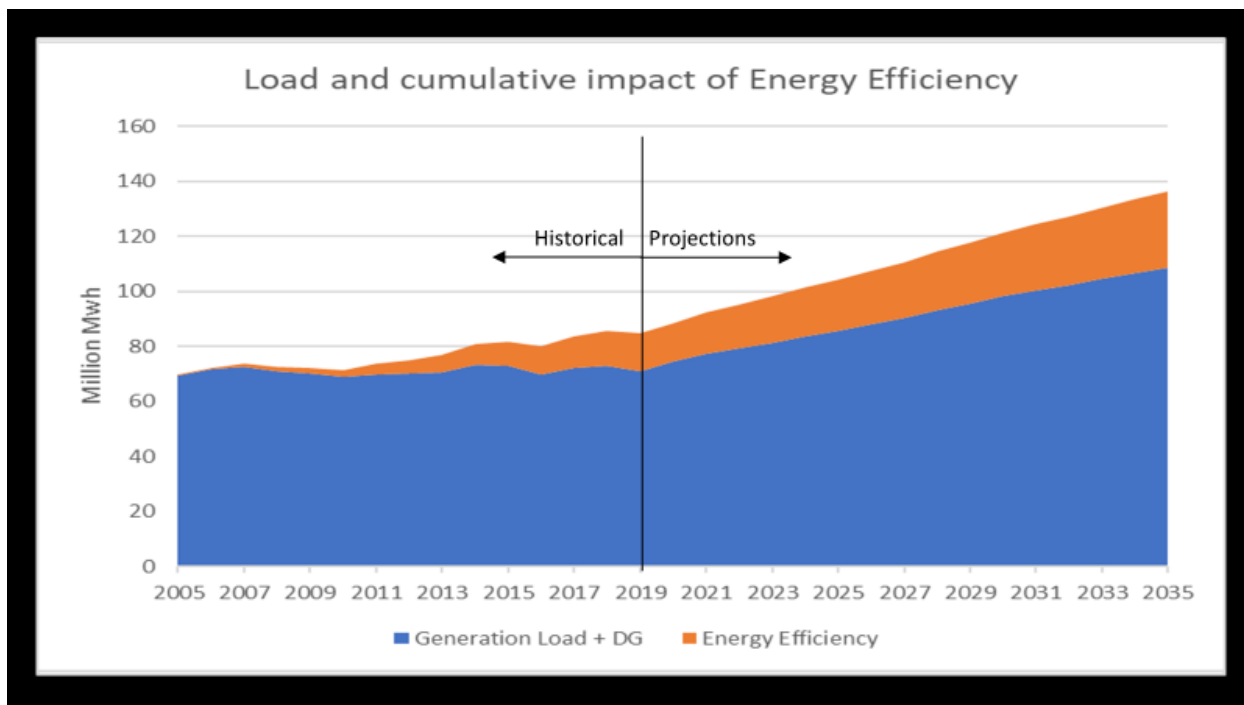


Figure 3

Emissions

The electrical utilities each provided historical carbon emissions data and projected carbon emissions data based on their current utility plans. Carbon emissions in 2005 were 43.3 Million Metric Tons (MMT) and have declined to 32.3 MMT as of 2019 (26% lower). Carbon intensity in 2005 was 1398 pounds per MWh and has declined to 1002 pounds per MWh as of 2019 (28.3% lower). These emissions declines shown in Figure 5 and 6 include historical data and projected averages for three time periods (2020-2025, 2026-2030 and 2031-2035) and a 2050 estimate.

The projections from 2020-2035 are based on current plans of the utilities. Beyond 2035, the utilities have few specific plans but each has made specific public commitments. The absolute carbon emissions and carbon intensity projections for 2050 reflect APS’s commitment to being a net-zero carbon emitter by 2050⁴, SRP’s goal of a 90% carbon intensity reduction by 2050⁵, and TEP’s estimate of 2050 emissions provided to ASU. All these figures are likely to change substantially as policy and commitments change in the coming years.

⁴ (2020) Clean Energy, APS

⁵ (2020), 2035 Sustainability Goals, SRP

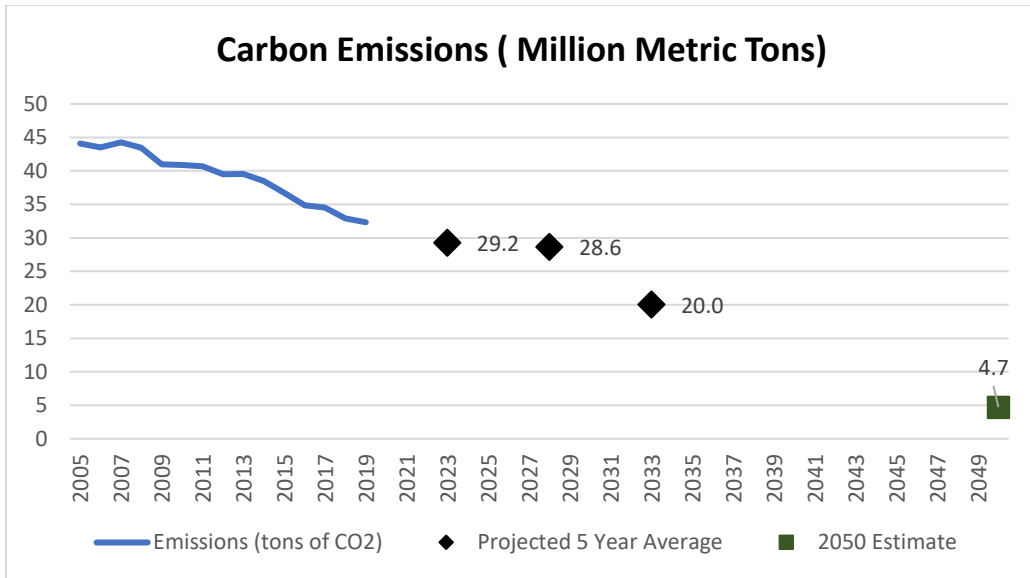


Figure 5

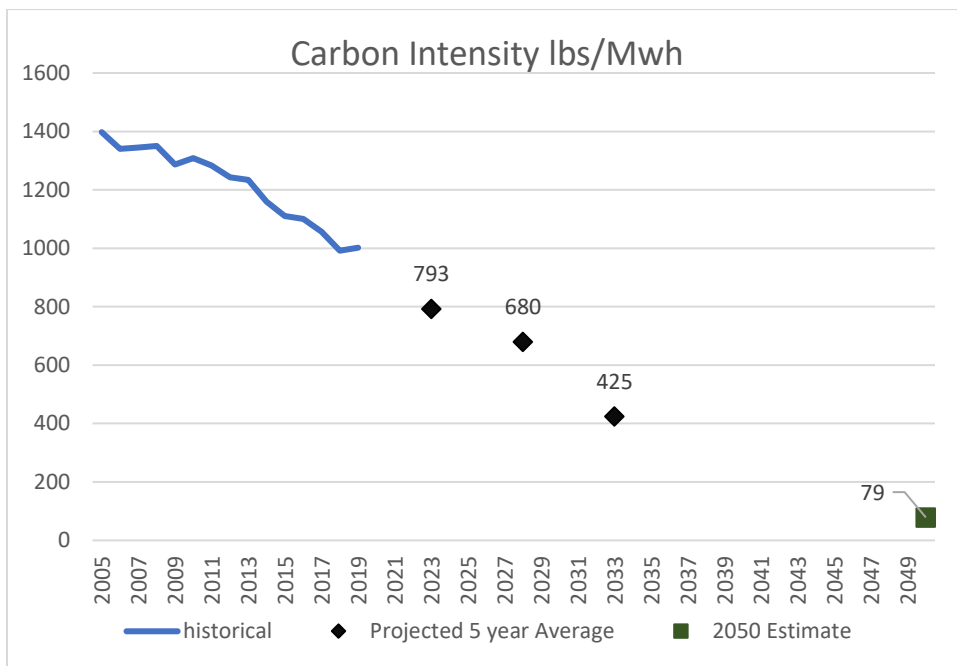


Figure 6

Conclusions

Substantial progress has been made towards reducing Arizona’s emissions in the electricity sector. As of October 2020, the utility plans already represented ambitious goals, years of planning and a substantial knowledge base within the utilities of the opportunities provided by clean energy. Short term-trajectories of emissions will be highly dependent on load growth, until the coal plant closures currently planned for 2031 come to fruition. Further efforts to meet the goals of Arizona Thrives will be dependent on Arizona’s

utilities and cooperatives continuing to maintain existing commitments and strengthening their current efforts. However, By 2030 other sectors of the economy will become the largest contributors to carbon emissions in Arizona. With the commitments of Arizona's electricity providers, it is possible that increased electrification across our economy could become an essential way to remove carbon emissions from other parts of the economy, rather than a source of those emissions. This issue is likely to be a significant focus of future work by Arizona thrives to cover additional economic sectors.

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