Planning for a Sustainable Future with an Electric Utility: Emissions Reductions and Cumulative Carbon Budgets

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End Users: Tucson Electric Power, Western Energy Institute, Salt River Project, Arizona Public Service

Additional Support: Tucson Electric Power; Udall Center for Studies in Public Policy – University of Arizona; Institute for Energy Solutions – University of Arizona

Project Dates: 2019 – 2020

Summary of Impact

Supporting carbon reduction: This project significantly impacted how Tucson Electric Power (TEP), a utility in Tucson, AZ, plans for and implements carbon reduction strategies. TEP now considers the total accumulated emissions of its energy portfolios, instead of relying on percent emission reductions, providing a more comprehensive view of long-term environmental impact. By using the project's tools and data, TEP could better evaluate different energy scenarios and understand the impact of their choices on emissions and warming. The project helped justify a rapid phase-out of coal-fired power plants and a transition towards cleaner energy sources, as reflected in TEP's 2020 Integrated Resource Plan.

Creating a reusable framework for carbon budget evaluation: The project's data and methodology are publicly available, allowing researchers and other organizations to reproduce the analysis, contribute improvements, and adapt the tools for their own needs. Researchers created a reusable framework for evaluating carbon budgets across various sectors, enabling organizations to understand their carbon footprint and contribute to global emissions reduction efforts.

Problem Statement

Public utilities are under considerable pressure to respond to public demand for carbon reductions but lack the mechanisms to evaluate resource portfolio decisions objectively.

Research Focus

The project examined different combinations of energy sources (like solar, wind, natural gas, and coal) that TEP could use to generate electricity. Research focused on analyzing carbon reduction strategies for TEP's resource portfolio and assessed the implications that

different portfolio decisions might have on things like carbon emissions, global warming, and air quality.

Project Activities

Stakeholder engagement: Held in person and virtual meetings and presentations with TEP, with its stakeholder advisory council, and with other utility partners. Feedback incorporated into research design and analysis.

Data collection and analysis: Analysis of carbon reducing energy portfolios. Review of practices from other utility companies in U.S.

Documenting project approach: Project materials were shared beyond project partners.

Project Outputs

Data:

TEP Carbon Goals – Data and Process GitHub Repository: This repository contains the data and analysis used to inform Tucson Electric Power's carbon goals in their 2020 Integrated Resource Plan. All the assumptions, code, documentation, and results are available on the repository. The code is open source and fully transparent. Anyone can replicate, test, or improve this analysis, or update it based on new information.

Workshops and Partner Meetings:

Integrated Resource Plan Monthly Workshop – Stakeholder Advisory Council. 2019. Hosted by Tucson Electric Power, Tucson, AZ. Researchers presented the process and framework of UA's involvement in the IRP process to the council for feedback.

Emissions Framework Workshop - Stakeholder Advisory Council. 2020. Tucson Electric Power, Tucson, AZ. Presented a cumulative emissions framework to the council for feedback.

Integrated Resource Plan Virtual Forum. 2020. Western Energy Institute. Present the cumulative emissions framework to IRP practitioners for feedback and discuss how it is as an 'innovative' way to empirically track emissions and emissions reductions as opposed to a percent reduction framework.

Emissions Framework Git Hub Demo - Stakeholder Advisory Council. 2020. Tucson Electric Power. Demonstrate the GitHub site for the cumulative emissions framework for the IRP process to the council for feedback.

Presentations:

University of Arizona Partner Showcase. 2019. Presentation for TEP/Fortis Executives. University of Arizona. Opportunity for teams to share research activities with Fortis vice-president of sustainability.

TEP Integrated Resource Plan – Public Workshop. 2020. Hosted by Tucson Electric Power. An all-day, virtual workshop to solicit comment about resource planning alternatives to

reduce greenhouse gas emissions while providing reliable, affordable electric service. Researchers presented project background and demonstrated the emissions reductions framework and analysis.

Reports:

McMahan, B., W. Holmgren, A. Gerlak. 2020. Climate and TEP Resource Portfolios – Emissions Reduction and Cumulative Carbon Budgets. Appendix to the Tucson Electric Power 2020 Integrated Resource Plan. This report summarizes global warming implications for various resource portfolios developed by TEP as part of their 2020 IRP process.

Knudson, C., A.K. Gerlak, B. McMahan. 2019. Greenhouse Gas Reduction Goal Planning Report. Prepared for Tucson Electric Power. Institute of the Environment, University of Arizona. Provides an overview of current scientific understanding of observed and projected global climate change, emphasizing the evidence behind these global processes and their impacts. Summarizes frameworks for carbon reduction targets, describes goals and targets of a set of electrical utilities, and summarizes the characteristics of these utilities (like size, fuel source, history, target setting).

Media Coverage:

TEP's 2035 energy plan and the role of UA's Institute of the Environment. 2020. *Daily Wildcat*.

New TEP plan ends coal use by 2032, ratchets up renewables use. 2020. *Arizona Daily Star*.

Tucson Electric Power gets an earful about how to cut greenhouse gases. 2019. *Arizona Daily Star*.

On use of findings:

It was very helpful to learn that we were close to where we had to be in terms of our carbon commitment. It also was helpful to see how that stacked up against other utilities. All the rest of our stakeholders and rate payers, whoever read the IRP, would see that we're on the right path, both compared to other leaders in the in the industry and in terms of the science. This was a big down payment on ultimately where we needed to go. It helped our credibility in terms of goal setting.

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Lee Alter, Tucson Electric Power

Selected Scientific Findings:

Cumulative carbon portfolio: Decisions about energy sources are often based on cost. This project provided a new way to compare portfolios by considering their environmental impact, giving TEP a more complete picture for decision-making. Instead of just looking at percent of emissions reductions, the analysis considered the total amount of carbon released over time. This highlighted the importance of reducing emissions quickly, as early reductions have a greater impact on long-term warming. The analysis looked at how each portfolio would affect both carbon emissions and the resulting increase in global

temperature. This helped determine if a portfolio would meet specific climate targets (like limiting warming to 1.5°C or 2°C).

Societal Impacts by Category

Connectivity:

- This project extended from a prior partnership to develop plausible, climate-driven carbon-reduction scenarios for Tucson Electric Power.

Capacity Building:

- To offer transparency and encourage wider collaboration, researchers made this project's data and methodology fully accessible through an open-source GitHub repository. Anyone can reproduce the analysis to verify findings, offer changes, or update the analysis with new data. Members of TEP's Advisory Council recognize the value of the open-source nature of the repository and have referenced it in their own work.

> ***On academic expertise:***
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> It was really helpful for all the other stakeholders to hear what Ben and Andrea had to say. They were there all the time, at least one of them, and they would speak up when people had just general questions and discussions. They were the experts in the room. That was like another layer of value that they brought beyond the analysis.
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> *Lee Alter, Tucson Electric Power*

Instrumental:

- TEP's 2020 Integrated Resource Plan demonstrates a significant commitment to reducing carbon emissions in terms of timing and intensity. It adopted an aggressive timeline for carbon reduction. The plan uses a more transparent and data-driven approach to justify its strategies compared to plans from other utilities.
- Researchers created a transparent and reusable framework for evaluating carbon budgets across various sectors. This data infrastructure allows any organization with emissions and warming targets to better understand their carbon budgets. By working closely with TEP, researchers tailored this tool to meet their specific needs, enabling them to contextualize their energy decisions and how those decisions might scale to a global context.
- Despite constraints due to prior investments in carbon-intensive generating sources, through this project TEP was able to explore various energy portfolio scenarios and their impact on warming and emissions, emphasizing the importance of timing in reducing carbon emissions. This analysis demonstrated to regional stakeholders that while immediate elimination of all carbon-based fuels may not be feasible, a rapid phase-out of coal-fired power plants would significantly reduce cumulative carbon emissions. This strategy allows for a transition period where natural gas serves as a "bridge fuel" on the path towards 100% clean and renewable energy.

- TEP incorporated cumulative emissions assessments in its Integrated Resource Plan, which is presented to the Arizona Corporation Commission. Project recommendations and analysis were directly integrated into this document. The data repository was published on TEP's Integrated Resource Plan web page.

Conceptual & Capacity Building:

- This project provided TEP with a more comprehensive understanding of the impact of their energy choices. Initially the project focused on setting emissions reduction targets, but it shifted toward a cumulative emissions analysis**.** Instead of just measuring reductions from a baseline, the project analyzed the total accumulated emissions of different energy portfolios. This approach provided a clearer picture of long-term environmental consequences.
- By linking emissions data with climate models, the project allowed TEP to directly assess the warming impact of their portfolio decisions. This highlights the importance of early and continuous emissions reductions beyond setting percentage-based targets.
- While TEP was already moving toward renewables and low carbon fuels because of their low cost, but the metric to describe cumulative impact of early reductions may have helped them justify their earlier reductions.
- Feedback from TEP stated that CLIMAS' participation in the Salt River Project advisory committee improved climate knowledge and how climate overlapped with other challenges. This improved knowledge built committee members' capacity to discuss issues around a clean energy transition with more peers and colleagues.

On environmental & societal impact:

The most significant outcome is the closure of coal plants, which have an ecological impact locally and globally. And while the ecological effects are really nuanced, these closures will also have a huge social impact up at Springerville and Eagar and Holbrook, where these coal plants are located. All these things stem from our decisions which stem in part from the work that CLIMAS did.

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Lee Alter, Tucson Electric Power

Socio-environmental:

- TEP is closing Units 1 and 2 at the coal-fired Springerville Generating Station, one in 2027 and one in 2032. These closures aim to help TEP reduce its carbon emissions to 80% below 2005 levels by 2035. Another utility, Arizona Public Service, is closing the Cholla Power Plant near Holbrook in spring 2025. These utilities have set up training and education programs for these employees and communities to help them transition to new careers. They are also offering a combined total of $1 million in funding assistance for impacted communities.