ENERGY STRATEGIES

PLATTE RIVER POWER AUTHORITY'S ZERO NET CARBON ANALYSIS

A Critique of the Pace Global Report and Recommendations for Future Analysis

EXECUTIVE SUMMARY

Prepared for

Colorado Sierra Club
Northern Colorado Partners for Clean Energy

March 30, 2018

Disclaimers

Energy Strategies, LLC and employees or persons acting on behalf of the company provides no warranty or representation, expressed or implied, with respect to the use of information contained in this document. Energy Strategies, LLC and its employees assumes no liabilities for damages resulting from the use of any information, data, analysis or conclusions disclosed in this document. While we consider the sources and analysis reliable, Energy Strategies does not recommend that the information contained herein be the sole source of information for decision-making purposes.

Acknowledgements

This report was prepared under a consulting services agreement with Sierra Club's Beyond Coal Campaign. Guidance preparing the report was provided by an Advisory Committee representing the Sierra Club and membership of Northern Colorado Partners for Clean Energy (NCP4CE). Energy Strategies would like to extend our appreciation to members of the Advisory Committee for their insights and feedback throughout the development of this report. Energy Strategies also wish to express our appreciation to Platte River Power Authority's Strategic Planning staff and Pace Global for their thorough and timely responses to our data requests and questions.

While many people provided support to Energy Strategies in the preparation of this report, the opinions, findings and recommendations expressed in this document are those of Energy Strategies, LLC.

Project Team
Jeff Burks, Principal
Gary Mirich, Principal
Keegan Moyer, Principal
Kathleen Fraser, Senior Consultant
Daniel Ramirez, Consultant
Hollie Hohlfelder, Subcontractor

Energy Strategies, LLC
215 South State Street, Suite 200
Salt Lake City, Utah 84111
801-355-4365

Executive Summary

Platte River Power Authority (Platte River) provides wholesale electric generation and transmission services to the municipal utilities of its owner communities—Estes Park, Fort Collins, Longmont, and Loveland. Its generation portfolio is heavily dependent on coal. Due to the interest of its owner municipalities and their customers for cleaner sources of power, Platte River undertook a study to explore the costs of transitioning to a resource generation portfolio that would achieve and maintain zero net carbon (ZNC) emissions. Platte River hired Pace Global, who used the Aurora economic planning model to evaluate the cost impacts to Platte River of transitioning to a generation portfolio that achieves zero net carbon dioxide emissions starting in 2030. The study, Zero Net Carbon Portfolio Analysis ("ZNC Analysis"), showed that Platte River could achieve a ZNC portfolio by retiring its Craig and Rawhide coal-fired power plants while adding 950 megawatts (MW) of solar and wind energy and a new 286 MW combined cycle natural gas fired plant to its generation portfolio in 2030. Compared to a more business-as-usual portfolio, developed through the last Integrated Resource Plan (IRP), the ZNC portfolio costs were shown to be only 8% higher than the IRP portfolio on a net present value basis, over the period of the analysis, 2018–2050. . In a future that deployed the ZNC portfolio, 76% of the power generated by Platte River would be from wind, solar and hydro sources by 2030. The ZNC portfolio also achieves significant CO_2 reductions. The CO_2 emitted from Platte River's portfolio declines from about 3.2 million tons in 2018 to an average of 443,079 tons in the years 2030–2050.

Energy Strategies evaluated the modeling approach, the data inputs, and the assumptions underlying the ZNC Analysis. The purpose of the evaluation was to identify gaps in the analysis and provide recommendations on how the analysis could be improved to provide a more robust and complete assessment of the costs to Platte River of transitioning to a zero-net-carbon or 100% renewable zero-carbon resource portfolio. The Energy Strategies review of the ZNC Analysis resulted in the following key findings and recommendations.

ZNC Accounting

The ZNC accounting scheme is problematic and may undermine effective resource planning.

The ZNC accounting scheme adopted for the ZNC Analysis has limited value as a metric for use in resource planning and decision making. Its use in this analysis is problematic for three reasons. First, it is an unreliable measure of actual carbon dioxide (CO_2) emissions reductions and is not a standard that has been adopted by any existing or proposed regulatory framework to control emissions of CO_2. Second, it depends on an emissions rate to account for the emissions associated with sales and purchases in the wholesale market. The single proxy rate that was used inaccurately reflects regional emissions rates and resource transition occurring in the Colorado market and broader region. Lastly, in this analysis ZNC accounting is dependent on Platte River procuring resources and incurring costs in excess of what is needed to serve its load. There has been no assessment

The emissions rate used in the ZNC analysis for wholesale market transactions is too high.

of whether there will be a market for the excess renewable energy Platte River is required to sell to achieve ZNC.

Energy Strategies recommends Platte River abandon the ZNC accounting scheme and instead work with its owner municipalities and stakeholders to develop a baseline CO_2 emissions forecast and then establish CO_2 reduction goals for the utility that would be achieved within a specified time period. If the ZNC portfolio approach is used in future resource modeling, Platte River should calculate a more accurate emissions rate and account for how the emissions rate will change over time. Aurora can be used to dynamically identify the emissions rate of the marginal dispatchable generation units in the region at the point in time that Platte River is selling excess energy or purchasing energy in the regional market.

Establishing a carbon dioxide reduction goal would be a better approach than ZNC accounting.

Modeling Approach

The ZNC Analysis conducted by Platte River was acknowledged to be a limited "proof-of-concept" study. The analysis only evaluated a single ZNC resource portfolio and did not include sensitivity analysis to account for the uncertainty of assumptions such as future load growth, fuel prices, capital and operating costs and performance of new supply technologies, and costs of environmental regulations. Future resource assessments of ZNC portfolios should evaluate more than one ZNC portfolio, including 100% renewable energy plus storage portfolios. To account for future uncertainty, each portfolio should be tested with high and low ranges of prices and other data assumptions to assess the sensitivity of the results to changes in input values.

Future resource planning should evaluate a number of portfolios that achieve ZNC or zero carbon goals and include sensitivity analysis.

Another limitation of the ZNC Analysis is the dependence on "least-cost" as the primary metric for portfolio selection. In the changing utility business environment, least-cost and reliability metrics alone are not sufficient for making resource decisions. Platte River's selection of a future resource portfolio must account for the performance of its resource portfolios against environmental costs and performance, fuel price risk, demand-side and new technology supply options, and impacts on customers' bills, in addition to least-cost and resource adequacy requirements.

"Least-cost" and reliability metrics alone are not a sufficient basis for selecting a resource portfolio.

Renewable Energy and Storage Modeling Assumptions

Platte River's modeling assumptions for renewable energy and energy storage were overly conservative. Reasonable assumptions about costs, performance, and availability of each resource option based on the most current market information must be included in the evaluation of future portfolios.

Assumptions used in the ZNC Analysis to evaluate renewable energy and battery storage as supply option were overly conservative and did not reflect current market conditions

For renewable energy prices, assumptions should be developed by a thorough process of price discovery that takes into account published independent third-party costs estimates and the most current renewable energy power purchase agreements in the region. For battery energy storage, there have been dramatic decreases in the costs, and Platte River should use more recent and accurate capital and operating cost assumptions for battery energy storage. Battery storage was inappropriately eliminated early on, based on the high prices used. Given the uncertainty of future costs, sensitivities around the battery storage capital costs, especially, could allow an evaluation that would show the price point at which storage would be compelling as an alternative to more fossil-fueled generation.

Platte River should develop and use more accurate pricing, capital costs, capacity factors, and capacity credit values for renewable resources and battery storage in future resource assessments.

For renewable energy capacity factors, assumptions that more accurately account for efficiency improvements should be used. Assuming future renewable energy supply options will have the same performance as resources in Platte River's current portfolio may be a conservative assumption, but it is not reasonable. If capacity factors are unknown, Platte River should evaluate renewable resources using two sensitivities that reflect low and high range of capacity factors that reflect resources available in the region.

Capacity credit values assigned to wind and solar resources, and battery storage, should be based on an Effective Load Carrying Capability (ELCC) study of the Platte River system. Battery storage in sizes of 4 megawatt-hours and above should receive capacity credit at 100% in future analysis. Alternatively, Platte River could include a capacity credit for battery storage lower than 100% for its baseline and use 100% in a sensitivity case.

Regional Transmission Organization Participation

Platte River may be part of an RTO in the near future, such as the Southwest Power Pool. Despite the challenges of modeling

Platte River's system as part of an RTO, every effort should be made to incorporate this into future modeling. It will have direct and immediate effects on transmission costs and the appropriate emissions rate to use for market sales and purchases.

Modeling capability should be developed to evaluate how resource portfolios perform under the assumption Platte River joins a regional transmission organization.

Pricing Carbon Dioxide

To account for the likelihood of state or federal regulations and the economic and environmental impacts of climate change on broader society, Energy Strategies recommends that Platte River's future ZNC portfolio analysis and integrated resource planning modeling be run using at least two CO_2 price sensitivities.

Platte River should include a CO_2 price in its analysis that reflects the risk of carbon regulation over the study period.

The first set of CO_2 prices should reflect the regulatory costs Platte River's generation portfolio will be subject to under federal or state CO_2 regulation. A second CO_2 price sensitivity Platte River should include in all future ZNC and IRP portfolio analyses should account for the economic and environmental damages associated with climate change. The best measurement available for these costs is the Social Cost of Carbon (SCC).

A sensitivity case using the Social Cost of Carbon for a CO_2 price should also be run to reflect the economic and environmental damages of climate change.

Demand-Side Resources

Efficiency, demand response and distributed generation are resources that reduce load, contribute to capacity planning requirements, defer investments in transmission and distribution upgrades, and mitigate environmental regulatory and fuel price risks. Platter River should treat demand-side resources on a comparable and consistent basis to supply-side resources by developing levelized cost curves and allowing Aurora to choose the amount of demand-side and distributed resources that are cost effective.

Demand-side and distributed resources should be modeled in Aurora and evaluated in a manner that is comparable and consistent with how supply-side resources are evaluated.

Combined Cycle Capacity Additions

The ZNC portfolio includes a 286 MW combined cycle natural gas-fired plant to provide for the reserve margin needs of the system and to shape and firm the substantial amounts of new wind and solar resources added to the ZNC portfolio. The costs of this resource are substantial, approaching $350 million. Platte River should ensure that the Aurora model has the option to choose a smaller combined cycle GE Frame unit and is not limited to the 286 MW plant. Platte River should also allow the model the option to choose to convert one of the simple cycle units at

Platte River should ensure Aurora has the option to choose smaller combined cycle options, to avoid adding an expensive, large combined cycle unit that is underutilized.

the Rawhide CT plant to combined cycle production, specifically, the 7FA unit installed in 2008. Energy Strategies expects that this would allow significant installed cost reductions, making the ZNC portfolio's costs more competitive with the IRP reference portfolio.

Natural Gas Prices

The addition of the 286 MW natural gas-fired combined cycle plant to the ZNC portfolio in 2030 increases the relevance of natural gas prices in evaluating the overall cost of the ZNC portfolio. Natural gas markets have experienced episodes of extreme price volatility over the past decade. Projections of natural gas prices used to analyze supply-side options should account for the uncertainty of natural gas markets by including low and high natural gas price forecast sensitivities in addition to the base price assumptions.

Sensitivity cases with different gas price forecasts would help quantify the costs and risk of Platte River's ZNC portfolio relying on gas-fired generation.

Timing of Coal Unit Retirements

Early achievement of the ZNC goal by accelerating the procurement of renewable energy and moving up the retirement dates of Platte River's coal-fired generation may be a financial benefit to Platte River and the owner municipalities it serves. Modeling of future resource portfolios during the next planning process should include scenarios in which Platte River accelerates the retirement dates of its coal-fired generation fleet and evaluates the economic and environmental trade-offs of transitioning to a ZNC or 100% renewable energy portfolio before 2030.

Earlier retirement of Platte River's coal generation and accelerated procurement of renewable energy resources should be evaluated.

Stakeholder Involvement in ZNC and Zero Carbon Planning

A robust and meaningful stakeholder process is essential to ensure Platte River's resource decisions are aligned with municipal owners' and stakeholders' shared energy, public health, and environmental goals

Platte River should incorporate a more robust stakeholder process into future ZNC and resource planning assessments.

Energy Strategies acknowledges Platte River's substantial public outreach efforts to engage stakeholders after the release of the study through the public outreach meetings. There are a number of ways public outreach and stakeholder processes can be improved, however. The goal would be to increase the level of transparency and provide stakeholders with the opportunity to

be more engaged and provide meaningful input during the development of future resource planning efforts.

With this study, Platte River has taken an important first step to account for the structural trends that are taking place in the electric utility industry and respond to the expressed interest of the owner municipalities and their customers to reduce CO2 emissions and provide cleaner sources of power.

The ZNC Analysis was an acknowledged "proof of concept" study whose value as a resource planning tool was severely limited. The analysis only evaluated a single ZNC portfolio and used a single set of overly conservative assumptions regarding the price, capital costs, and performance of renewable energy, energy storage, and demand side resource options. However, even with these constraints the study concluded that Platte River could transition to a resource portfolio that supplied 76% of Platte River's electricity load with renewable energy, reduced its CO_2 emissions by 86% and did so at a cost that was only $221 million (8%) more on a NPV basis than the 2016 preferred IRP portfolio. The use of more reasonable assumptions could easily have resulted in the ZNC portfolio actually being the least-cost portfolio.

The recommendations that Energy Strategies has provided, if adopted, will affect the process for how future resource portfolios will be defined, how the costs of those resource portfolios will be evaluated and will result in a more robust and meaningful assessment of resource options that would enable Platte River to transition to a zero-carbon portfolio.

Energy Strategies encourages Platte River to continue the analysis and research it has begun into a zero-carbon future. By meeting the structural changes coming to the utility industry with a thorough assessment of resource options, thoughtful deliberation and stakeholder involvement, Platte River will be able to meet the environmental goals of its owner municipalities while still providing reliable, affordable energy.