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RENEWABLE ENERGY PARKS: AN ECONOMIC DEVELOPMENT STRATEGY FOR PUEBLO, COLORADO

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Pueblo, Colorado's Comanche coal plant consists of three electric generating units, with the first two units brought into service in the 1970s. The third unit, an 857 megawatt (MW) generator, was built in 2010, but has experienced serious reliability issues. Partially due to these concerns, and partially due to primary owner Xcel Energy's clean energy goals, the final unit's retirement date will be moved up to 2031, from its original expected retirement in the 2070s.

In many ways, this is good news for the people of Pueblo and Colorado as a whole: Coal power is the dirtiest type of electric generation. For 52 years, the plant has emitted thousands of tons of toxic air pollutants like sulfur dioxide and nitrogen oxides along with millions of tons of heat-trapping carbon dioxide. While the existing plant has provided tax revenue and jobs to Pueblo County, closing it opens the door for new economic opportunity and cleaner air, making the choice of what replaces it of the utmost importance.

Replacement proposals for the Xcel Just Transition Proceeding include a gas plant with carbon capture or small modular nuclear reactor, but we present an economic revival strategy for Pueblo offering an alternate vision that enables a more affordable, reliable, resilient, and clean Colorado grid. This strategy, referred to here as an "energy park," would provide around $40 million annually in replacement property tax for Pueblo County, stimulate economic development and job creation, and make Pueblo a statewide leader in the energy transition – all while minimizing financial, planning, and operational risk through a diverse approach to a reliable electricity supply.

Importantly, capital investment into the energy park components will not fall solely to the electricity bills of Coloradans. Instead, only about 25 percent of the cost to build the energy park will be paid by Xcel's electricity customers. This will cut bills for families and businesses who would otherwise be on the hook for a larger investment in a scenario where a gas plant with carbon capture or small modular nuclear reactor was chosen, all while retaining

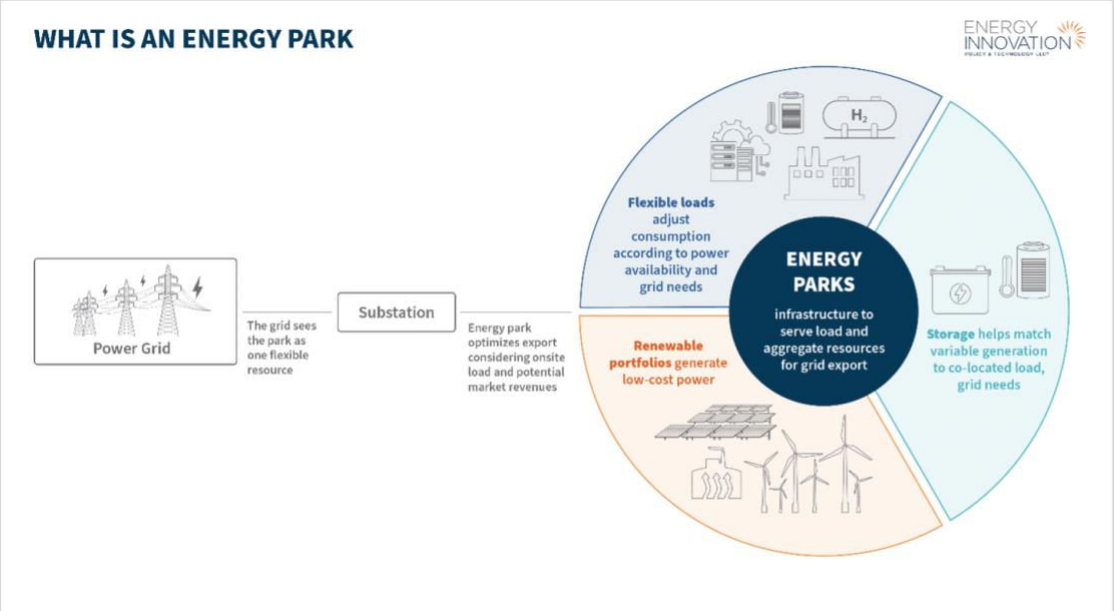
high levels of property tax for Pueblo.

COMANCHE ENERGY PARK IN PUEBLO: "FLEXIBLE" INDUSTRIES ARE THE HEART OF THE STRATEGY

An "energy park" is a win-win solution for Pueblo and Xcel. Energy parks pair clean power and battery storage with new industrial facilities and technologies that convert electricity into reliable, affordable, and clean heat for local industry. The energy park would diversify Pueblo's and Xcel's energy supply by adding a wide range of electricity resources, enhancing energy security. The energy park would consist of a portfolio of resources that can be built up over time, some owned by Xcel and others through third parties such as clean industrial facilities. Because many components of the energy park would not be owned by Xcel directly, the cost to Xcel Energy's electricity customers will be significantly reduced compared to a singular large power plant.

The buildout's piece-by-piece nature reduces reliance on materialization of any one technology and creates jobs and tax revenue earlier than building a single large generator, or waiting for new, speculative technologies like small modular nuclear reactors. The combination of resources would be coordinated to deliver value to the grid while offering low-cost clean electricity and heat for industry, such as Pueblo's steel and cement plants. A Pueblo energy park would locate all facilities and serve existing plants in the county[1] and would access the power grid via existing substations. The low-cost power and storage are no-regrets foundations to replace much of Comanche's energy and capacity value, while setting the stage for industrial development through the energy park.

Figure 1. Energy park concept



OBJECTIVES FOR THE ENERGY PARK

The first goal is to replace an existing electric asset (the coal plant) with generation that

[1] Some generation, namely incremental wind, may be located outside the county but coordinated with the energy park assets.

increases grid resiliency, reduces greenhouse gas emissions, and toxic air pollution in Pueblo. To create a more functional future resource mix for the Xcel system, this should go beyond just adding more renewables and battery storage. The second goal is to maintain property tax and provide positive economic drivers, like new clean industry, for Pueblo. The electric resource buildout should avoid increasing costs for other Colorado electricity customers while managing risk, both for the community and for other consumers.

THE ROLE OF FLEXIBLE INDUSTRIES, LIKE HEAT OR HYDROGEN

While most factories use electricity whenever they need it, some industrial-scale technologies can primarily use electricity when it's available or in excess, in exchange for lower electricity rates. These "flexible" electricity consumers pair especially well with variable, low-cost resources like solar and wind. The flexible industrial electricity consumers proposed in this vision would balance wind and solar-generated electricity output by absorbing power quickly in times of high wind and solar production, converting electricity into other commodities like heat used by local Pueblo industries such as steel and cement manufacturing. They could even deliver electricity back to the grid during low wind and solar output by converting heat or another commodity back to electricity, resulting in a combined portfolio of electricity resources that is more responsive to the grid's needs.

Many types of flexible, clean industrial technologies are already commercially available and at least two could be incorporated into a Pueblo energy park. In addition to flexible, clean industry, traditional electric batteries that store energy for four to eight hours could promote additional responsiveness from the energy park.

A thermal battery takes in electricity and stores it as heat,[2] which can be used directly in an industrial process that requires hot air or steam, including very high heat up to 1700°C. This on-demand steam would be very compatible with Pueblo's existing industries, providing a clean source of industrial heat to reduce emissions at facilities like the GCC cement plant or the EVRAZ steel mill. Because these facilities would be utilizing heat service from the thermal batteries, this arrangement would not run counter to Black Hills Power's retail electricity franchise in Pueblo.

A hydrogen electrolyzer takes in electricity as an input to create hydrogen,[3] which could then be converted into carbon-free commodities like ammonia or sustainable aviation fuels. Hydrogen can be stored onsite and power a turbine, fuel cell, or boiler to convert that fuel back into electricity or heat during times of low electricity supply. The PuebloPlex, or former Pueblo Army Depot site, is currently undergoing redevelopment and could be an ideal site for building hydrogen electrolyzers and additional equipment for conversion into ammonia, particularly due to the PuebloPlex board's control over electric utility services at the site. [4]

[2] https://energyinnovation.org/report/thermal-batteries-decarbonizing-u-s-industry-while-supporting-a-high-renewables-grid/

[3] https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis

[4] https://law.justia.com/codes/colorado/title-29/special-statutory-authorities/article-23/section-29-23-108/

EXAMPLE ENERGY PARK PORTFOLIOS

Figure 2. Example Comanche Energy Park portfolio development over time

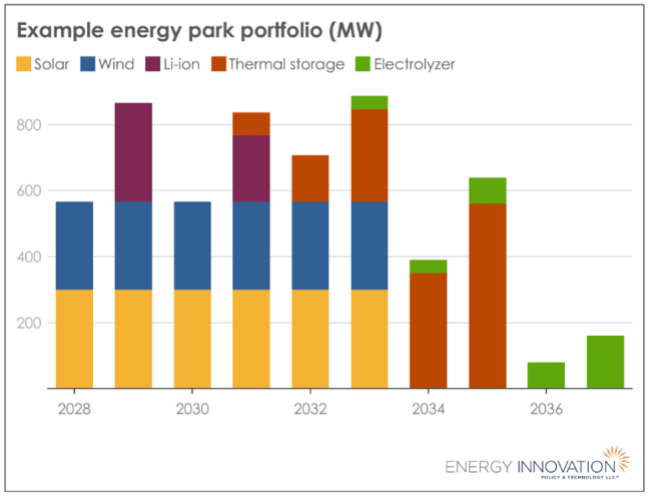
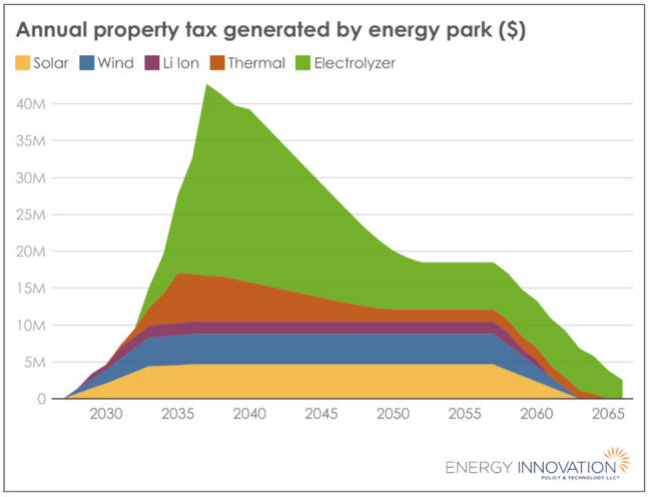


Figure 3. Property tax generated over time by energy park portfolio



The energy park buildout could begin before 2030, with more components added over the course of several years, meaning that new jobs could be created, new property tax could start accruing, and air pollution could be reduced even before the coal plant retires. Modeling details on scenarios for the energy park portfolio are forthcoming in a longer analysis, but the concept is laid out in Figure 2. One possible build-out would be initially dominated by local solar and wind resources, with four-hour duration lithium ion battery storage added to complement those renewable resources. Then, in the early 2030s, thermal battery storage deployment starts and gradually increases. Finally, hydrogen electrolyzers begin to deploy, again seeing rapid growth as the technology becomes increasingly familiar. Xcel and Colorado could also consider piloting thermal batteries earlier.[5]

This sample portfolio generates property tax immediately for Pueblo County and rises quickly as deployment of thermal storage and electrolyzers begins. Annual property tax payments exceed $40 million by the mid-2030s, and the certainty of the levelized renewable energy property tax payments maintain higher levels of taxes throughout the 2040s and 2050s.

The total capital investment into the example energy park portfolio would be approximately $6.9 billion. However, only about 25 percent of the capital investment would be allocated to Xcel's electricity customers, which means significantly lower utility bills for Colorado citizens.

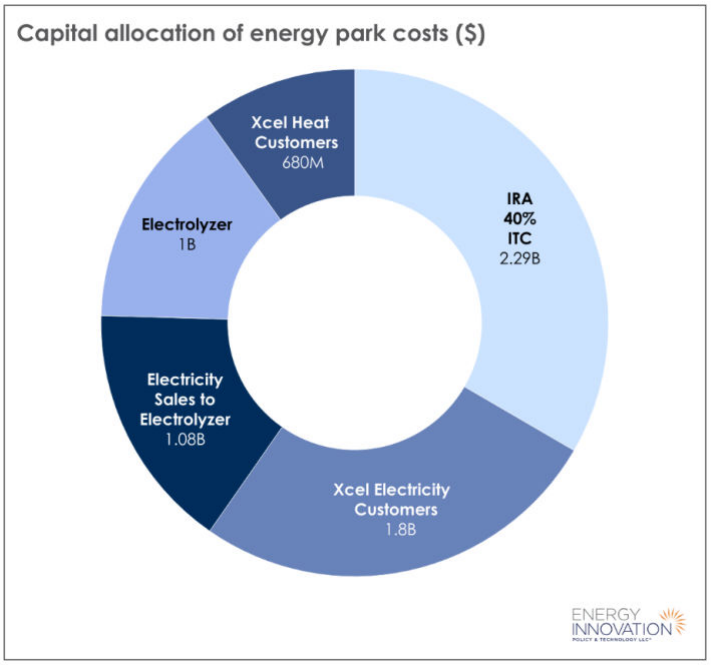
The 25 percent amounts to approximately $1.8 billion for Xcel's electricity customers (see Figure 4), covering primarily investment in the wind, solar, lithium-ion batteries, and thermal batteries. This is significantly lower than the estimated cost of a small modular

[5] Xcel already has a pilot for a 10 MW/1000MWh iron-air battery at Comanche, https://coloradosun.com/2023/01/27/xcel-energy-renewable-battery-storage-pueblo-comanche-form-energy/, and a committed to developing a thermal battery pilot and bringing a proposal to the Minnesota Public Utilities Commission in 2025, https://newsroom.xcelenergy.com/news/xcel-energy-gains-approval-for-new-energy-resources-to-deliver-reliable-clean-energy-in-the-upper-midwest

nuclear reactor, even after tax credits. The industrial customer's operations then balance out the power generated by those resources, making electricity available to the grid effectively on-demand. The energy park can match and even exceed the performance of the existing coal plant by not only generating, but also absorbing power in times of high wind and solar generation.

And, electricity sales to those industrial customers pay for a commensurate share of the energy park investment (approximately $1.7 billion), which is further offset by the $1 billion investment by third-party entities into electrolyzers, and the investment tax credit provided by the Inflation Reduction Act.

Figure 4. Comanche Energy Park cost allocation



The resources in this scenario can be built on an even earlier timetable, possibly helping reduce emissions from Comanche Unit 3 before it retires in 2031, all while improving its operations. As the Comanche Energy Park ecosystem deploys, more and more new possibilities can accrue due to interest from additional businesses in access to clean heat from the thermal batteries. These additional businesses would bring even more property tax to county coffers beyond what is calculated here.

ENABLING THE VISION

This vision for Pueblo is distinct from those that have been offered previously, as it looks beyond electricity generation resources and creates economic development that the community needs without relying on a single technology, like small modular nuclear reactors, that may or may not be ready in time. This means it relies on more than just electricity system planning, bringing a holistic approach requiring community leaders and Xcel to work with additional industrial customers who might be interested in coming to Pueblo, particularly those interested in accessing world-class renewable resources at a low cost.

This proposal offers a pathway for Pueblo to keep expanding its role as a leader in clean industry. Pueblo already hosts the largest wind turbine manufacturer in the world, and the conversion of the EVRAZ steel mill to clean electricity helped ensure those jobs and tax revenue stayed within the county. With Colorado working to position itself as a leader in the clean energy transition and pursuing 100 percent clean electricity by 2040, forging new paths and finding solutions where others might be less bold is necessary. In this pursuit, an energy park could bring exactly what the state and county need.