

# ELECTRIFICATION PROJECTS

Golden Eagle Award for Environmental Excellence

## A note about our application

Our application for the Golden Eagle Climate Change Award is being submitted for 2 different Electrification Projects that Jay Peak Resort has completed in the past 12 months.

### **The first project is a Waste Heat Utilization project that was part of a Pilot Program through the State of Vermont.**

Planning for this project started in 2019 and the project was completed in 2023. Jay Peak Resort's Hotel Jay has 297 water source heat pumps. In the cooling season, the heat pumps provide air conditioning to interior spaces. A byproduct of air conditioning is heat. Before this project this "waste heat" was rejected outside via cooling towers. The goal of this project was to keep the "waste heat" in the building and recycle it to help heat water used in our 60,000-square-foot indoor waterpark. The net result of this project lowers the resort's propane consumption, lowers CO2 emissions, and lowers the resort's utility costs.

### **The second project is the installation of a 3-megawatt Electric Boiler.**

The Hotel Jay and Pump House Indoor Waterpark is heated by (12) 3mm BTU propane boilers. This project uses grid connected software to monitor electricity pricing in real time and will switch from a propane-fired heating plant to electric heating when electricity prices are lower than propane prices. The net result of this project is an annual reduction in resort propane consumption, which reduces CO2 emissions, reduces the resort's utility costs, and allows more local renewable power to be utilized in our surrounding communities.



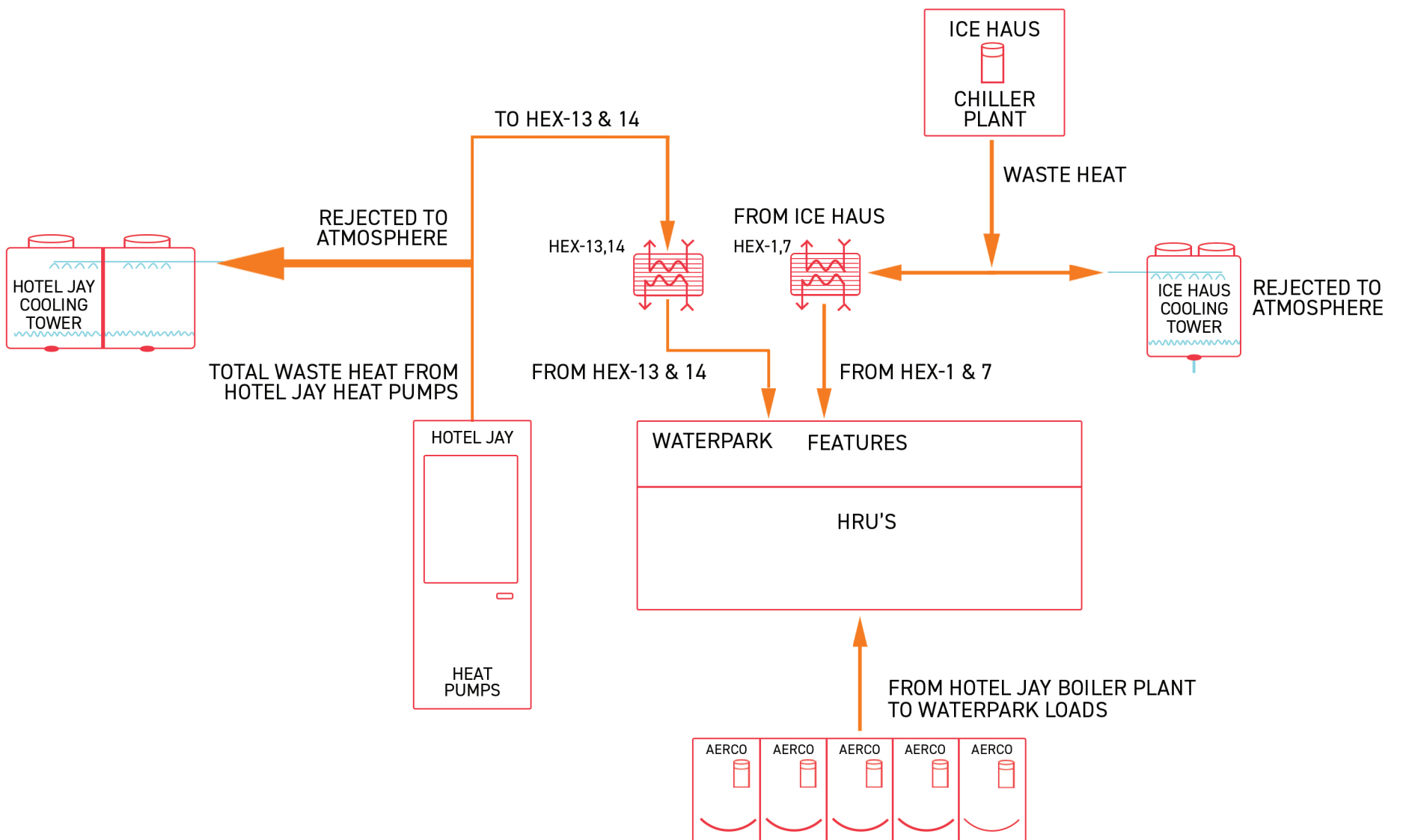
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## SYSTEM BEFORE PROJECT

### HEAT TRANSFER LEGEND

HEAT LOAD ← HEAT SOURCE



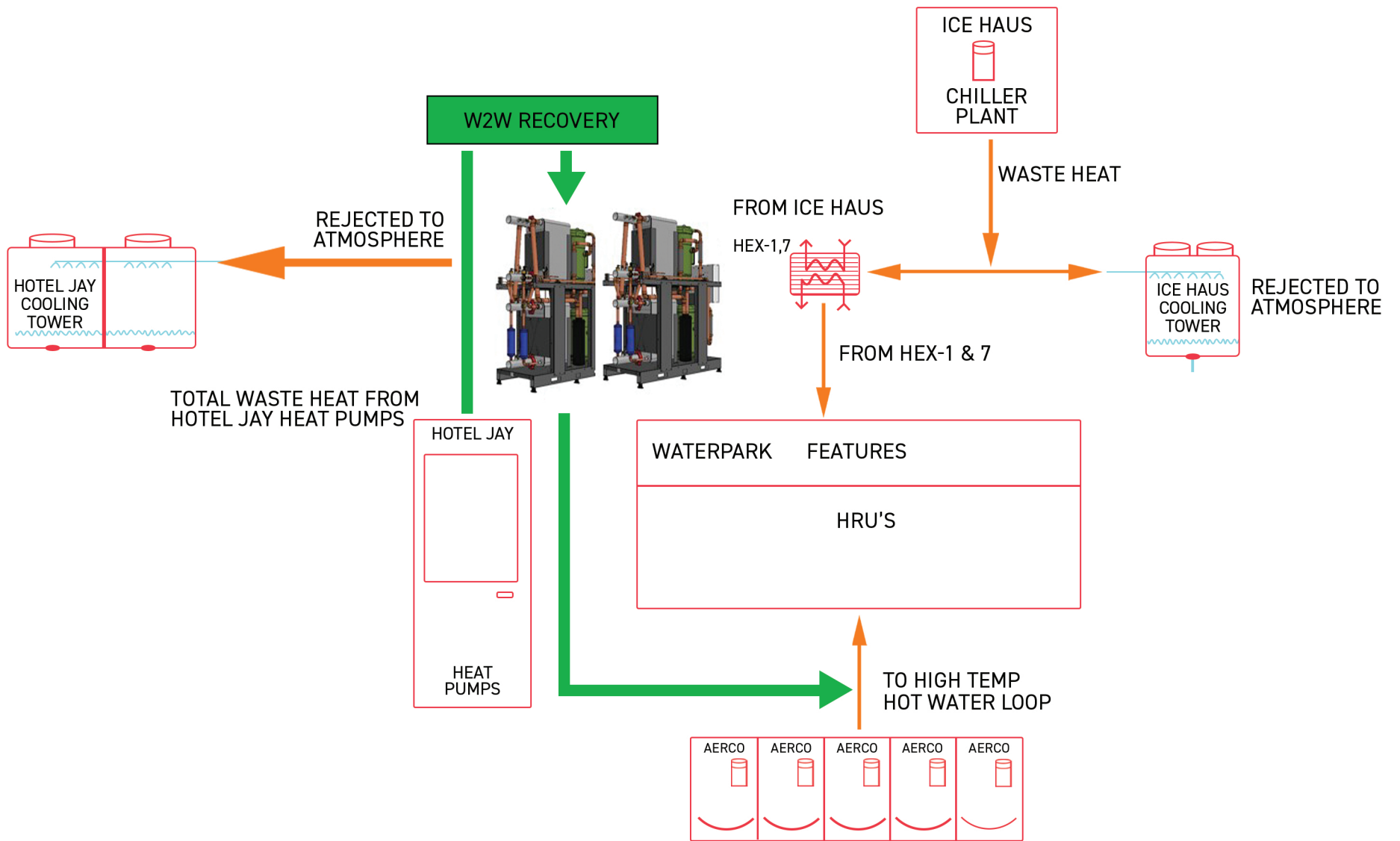
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## NEW WASTE HEAT RECOVERY SYSTEM

### HEAT TRANSFER LEGEND

HEAT LOAD ← HEAT SOURCE



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**Describe the objectives and features of your program and how they were implemented.**

Jay Peak Resort has implemented many sustainability projects over the past 20 years. The projects being submitted for this application are two of the largest carbon-reducing projects in Vermont's history. Our goal with both projects is to lessen our carbon footprint, lower our utility costs, and inspire other resorts and businesses to follow our lead in committing to a more sustainable future.

## Waste Heat Utilization

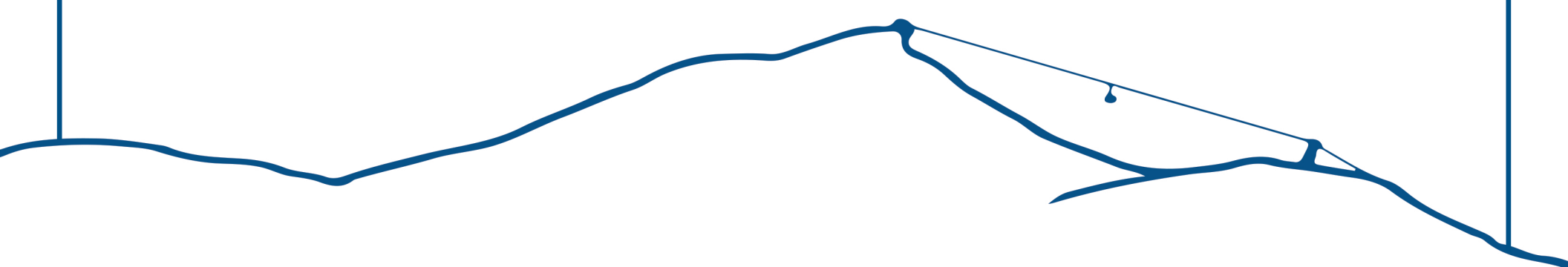
In 2019 Jay Peak Resort was selected to participate in the Vermont Energy Saving (ESA) Pilot Program. This program allowed large Vermont utility consumers to use Energy Efficiency Charge (EEC) funds on projects focused on reducing fossil fuel emissions. Historically, the only way to access these funds was through electricity-reducing projects. Jay Peak utilized 3 years of EEC funding on a fossil fuel reduction project and worked with a Burlington-based Energy Consulting firm (CX Associates) to develop a project that met the program's criteria.

The project consisted of installing 3 large water-to-water heat pumps that take rejected heat from our main heat pump loop and repurpose the rejected heat to heat pool water for our indoor waterpark. The project is most productive in the summer months when there is a large cooling load at Hotel Jay.

## Electrification of Resort Heating

In 2019 Jay Peak had discussions with Jordan Kearns from Medley Thermal about the feasibility of installing a large electric boiler that would provide an alternate heat source for the 235,000 sq ft Hotel Jay and 50,000 sq ft Pump House Indoor Waterpark.

A large electric boiler was installed to serve the heating load at Jay Peak Resort. The electric boiler operates in tandem with the existing propane boilers and electrifies the heating load at times when additional electric load would be beneficial to the electric grid. The electric boiler operates based on signals from ISO-NE (New England grid operator), VELCO (Vermont electric transmission authority), and Vermont Electric Cooperative (VEC- local electricity distribution company). When the electric grid is constrained, the existing propane boilers run. Consuming electricity selectively in response to these signals enables the boiler to receive significantly cheaper and cleaner electricity while improving the efficiency of the local grid.



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## Electrification of Resort Heating

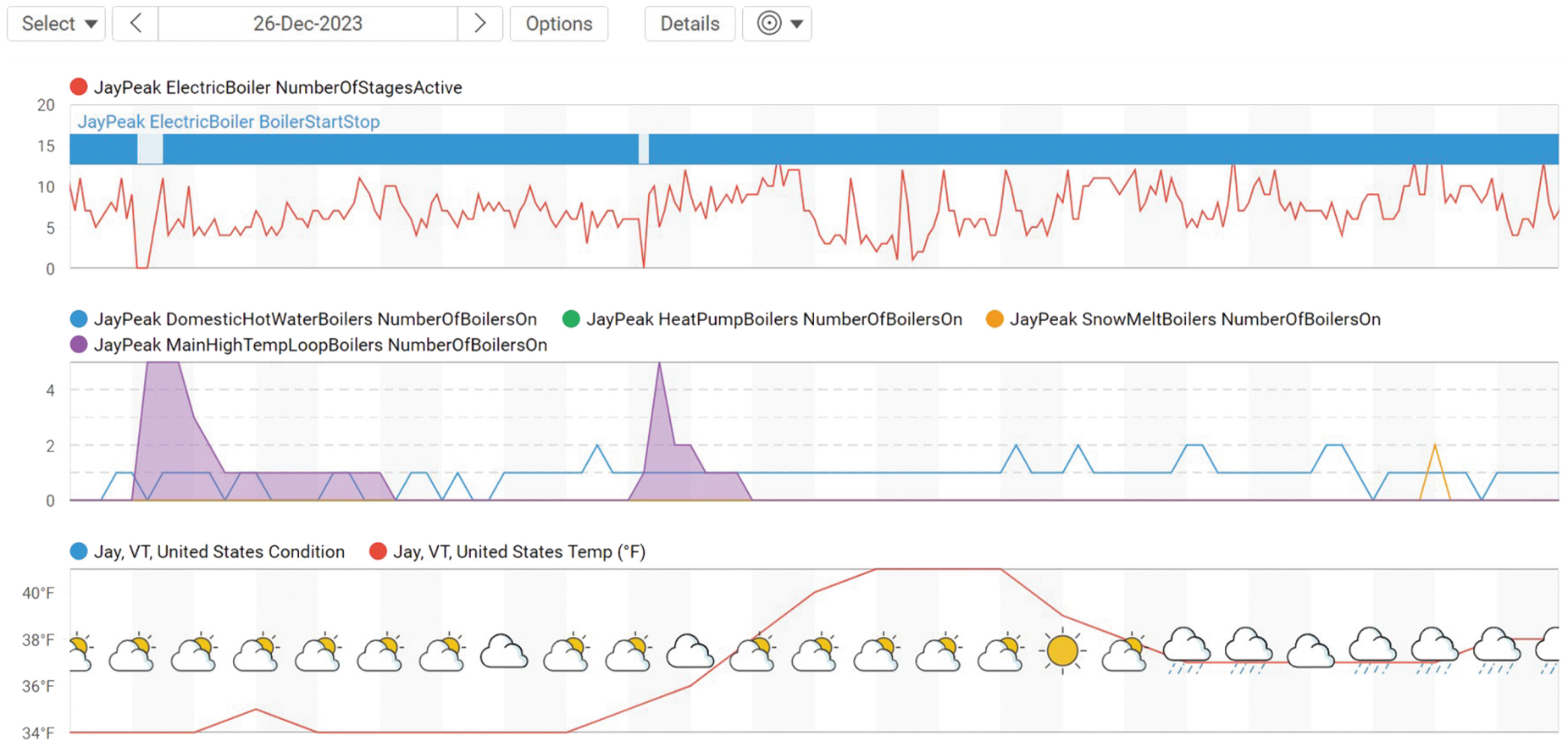


Figure 1 - Trend data showing the Grid signal in Blue at the top allowing the boiler to stage up, the purple in the middle shows the number of propane boilers running, when the electric boiler is allowed to run for long periods, the propane boilers shut down completely. The period shown is December 26<sup>th</sup>, 2023.

Throughout this project, **Jay Peak Resort will reduce its propane consumption from the Hotel Jay and Pump House Waterpark by 60%, or a reduction of 450,000 gallons of propane per year.** The resulting 2,500-ton annual reduction in CO2 emissions is substantial and has made a meaningful contribution to Vermont's carbon reduction goals. As the State works to create the 2022 Comprehensive Energy Plan, and the Vermont Climate Council develops legislative recommendations necessary to tackle the climate crisis, projects like this with active partnerships will be critical to meet the carbon reduction goals cost-effectively. VEC made a commitment to 100% carbon-free power supply by 2023, and 100% renewable energy by 2030, ensuring positive environmental outcomes.

**This dynamic electrification project will result in \$175k per year in net energy cost savings for a critical employer in a region of the state with especially high energy burdens.** This reduction in operating costs has strengthened Jay Peak's ability to continue to operate as a key driver of economic activity in the region and retain employees. Jay Peak is VEC's second largest electrical user and a key partner in VEC's member base whose financial contributions support overall VEC infrastructure and administration. The substantial reduction in CO2 emissions has also demonstrated Jay's commitment to being a sustainably oriented tourist destination attracting more visitors and revenue to the region. **Additionally, this project has shifted \$540k in annual spending by the resort from the largely out-of-state propane supply chain to the cleaner, and primarily local electricity supply chain.**

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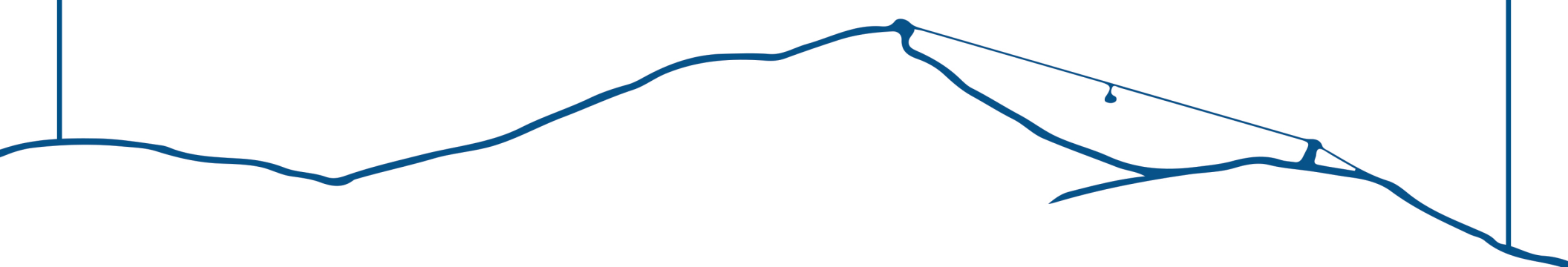
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## Electrification of Resort Heating

The new electrical load that has been realized from the boiler conversion has helped to mitigate some of the current electric system congestion problems in the constrained Sheffield Highgate Export Interface (SHEI) area. In the SHEI there are times when there is too much generation and not enough load (energy demand) which causes some renewable resources (such as Kingdom Community Wind) to be curtailed. This project has assisted in mitigating that problem and is helping reduce the financial impact on VEC members from those curtailments.

Another benefit to VEC is that the carbon reduction outcomes will allow VEC to meet its “TIER 3” energy transformation requirements over the next couple of years. The Tier 3 requirements accelerate over time and projects like this will be necessary to avoid any penalties if requirements are not met. The carbon reduction contributed by this project toward the Tier 3 obligation will protect all VEC members against potential future increases in Tier 3 compliance costs.

Because of the benefits to the local electric grid, if successfully demonstrated with Jay Peak, VEC is interested in replicating this type of project with other large commercial and industrial facilities in the region and exploring scaled-down applications for residential boilers and heat pumps. Successful demonstration of this solution with Jay Peak will spur entrepreneurial effort in the region with the potential to create new jobs installing equipment, reduce energy costs for existing businesses, and reduce emissions of greenhouse gases.



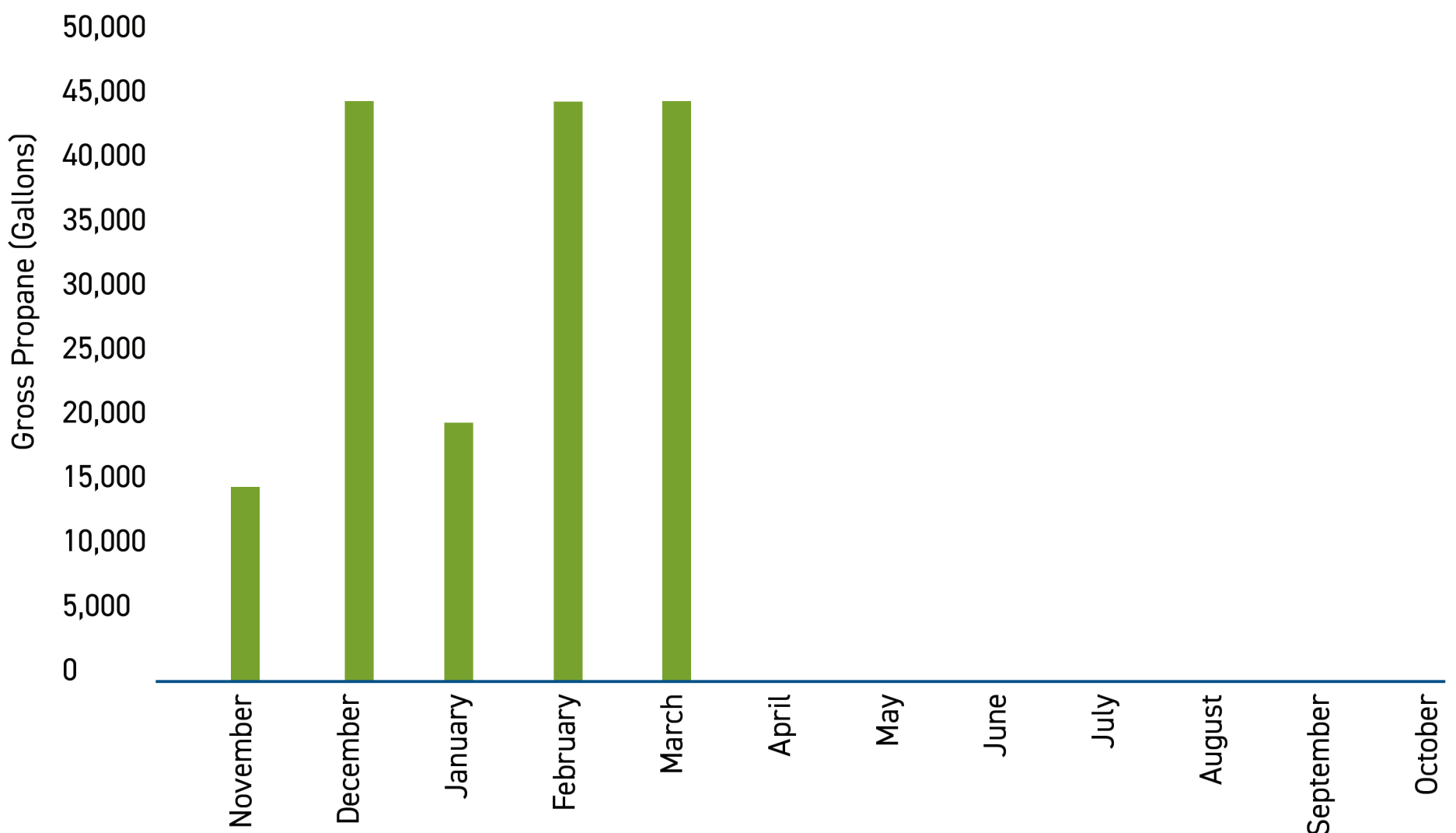
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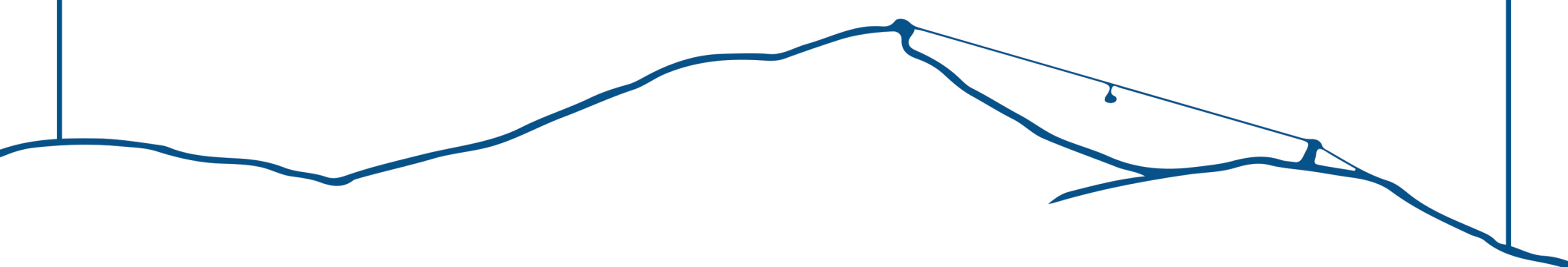
Quantify the program's results as a percentage and as an absolute value.

## Operation Report

Over the course of the first 4 and a half months of operation the hybrid system reduced propane demand by an estimated 170k gallons. This equates to one fully loaded propane delivery truck every 4-5 days.

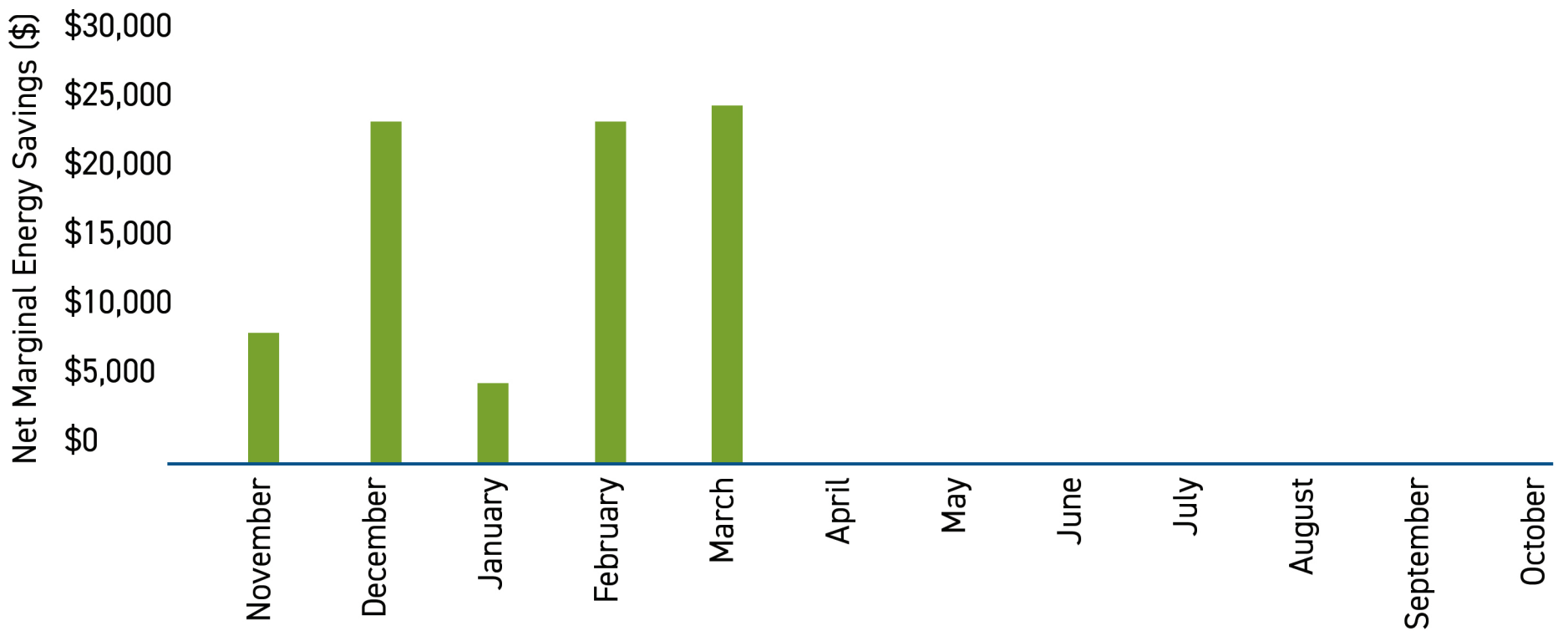


The system produced an estimated gross savings of \$285k and a savings net of electricity costs of \$82k. The average cost of power procured during this period was roughly \$55/MWh, substantially lower than the Vermont industrial average price of \$120/MWh.

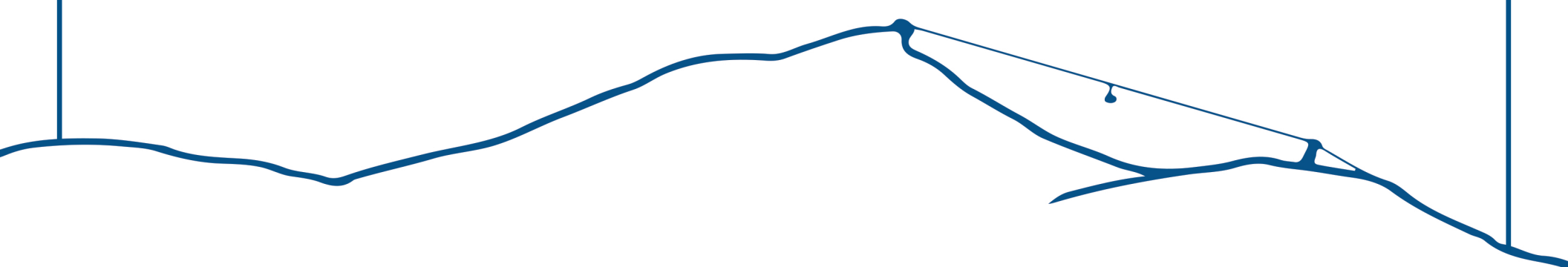
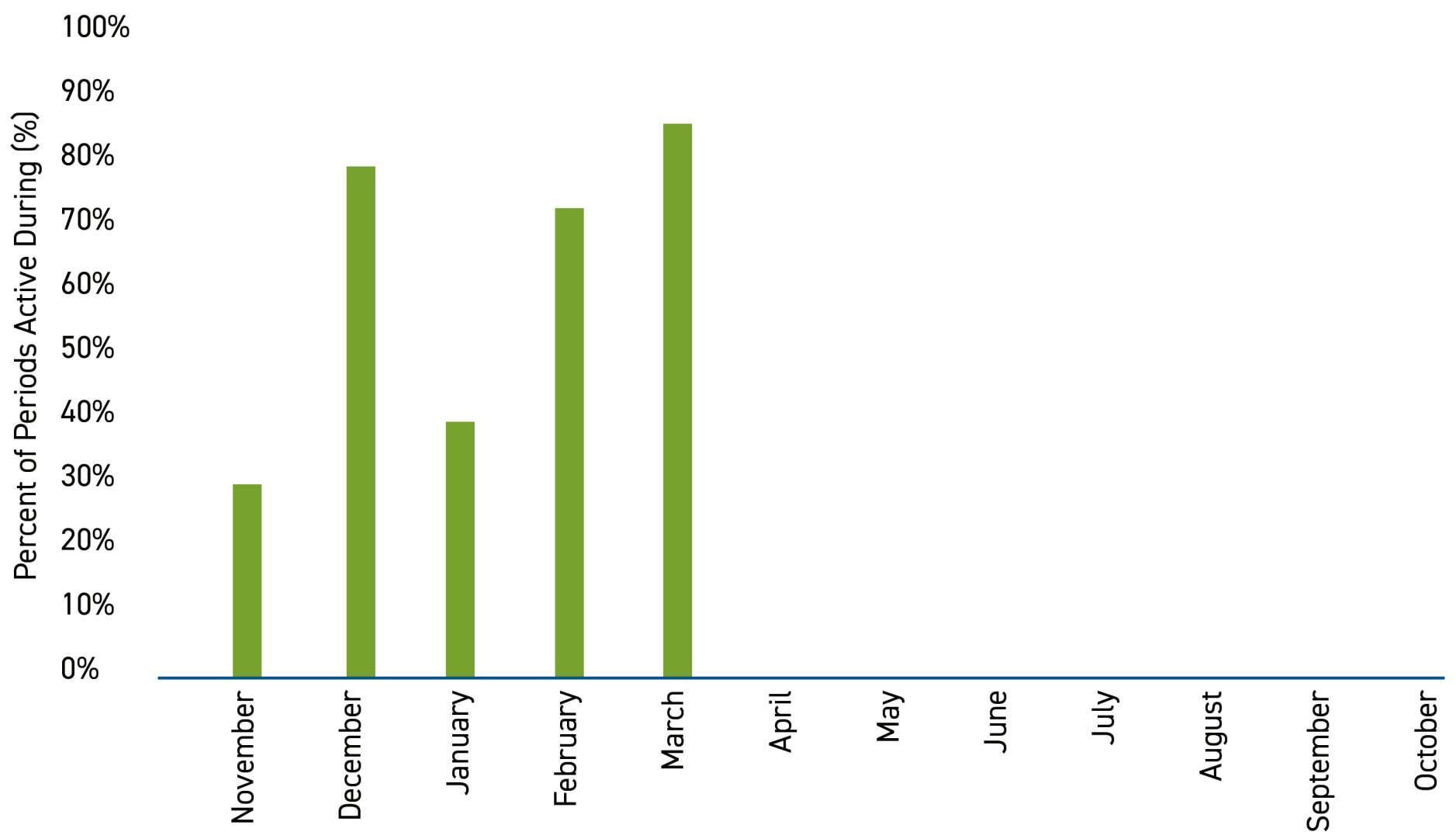


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The total carbon reduction during this period was be 960 Tons. The system was to be active during ~70% of hours during this period.





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## Waste Heat Utilization Projected Performance

Heat recovery	4,059,490	kBtu
Average heat recovery load:	463.41	kBtu/hr
Heating System Efficiency	90%	
Propane heat content:	91.6	kBtu/gal
<b>Annual gallons propane saved:</b>	<b>49,242</b>	<b>gal</b>
Propane cost	\$1.59	per gal
<b>Propane costs savings:</b>	<b>\$78,294</b>	
Water-water heat pump COP	3.37	
Heat pump power input:	137.51	kBtu/hr
Heat pump power input:	40.30	kW
Heat pump electric consumption:	353,047	kWh/yr
Cooling Tower Electricity consumption	54,668	kWh/yr
Net energy increase:	298,379	kWh/yr
Average power increase:	34.1	kW
Electricity cost increase:	\$31,408.69	
<b>Net cost savings:</b>	<b>\$46,885.68</b>	
<b>Propane CO2 Reduction</b>	<b>564,269</b>	<b>lbs. CO2</b>



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The cost of implementing this program, the expected ROI, and the cost savings as a result of this project?

## Project 1 | Waste Heat Utilization

The total project cost for the (3) water to water heat pumps was \$385,000. The breakdown of funds used and ROI is below:

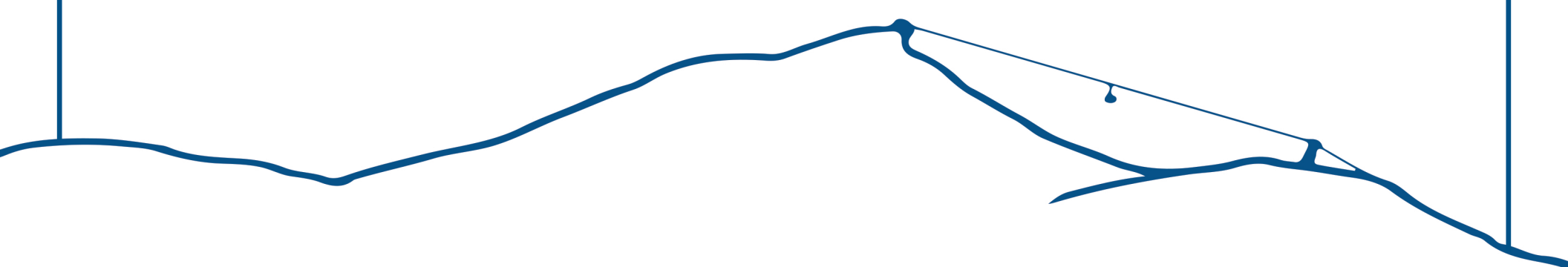
EEC Funds Used	\$340,000
Jay Peak Resort	\$45,000
<b>Total Project Cost</b>	<b>\$385,000</b>
<b>Net Annual Utility Savings</b>	<b>\$45,408</b>
<b>Return on Investment in Months</b>	<b>12</b>

## Project 2 | Electrification of Resort Heating

The installation of the electric boiler presented several financial hurdles to overcome. The total cost of the project was budgeted at \$1,100,000. With an estimated annual utility savings of \$175,000, the payback on the project was 6 ¼ years. Jay Peak was able to secure funding from 5 project partners (listed below) to help bring the ROI into a more manageable timeframe. The project funding breakdown is below:

Vermont CIP Grant	\$130,000
Vermont Electric Coop	\$87,937
Efficiency Vermont	\$175,000
Massachusetts Clean Energy Grant	\$200,000
Vermont Gas	\$150,000
Jay Peak Resort	\$394,437
<b>Total project Cost</b>	<b>\$1,137,374</b>
<b>Net Annual Utility Savings</b>	<b>\$175,000</b>
<b>Return on Investment in Months</b>	<b>27</b>

The benefit from the financial assistance from our 5 project partners cannot be understated. If it had not been for their support this project would not have happened. While Jay Peak and all the project partners have vastly different backgrounds, we are all united in joining together to fight climate change through action. The electric boiler project is the largest standalone carbon-reducing project in the history of the State of Vermont and likely the largest ever completed by any ski area in the United States. We are all extremely proud of the project and hope it serves as a model of what can be accomplished through community and state support.



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## In what ways does your program address the impacts of climate change?

These transformative projects have significantly lowered Jay Peak's carbon footprint by reducing CO2 emissions in a meaningful way.

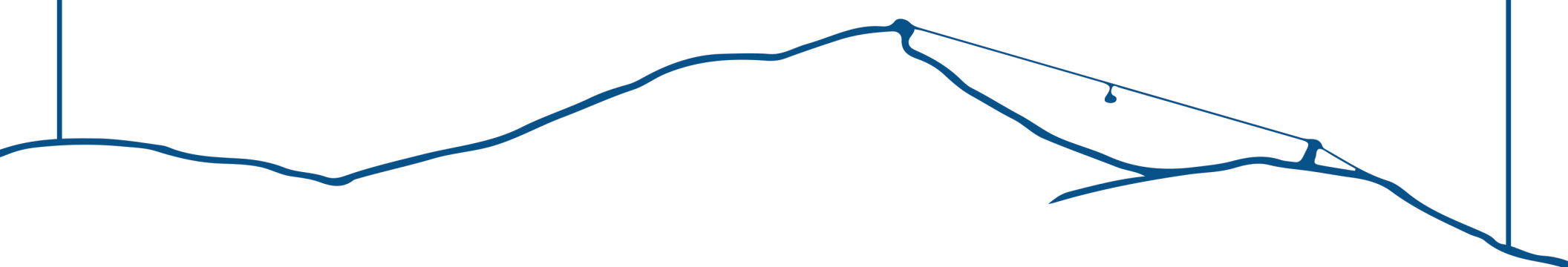
The Waste Heat Recovery Project has decreased annual CO2 emissions by 564,269 lbs. A reduction of nearly 50,000 gallons annually has been realized from the project being completed.

The Electric Boiler Installation has decreased annual CO2 emissions by 2,500 tons and lowered propane consumption in the Hotel Jay and Waterpark by 60% (450,000 gallons). This comes with secondary savings involved with the transportation of this fuel up to 1,800' elevation on a regular basis and the reduction in embedded carbon associated with that reduction in upstream infrastructure use.

The increase in our electricity consumption, because of these projects, has helped better utilize sustainable electric grid resources thus improving the financial outcomes of those investments for the utility as well as allowing those sustainable sources to implement longer runtimes.

These projects are a major step in our continued effort to operate our resort more sustainably. The ski industry is facing major challenges due to climate change. Reducing our carbon footprint is something we all need to commit to. Not only have these projects made significant reductions to greenhouse gas emissions in Vermont, but they inspire and provide a road map for other industries to follow.

We are committed to continuing the fight against climate change. Having seen the successful implementation and operation of these transformative projects we are in early planning for more projects. We are planning to install another electric boiler at our Stateside Hotel and Day Lodge as well as utilize more waste heat from our Ice Rinks refrigeration system. The future of sustainability at Jay Peak Resort is bright.



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## A few comments from our project partners

VGS (Vermont Gas), is the state's largest thermal energy utility, serving 55,000 customers in northwest Vermont.

Addressing emissions from large commercial and industrial buildings is key to keeping pace with Vermont's ambitious climate goals. VGS is focused on piloting innovative thermal solutions, such as electric boiler systems, in an effort to identify cost-effective solutions for these large and complex buildings. The Jay Peak boiler project is a great example. Historically, electric boiler technology has been more expensive than fossil fuel alternatives. Full electrification at industrial scale has often been cost prohibitive due to the cost associated with local or regional electric peaks. The Jay Peak project addressed these challenges by integrating an electric boiler alongside the existing propane system. The system will select between the more cost-effective technology (propane or electric) in real-time, achieving a reduction in carbon emissions and operational costs that would not be possible with a single fuel source.

The Jay Peak project allowed VGS to learn about this technology and is a model as we scale solutions for our customers. It has helped us understand opportunities to deploy hybrid heating systems to our large-scale natural gas customers, which in turn would help Vermont achieve GHG reductions.

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"We're proud to support solutions like Jay Peak's electric boiler project that can achieve several important climate goals at once," said Peter Walke, Efficiency Vermont Managing Director. "The electric boiler not only lowers emissions to help achieve important decarbonization goals. The project also embraces local renewable energy to power a more resilient and flexible system for years to come."


Efficiency Vermont supports the 3 MW electric boiler project because heating with electricity is more cost-effective than heating with fossil fuels, saving Jay Peak about \$250,000 in fuel costs every year. We also support the project for its decarbonization benefits, like preventing 450,000 gallons of propane from being burned annually and avoiding the release of some 2,500 tons of CO2 emissions. And we support this project because it promotes grid reliability through flexible load management. By controlling when it uses its electric boilers, Jay Peak can match its demand for electricity with local supplies. This helps renewable energy producers like Kingdom Community Wind supply clean electricity to customers even when the grid's overall demand is low.

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VEC was an early and enthusiastic partner in this project. The carbon reduction savings are substantial and help VEC and Vermont in our efforts to make meaningful progress on our greenhouse gas reduction targets. Another significant benefit is that allows us to integrate more renewable energy, primarily local wind power, into our system. This results savings in our power supply costs. We are very pleased with the initial results of this close partnership with Jay Peak Resort. They are doing an outstanding service to the community.

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"The Vermont Department of Economic Development was proud to support Jay Peak's electric boiler project with a Capital Improvement Program (CIP) grant. CIP used federal COVID funds to spur economic recovery in adversely impacted sectors and gave innovative projects, like Jay Peak's, the ability to move forward. Jay Peak's ability to drastically cut carbon emissions represents a transformational change in energy use, resulting in positive outcomes for the resort, community, and State of Vermont."



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## Media Links

**VERMONTBIZ**  
click to view



**VERMONT ELECTRIC**  
click to view



**SAM INFO**  
click to view



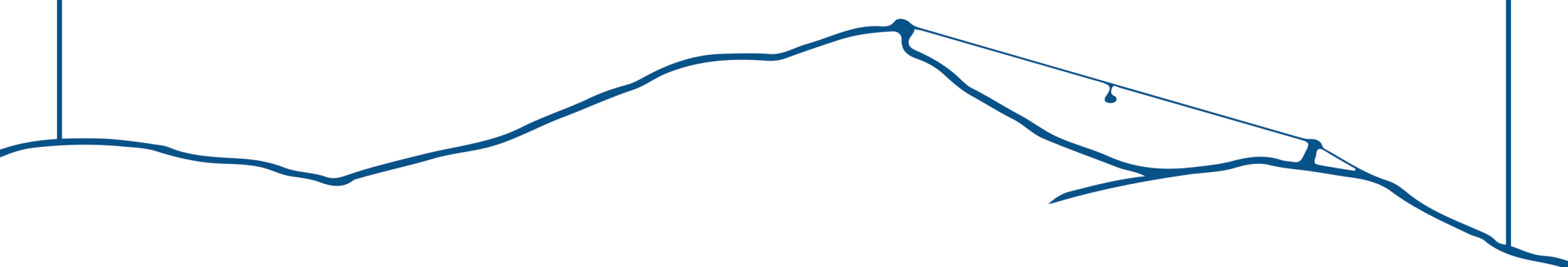
**WCAX**  
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- [vermontbiz.com/news/2023/april/26/jay-peak-make-major-carbon-reduction-investment](https://vermontbiz.com/news/2023/april/26/jay-peak-make-major-carbon-reduction-investment)
- [vermontelectric.coop/latest-news/jay-peak-heating-project-brings-big-benefits-to-the-region-01-30-24](https://vermontelectric.coop/latest-news/jay-peak-heating-project-brings-big-benefits-to-the-region-01-30-24)
- [saminfo.com/archives/2020-2029/2023/item/165438-clean-heat-boiled-down](https://saminfo.com/archives/2020-2029/2023/item/165438-clean-heat-boiled-down)
- [wcax.com/2023/09/12/jay-peak-shares-new-green-energy-emissions-plans/](https://wcax.com/2023/09/12/jay-peak-shares-new-green-energy-emissions-plans/)

## 2024 ASHRAE Presentation on both projects

**HEAT RECOVERY AND GRID INTERACTIVE BUILDING CONTROLS AT JAY PEAK**  
click to view



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## Pictures of projects

### Waste Heat Utilization Project



Three water to water heat pumps



Heat pumps and associated piping

### Electric Boiler Project



Electric boiler room



Electric boiler



Seven of the propane boilers the electric boiler takes the place of during operation



Boiler and electric cabinet