Phase 1 Report For

Prairie Island Indian Community

Net Zero Project

July 1, 2021

Prepared For:

Minnesota Department of Commerce
Minnesota House of Representatives Climate and Energy Finance and Policy Committee
Minnesota Senate Energy and Utilities Finance and Policy Committee

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EXECUTIVE SUMMARY

Reshaping Our Energy Future

The Prairie Island Indian Community (PIIC or the Tribe), a federally recognized Indian Nation, is located in southeastern Minnesota along the banks of the Mississippi River, approximately 30 miles from the Twin Cities of Minneapolis and St. Paul. There are more than 1,050 Tribal members living on and off the Prairie Island Indian Reservation. For decades, the Tribe has been unfairly burdened with the negative impacts of energy production.

In addition to flooding part of the Tribe's land during the construction of Lock & Dam #3 on the Mississippi River, the federal government allowed for a nuclear power plant to be built adjacent to the Reservation. Today, one of the nation's oldest operating nuclear power plants is located approximately 700 yards from the Tribal community, along with a nuclear waste storage site containing more than 1,000 tons of highly toxic nuclear waste. Compounding the ever-present threats facing the Tribe, the only evacuation route off Prairie Island is blocked several times daily by train traffic, with many of those rail cars carrying highly volatile crude oil.

The Prairie Island Net Zero Project (the Net Zero Project) is empowering the Tribe to change the historical narrative and turn energy production into a positive for its current population as well as generations to come. The Net Zero Project is ultimately about clean air quality by eliminating the carbon and other GHG emissions that cause illness and other chronic health issues while reducing the negative impacts on the environment and reversing the effects of climate change. The Tribe will benefit from this project because it will it help people prosper and live healthier lives.

Prairie Island Net Zero Project

A $46.2 million grant from the Renewable Development Account (RDA) to the PIIC will create a comprehensive energy system for the Tribe that results in net-zero emissions. The Minnesota Legislature approved the appropriation for the Net Zero Project during the 2020 Legislative Session. The State established the RDA as a condition of allowing Xcel Energy to temporarily store nuclear waste in dry casks outside its nuclear power plant.

On May 27, 2020, Minnesota Governor Tim Walz signed House File 1842. As provided in the legislation, the "Prairie Island Net Zero Project is established with the goal of the Prairie Island Indian Community developing an energy system that results in net zero emissions." Further, the law states, "The Prairie Island Indian Community must file a comprehensive Net Zero Project plan with the commissioner of commerce and the legislative committees with jurisdiction over energy policy no later than July 1, 2021, describing the Prairie Island Net Zero Project elements and implementation strategy." (Laws of Minnesota 2020, chapter 118, section 3).

This Comprehensive Net Zero Project Plan (Plan) is being filed with Minnesota Department of Commerce Commissioner Grace Arnold, the Honorable Dave Senjem, Chair of the Minnesota Senate Energy and Utilities Finance and Policy Committee, and the Honorable Jamie Long, Chair of Minnesota House of Representatives Climate and Energy Finance and Policy Committee. The Plan describes how the PIIC intends to use the funding to achieve net zero emissions for the community and details all activities undertaken to date during Phase 1. Submission of the Plan represents the conclusion of Phase 1 of the Prairie Island Net Zero Project. Subsequent reports will illustrate activities that the PIIC will undertake in Phases 2 and 3.

The Opportunity

The PIIC believes this is a special moment and a unique opportunity to develop an innovative approach to creating a net zero community, which is likely a first of its kind in Indian Country. Following a competitive bid process, the PIIC selected a Net Zero Team comprised of Indian Energy, LLC, (Native owned and operated), Chief Strategy Group, Inc. (Native owned and operated), and NV5, an international engineering company, as their strategic partners for this Net Zero Project. The Net Zero Team was tasked with assisting the PIIC in establishing clear goals for the Net Zero Project, providing technical analysis of the PIIC's existing energy portfolio, and developing and executing a Net Zero Project plan that includes conservation, energy efficiency, generation, and sustainability.

Getting to Net Zero

The Prairie Island Net Zero Project is broken into three phases:

Phase 1: Stakeholder Engagement, Technical Analysis, & Net Zero Project Plan Development

Phase 2: Net Zero Project Costing and Vendor Selection

Phase 3: Construction and Implementation

Phase 1: Stakeholder Engagement, Technical Analysis, & Net Zero Project Plan Development

The Tribe created a public input protocol by utilizing the PIIC membership as the base. Many of the technical changes that are to take place at Prairie Island will affect Tribal members, thus it was critical to receive feedback from the Tribal membership as to what they believe would be the best path for the Tribe to pursue. The alignment of the community input with the technical solutions was important to create a strategy that is technically accurate while meeting the goals and the vision of the community.

The Net Zero Team developed and executed an internal and external stakeholder engagement process that included:

- Review of existing document and plans
- Stakeholder engagement process
- Community meetings
- A survey of community members

The Net Zero Team conducted four community meetings to engage Tribal membership as part of the overall outreach strategy. The first two meetings were meant to capture the ideas, thoughts, and preferences of the Tribal membership. The community meetings were instrumental in the development of the Net Zero Project's guiding principles, vision, and confirmation of the Tribal values. Additionally, they provided necessary guidance on technical solutions that were preferred by the community members. Lastly, these first two sessions directly influenced the priority areas for the Net Zero Project, as well as an understanding of the long-term needs and desired governance options.

The third and fourth meetings focused on confirming the information and insights gained from the first two meetings. Technical solutions were presented and shared, as was information on why some options may be preferred over others. These meetings and interactions allowed the community to ensure that their thoughts, ideas, and concerns had been appropriately captured and addressed. More importantly, awareness was generated and buy-in was created through the inclusion of the community's ideas.

The Net Zero Team conducted a comprehensive assessment of source energy and end-use emissions to create an emissions baseline. A multi-disciplinary team of Engineers spent three weeks on the Island with the Faculty staff gathering and analyzing data. After analyzing all the data, the Net Zero Team concluded that the Tribe would need to eliminate approximately 20M lbs. of CO_2 in 2023. See Figure 1.

Figure 1 – Targeted Reduction of CO_2 Emissions by Measure

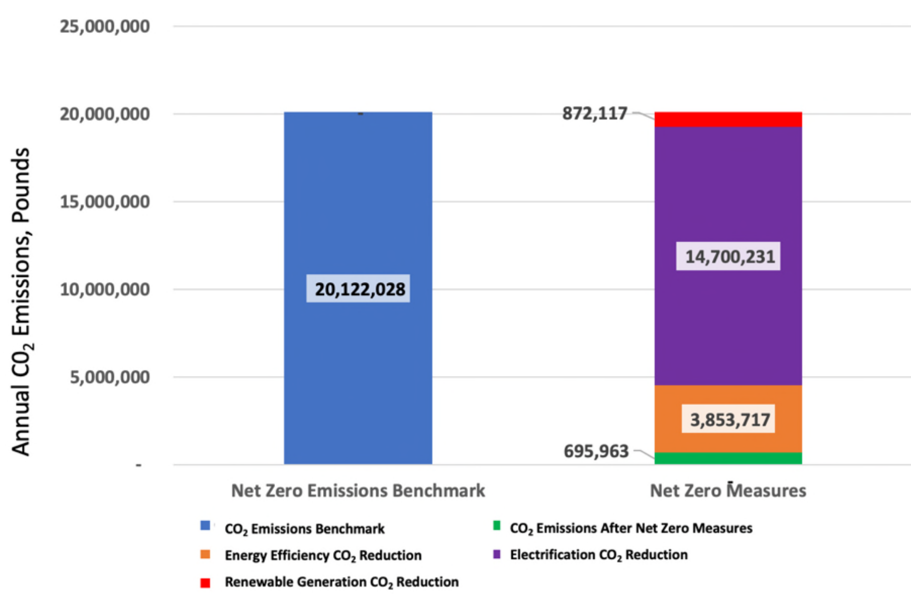
Type of Measure	Reduction of CO_2 Emissions	
	Pounds	%
Energy Efficiency	3,853,717	19.8%
Electrification	14,700,231	75.7%
Renewable Generation	872,117	4.5%
TOTAL	19,426,065	100.00%

Informed by the baseline assessment, technical analysis, and input from the stakeholder engagement, the PIIC Tribal Council approved a comprehensive plan for the Prairie Island Net Zero Project that maximizes carbon reduction through energy conservation, renewable energy generation, and deployment of innovative technologies.

- The PIIC Tribal Council weighed several factors, which included a wide array of technologies, the impact on Tribal Members and Tribal business operations, cultural implications, and the capital costs of each package and its carbon reduction potential.
- The Selected Net Zero Projects are comprised of 46 individual projects, including LED lighting and controls, a geothermal heating and cooling plant, rooftop and ground-mounted solar, and an energy management system.

The Plan will reduce 97% of the PIIC's carbon footprint. The remaining carbon will be reduced further with future renewable generation or sequestered through planting native vegetation. See Figure 2.

Figure 2 – Benchmark and Anticipated Reductions Based on Selected Net Zero Projects



Phase 2: Net Zero Project Costing and Vendor Selection

Phase 2 involves Net Zero Project costing and vendor selection to create a certified cost report due to the Minnesota Legislature by January 1, 2022.

Phase 3: Construction and Implementation

Phase 3 will be construction and implementation of the Plan to achieve net zero emissions. Annual progress reports to the Legislature will begin on July 1, 2022 and continue through completion of the Net Zero Project.

ACKNOWLEDGEMENTS

This work is the result of a collaboration between the Prairie Island Indian Community and several companies, professions, and across time zones. The study would not have been completed without the input and support of the following individuals:

Prairie Island Indian Community Tribal Council: President Shelley Buck, Vice President Lucy Taylor, Secretary Johnny Johnson, Treasurer Valentina Mgeni, and Assistant Secretary/Treasurer Michael Childs Jr.

Prairie Island Indian Community Net Zero Project Steering Committee: Darrell Breuer, Thomas J. Hanson, Blake Johnson, Brad Johnson, Grant Johnson, Rayanna Lennes, Eric Pehle, John Reich, and Jessie Seim

Prairie Island Indian Community Members: Through interviews, a survey, and small group sessions with Tribal elders and youth, dozens of Community members provided their input to the Net Zero Project.

Indian Energy: Henry Boulley, Allen Cadreau, Jessica Cadreau and Nicole Cadreau

Chief Strategy Group: Michell Hicks, Jason Lambert, and Bryan Small

NV5: Jack Gardner, Jennifer Guenther, Ben Juhnke, Dan Kolimar, Billy Parker, Shoshana Pena, Brian Roppe, Tom Schubbe, Isha Shah, Collin Smith, Kyle Thompson, and Brian Wallace

Mendota Group: David Sagara and Grey Staples

Transform LLC: Carmen Barker Lemay

With the additional assistance of Dakota Electric Association, Great River Energy and Xcel Energy.

ACRONYMS

AHU	Air Handling Unit
ASHP	Air Source Heat Pump
BESS	Battery Energy Storage System
BTU	British Thermal Unit
CHW	Chilled Water
COP	Coefficient of Performance
DB	Dry Bulb
DEA	Dakota Electric Association
DCW	Domestic Cold Water (potable)
DHW	Domestic Hot Water (potable)
DX	Direct Expansion
ECM	Energy Conservation Measure
EE	Energy Efficiency
ERU	Energy Recovery Unit
GHG	Greenhouse Gases
GRE	Great River Energy
GSHP	Ground Source Heat Pump (also Geothermal Heat Pump)
H.F.	House File
HHW	Heating Hot Water
HRC	Heat Recovery Chiller
HRG	Heat Recovery/Geothermal
HVAC	Heating, Ventilation, Air Conditioning
HX	Heat Exchanger
kV	Kilovolts
kWh or KWh	Kilowatt-hours
kW	Kilowatt
LCC	Lifecycle Costs
M	Million
MAU	Makeup Air Unit
MBCx	Monitoring-based Commissioning
MISO	Midcontinent Independent System Operator
MN	Minnesota
M&V	Measurement and Verification

MV&A	Measurement, Verification and Analytics
MW	Megawatt
MWh	Megawatt-hour
NRG	NRG Energy
O&M	Operations and Maintenance
OH	Overhead
PEC	People's Energy Cooperative
PF	Power Factor
PIIC	Prairie Island Indian Community
PPA	Power Purchase Agreement
PTAC	Packaged Terminal Air Conditioner
PV	Solar Photovoltaic
RDA	(Xcel Energy) Renewable Development Account
RE	Renewable Energy
RFP	Request for Proposals
RTU	Rooftop Unit
SF	Square Foot or Square Feet
SWOT	Strengths, Weaknesses, Opportunities and Threats
TIRC	Treasure Island Resort and Casino
V	Volt
VFD	Variable Frequency Drive
W	Watts
WB	Wet Bulb
WWHP	Water to Water Heat Pump
WWTF	Wastewater Treatment Facility
Xcel	Xcel Energy

DEFINITIONS

Behind (or Back of) the Meter: Refers to energy that is generated and consumed and or stored by the consumer and is typically NOT metered by the local utility.

Battery Energy Storage System (BESS): is a device that charges (stores) electrical energy from the grid, later discharging energy to provide electricity or other grid services.

British Thermal Unit (BTU): BTU is a measure of the heat content of fuels or energy sources. It is the quantity of heat required to raise the temperature of one pound of liquid water by 1°F at the temperature that water has its greatest density (approximately 39°F). The measurement is used to compare energy sources or fuels on an equal basis. Fuels (such as natural gas or electricity) can be converted from physical units of measure (such as weight or volume) to a common unit of measurement of the energy or heat content of each fuel.

Dry Bulb (DB): The temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture.

Energy Efficiency: Measures or programs, including energy efficiency measures or programs, including energy conservation measures or programs, that target consumer behavior, equipment, processes, or devices designed to produce either an absolute decrease in consumption of electric energy or natural gas or a decrease in consumption of electric energy or natural gas on a per unit or production basis without a reduction in the quality or level of service provided to the energy consumer. (Minn. Stat. § 216B.241, subd. 1 (f)) https://www.revisor.mn.gov/statutes/cite/216B.241. For the PIIC specifically, operate all facilities at the lowest cost with a focus on saving energy by educating Tribal employees and membership on cost saving techniques. Focus on saving a dollar will result in making a dollar.

Energy Resiliency: The ability to maintain all critical operations during high and low peak times, utilizing the experience of the Tribe and its ability to survive while protecting the land and resources.

Energy Sovereignty: Self-generate all energy on the Reservation to benefit Tribal operations and Tribal membership. Prairie Island becomes an island to itself with an infrastructure that is evolving and sustainable for the benefit of the community.

Front of the Meter: Refers to energy that is generated and injected into the regional and or local distribution grid. Examples may include roof top solar, but typically consists of community scale solar and utility scale electric generation. These front of the meter power plants are typically financed through a long-term power purchase agreement (PPA) with the local utility.

Global Warming: Scientific consensus holds that the rapid rise in human-caused (anthropogenic) GHG emissions is contributing to a general warming of the earth's atmosphere. In 2018, the International Panel on Climate Change (IPCC) issued a special report which concluded that human activities are estimated to have caused an approximately 1.0°C increase in global temperatures above pre-industrial levels. The Report further concluded that recent trends in emissions will increase the warming trend and that, "without increased and urgent mitigation ambition in the coming years, leading to a sharp decline in greenhouse gas emissions by 2030, global warming will surpass 1.5°C in the following decades, leading to irreversible loss of the most fragile ecosystems, and crisis after crisis for the most vulnerable people and societies."

Greenhouse Gas Emissions (GHG): The main greenhouse gases are carbon dioxide (frequently referred to as simply "carbon" or CO_2), methane, nitrous oxide, and fluorocarbons. Carbon dioxide is the primary contributor and methane is the second largest contributor. Methane is ten times more potent than carbon dioxide in contributing to warming.

Ground Source Heat Pump (GSHP): Also referred to as a geothermal heat pump, a GSHP is a type of heat pump used to heat and cool a building by exchanging heat with the ground, often through a vapor-compression refrigeration cycle. It uses the earth, without any intermittency, as a heat source or a heat sink.

Heat Pump: A device that can provide heating, cooling and hot water for residential, commercial and industrial applications. Any heat pump installation can provide heating and cooling in parallel.

Master Planning: Creating a plan that is expandable and flexible yet aligns with the PIIC expertise and overall vision.

Monitoring-Based Commissioning: MBCx is an ongoing commissioning process which monitors and analyzes large amounts of building performance data, such as that from a commercial heating and air units, on a continuous basis.

Net Zero Project (or Project): Per H.F. 1842, net zero is defined as net zero emissions. "The Prairie Island Net Zero Project is established with the goal of the Prairie Island Indian Community developing an energy system that results in net zero emissions."

Net Zero Emissions: Refers to buildings or communities where, on a source basis, the Greenhouse Gas emissions produced by the consumed energy (and potentially other products and services) are less than or equal to zero. Given that carbon dioxide is the primary greenhouse gas and activities that reduce carbon also reduce other greenhouse gas emissions (such as methane), the primary focus of the Prairie Island Net Zero Project will be to achieve net zero carbon dioxide emissions.

Net Zero Energy: Net Zero also frequently refers to net zero energy. A net zero energy building is a building where, on a source basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy. The designated entity can be a building, a campus, a portfolio of buildings, or a community. Other frequently used terms include: zero net energy, zero energy, or zero net source energy use.

Net Zero Team: Indian Energy LLC, Chief Strategy Group, Inc., NV5.

PIIC NZ Procurement Plan: The plan to obtain bids to develop the Certified Cost Report. The Procurement Plan is elaborated in Section 6 of this report.

Plan: Comprehensive Net Zero Project Plan for the Prairie Island Net Zero Project.

Prairie Island Indian Community Council: The Tribal Council is the common reference to "The Community Council of the Prairie Island Indian Reservation." Per the *Constitution and Bylaws of the Prairie Island Indian Community in Minnesota, as amended*, it is the governing body of the Prairie Island Indian Community. It is comprised of five, duly elected, members. Its powers, authority, and responsibilities are identified in the amended Constitution and Bylaws.

Net Zero Project Steering Committee: The committee that was assigned the responsibility during all phases of the Net Zero Project to assist in advising, guiding, scheduling, and providing general oversight for the Net Zero Project.

Procurement Team: The Net Zero Project Procurement Team is a subset of the Net Zero Project Team given the responsibilities of framing and implementing the procurement tasks associated with Phase 2 of the Net Zero Project. They work within the guidance and approval of the Net Zero Project Steering Committee and the Tribal Council.

Therm(s): A non-SI (international system of units) unit of heat energy equal to 100,000 British thermal units (BTU). It is approximately the energy equivalent of burning 100 cubic feet (2.83 cubic meters) – often referred to as 1 CCF – of natural gas. According to the EPA burning one therm of natural gas produces on average 5.3 kg (11.7 lb.) of carbon dioxide.

Wet Bulb (WB): The temperature read by a thermometer covered in a water-soaked cloth over which air is passed.

1.0 OVERVIEW

1.1 PRAIRIE ISLAND INDIAN COMMUNITY

1.1.1 Community History

The following represents a brief historical description of the Prairie Island Indian Community and its connection to its homeland.

The Dakota Oyate (people) lived on the lands around present-day Minnesota and Prairie Island long before European settlers first came to America or moved west. They are the Bdewakantunwan, or "those who were born of the waters."

Prairie Island represents more than land – it is a spiritual place that connects the Dakota to Mother Earth. This sacred land is home to long-gathered foods and medicines that sustained the Dakota through prosperous times and times of need. It represents a place of worship and a final resting place for many Dakota ancestors.

The Dakota and Prairie Island are one.

Despite the taking of their land and efforts to eradicate them from what is now Minnesota, the Dakota people persevered. Some never left and others returned, proving that the Dakota and Prairie Island are inseparable.

1.1.2 How the Prairie Island Indian Community Came to Be

Prairie Island Indian Community Members are descendants of the Mdewakanton (Bdewakantunwan) Band of Eastern Dakota. The Treaty of Traverse des Sioux of 1851, stripped the Dakota of their ancestral lands. The failure of the U.S. government to uphold its treaty obligations led to war with the Dakota people and, ultimately, the largest mass execution in American history – the hanging of 38 Dakota men in Mankato, Minnesota on December 26, 1862. Soon after, Congress invalidated treaties and the Dakota were driven from Minnesota. A small group of Dakota remained and settled near Prairie Island.

1.1.3 The Creation of the Prairie Island Reservation

In the late 1880's, the Secretary of the Interior placed land into trust for Dakota individuals living on Prairie Island. Additional land was purchased under the Indian Reorganization Act of 1934. The Act encouraged tribes to formalize their governments by adopting a Constitution and By-Laws, which the Prairie Island Indian Community did in 1936.

A few years later, the U.S. Government allowed the first in a series of events that created ever-present threats to the Prairie Island Indian Community. In 1938, the U.S. Army Corps of Engineers built Lock and Dam Number 3, which flooded much of the Community's original land base, including burial mounds, and created a larger floodplain. In 1973, Xcel Energy (formerly known as Northern States Power Company) began operating a nuclear power plant and later a nuclear waste storage site adjacent to the Reservation.

Resiliency has defined the Prairie Island Indian Community from its earliest history. Despite the many hardships, the Tribe has persevered and survived, overcoming hurdles while focusing on preserving Tribal culture and providing for future generations.

1.2 NET ZERO PROJECT ORIGINS

1.2.1 Brief History of Net Zero Project

The Minnesota Legislature established the Renewable Development Account (RDA) in 1994 as a condition to allow Xcel Energy to store nuclear waste on site in dry storage casks at the utility's Prairie Island nuclear power plant. Currently, Xcel Energy pays $500,000 annually into the RDA for each nuclear waste cask stored on Prairie Island; the utility also pays $350,000 for each cask stored at its Monticello plant.

House File 1842 (HF 1842) appropriated $46.2 million for the RDA for PIIC to become a net zero energy community, one of the first tribes in the United States to achieve that status and one of only a handful of Minnesota communities aiming to become net zero by reducing energy consumption, installing energy efficient equipment and lighting, and integrating renewable generation to eliminate the production of harmful GHG emissions. Governor Tim Walz signed the bill into law on May 27, 2020. Prior to the Net Zero appropriation, PIIC had not received funds or benefited from the RDA, despite shouldering the risk associated with the storage of the spent nuclear fuel in close proximity to Tribal Member homes.

1.2.2 Net Zero Project Overview

HF 1842 authorized the PIIC to receive $46.2 million to fund a Net Zero Project. As provided in the legislation, the "Prairie Island Net Zero Project is established with the goal of the Prairie Island Indian Community developing an energy system that results in net zero emissions." Further, the law states, "The Prairie Island Indian Community must file a comprehensive project plan with the commissioner of commerce and the legislative committees with jurisdiction over energy policy no later than July 1, 2021, describing the Prairie Island Net Zero Project elements and implementation strategy." (Laws of Minnesota 2020, chapter 118, section 3). This report fulfills the reporting requirement.

This Plan is being filed with Minnesota Department of Commerce Commissioner Grace Arnold, Representative Jamie Long, Chair of the Minnesota House of Representatives Climate and Energy Finance and Policy Committee, and Senator Dave Senjem, Chair of the Minnesota Senate Energy and Utilities Finance and Policy Committee. The Plan describes how the PIIC plans to use the funding to achieve net zero emissions for the community.

1.2.3 Net Zero Importance

International scientific consensus holds that the rapid rise in human-caused (anthropogenic) Greenhouse Gas ("GHG") emissions is contributing to a general warming of the earth's atmosphere. In 2018, the International Panel on Climate Change (IPCC) issued a special report[1] which concluded that human activities are estimated to have caused an approximately 1.0°C increase in global temperatures above pre-industrial levels. The Report further concluded that recent trends in emissions will increase the warming trend and that, "without increased and urgent mitigation ambition in the coming years, leading to a sharp decline in greenhouse gas emissions by 2030, global warming will surpass 1.5°C in the following decades, leading to irreversible loss of the most fragile ecosystems, and crisis after crisis for the most vulnerable people and societies."

Net zero is achieved by minimizing human caused emissions through energy efficiency, deploying renewable fuels, behavior change, and offsetting what emissions remain using proven approaches to

[1] *Global warming of 1.5°C: An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*.

remove GHGs from the atmosphere. In the context of this Plan, net zero emissions is defined as GHG emissions, most notably carbon dioxide. The emissions are primarily produced by fossil-fuel generated electricity, petroleum-fueled transportation vehicles, on-site consumed natural gas or propane, and emissions from other residential and commercial activities. Given that carbon dioxide is the primary GHG and activities that reduce carbon also reduce other GHG emissions (such as methane), the primary focus of the Net Zero Project will be to achieve net zero carbon dioxide emissions.

A plan to achieve net zero cannot neglect the human part of the solution as technological fixes are inextricably linked with human comfort and behavioral changes, and because the well-being of the community is critical to achieving successful outcomes. To this end, the Net Zero Project has actively engaged members of the PIIC and other relevant parties to better understand their needs, capture their ideas, and create plans that meet the Net Zero Project's objectives. Reaching the goal of net zero emissions will be a hollow achievement without also producing significant long-term, sustainable benefits for the community.

1.2.4 Report Outline

The plan to achieve net zero is broken into three phases:

Phase 1: Stakeholder Engagement, Technical Analysis, & Net Zero Project Plan Development (report due July 1, 2021);

Phase 2: Net Zero Project Costing and Vendor Selection (report due January 1, 2022);

Phase 3: Construction and Implementation (progress reports beginning on July 1, 2022).

This report marks the completion of Phase 1 and activities to support Phases 2 and 3 have already begun. Considerable effort will be expended between July 1, 2021, and January 1, 2022, to put the Net Zero Project on a path to meet the January 1, 2022 deadline to submit the total certified cost of the project to the state of Minnesota. The Phase 1 report is organized as follows:

Section 1 – Net Zero Project Overview: Provides a high-level Net Zero Project summary of the report and describes the stakeholder and community engagement that supports the analysis of net zero options and frames the Net Zero Project's long-term benefits.

Section 2 – Community and Stakeholder Engagement: Details the process of stakeholder and community engagement and the results that informed the selection of the Net Zero Projects.

Section 3 – Energy Baseline and System Study: Provides details regarding the Energy Baseline and System study used to establish the net zero goal.

Section 4 – Net Zero Target: Describes the Net Zero Projects selected to achieve the net zero goal.

Section 5 – Net Zero Implementation Plan: Provides the plan for implementing the selected Net Zero Projects.

Section 6 – Procurement Plan: Describes the plan, process and procedures the PIIC will use to procure the necessary resources to meet the requirements of HF 1842 and ensure that the funds are prudently spent to maximize benefits to the PIIC and the State.

Section 7 – Future Considerations: Discusses future considerations to implement the overall plan and other longer-term considerations. Section 7 also describes next steps after this report is submitted.

2.0 COMMUNITY AND STAKEHOLDER ENGAGEMENT

2.1 PURPOSE

In addition to technical feasibility, projects in Indian Country are subject to the priorities and needs of Tribal communities and other stakeholders. Without significant buy-in from Tribal communities and other Tribal stakeholders, the potential for long-term success of any project is likely minimal. The purpose of the initial community and stakeholder engagement in this Net Zero Project was to understand the priorities of the PIIC membership, staff members, and Tribal Council and generate buy-in for the Net Zero Project from all these groups. Once these priorities were understood, it was possible to design a strategy that aligned with Tribal priorities. However, true strategic alignment does not simply include buy-in from the community and staff. It includes alignment from financial and human resources perspectives as well. The financial and human resources piece is especially important in this project since the Net Zero Project is so capital-intensive and requires technical expertise for continued operations.

2.2 METHODOLOGY AND INPUT PROCESS

The methodology and input process for community engagement was designed to gather information about the PIIC and determine the priorities, expectations, and needs of the community and stakeholders. These processes included a review of existing documents and plans, stakeholder engagement, community meetings, and a community survey.

A review of existing documents and plans was designed to gather data around the current state and operational potential of the Tribal government.

- The stakeholder engagement process included group and individual interviews with Tribal Council as well as selected staff members and was designed to collect information about the Tribal government and its current capabilities to support the Net Zero Project.
- The community meetings were designed to educate, collect feedback, confirm feedback, and present the final Net Zero report to Tribal Members, including elders and the youth.
- The survey was distributed to collect both quantitative and qualitative data regarding Tribal Member priorities and needs regarding the Net Zero Project.

These methodologies and input processes yielded significant data and information regarding community priorities and needs. Further, the processes informed the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and current capabilities of the Tribal government staff with regards to implementation of the Net Zero Project.

2.2.1 Review Existing Documents and Plans

The document review included relevant planning documents that pertain to the PIIC, along with organizational charts, budgets, and other appropriate documents. Organizational documents were reviewed to gain historical context and assess the current operations and current planning efforts as well as organizational intent. The review informed the development of the survey and tools, individual and group interview protocol, and community sessions design. Specific documents reviewed included: prior planning documents, organizational charts, prior annual community update reports, and leadership communication efforts.

Tribal leadership and staff have historically engaged in project planning and budgeting activities. As part of this engagement, the goal of the Net Zero Team was to capture essential elements of prior planning initiatives that potentially impact the Net Zero Project and to create the protocol and design the strategic next steps of the Tribe. From the document review phase, our Net Zero Team was able to capture prior initiatives, goals, objectives, performance measures, and performance reports. This information was critical to inform the next phases of the Net Zero Project and to create a picture of how the Tribe has grown and evolved over time.

2.2.2 Stakeholder Engagement Process

The Net Zero Team collected multiple data points through the stakeholder engagement process. A data point is defined as a key word, phrase, thought, statement or complete sentence around a subject matter that is relevant and provides guidance to this Net Zero Project. These data points were an accumulation of multiple input avenues that have been summarized and divided into the most applicable area, such as SWOT, values, vision, priority areas and strategic pathways.

The purpose of the various sessions was twofold. First, the sessions were designed to understand the current state of the PIIC and the strategy for moving forward with key initiatives. The second purpose was to understand the key strategic initiatives the PIIC is interested in pursuing in the future related to the Net Zero Project.

The interviews with key stakeholders in group and individual settings provide data from a slightly different perspective than the document review. Although stakeholders are normally upfront with their opinions regarding department interaction, these points of view can vary significantly from one another as well as from the documents reviewed. The interviews taken in their totality provide effective feedback around how well operations are performing as compared to the intent as laid out in formal documents.

One facilitation technique used during this process was Ritual Dissent. Ritual Dissent is a rapid prototyping technique designed to posit solutions to problems through quick discussions within a “home” team and listening sessions with various other teams. The technique implements a thought process that requires the participants to find solutions by revisiting ideas multiple times during the sessions. This process is known to truly challenge the brain and each other's ability to criticize each teams' thoughts and solutions until ideas and solutions are fine-tuned to the satisfaction of each group.

2.2.2.1 Tribal Leadership Group Sessions

The Net Zero Team facilitated multiple Tribal leadership group sessions throughout this Net Zero Project. These sessions were comprised of the PIIC Tribal Council, and staff were invited to participate in certain sessions. The discussion around the elements of vision, values, guiding principles, and the overall Net Zero Project strategy were critical to the future success of the Net Zero Project.

2.2.2.2 Program Staff and Tribal Council Interviews

The Net Zero Team also interviewed all of the current Tribal Council to gain insight on the Tribe’s vision, values, guiding principles, and strategic paths of the Net Zero Project. The interviews centered on the current state of the PIIC and identifying opportunities to grow and expand the impact of the Net Zero Project nationally. The Net Zero Team individually also interviewed multiple program staff and members of the Steering Committee. The interviews with the individual program staff focused on the current state of the programs and the benefit of the Net Zero Project on their operations. Additionally, the Net Zero Team interviewed outside stakeholders that had a current or historical perspective on the Net Zero Project and whose input could help to guide the strategic path of the Net Zero Project. This interview process also allowed the Net Zero Team to capture the responsibilities and expectations of the Tribal Council for the future of the organization, both individually and collectively. The diversity of responses, along with commonalities centered on a shared vision, informed the evaluation and recommendation processes.

2.2.2.3 Steering Committee Updates

The Net Zero Team consistently met with the Net Zero Project Steering Committee on a weekly basis at minimum, that focused on Net Zero Project updates and continued guidance on multiple topics, including Net Zero Project scope, scheduling, element progress, and overall direction during the first phase of the Net Zero Project.

2.2.2.4 Tribal Council Updates

The Net Zero Team also met with the Tribal Council on a weekly basis. The purpose of the weekly meetings was focused on Net Zero Project updates and scheduling needs. This process allowed the Tribal Council to stay abreast of the major movements within the Project and provided our Net Zero Team the opportunity to gain further guidance.

2.2.3 Community Meetings

A key aspect of the stakeholder engagement piece focused on community meetings with the membership of the PIIC. Due to the extended impacts of the COVID-19 pandemic these meetings were primarily held through virtual platforms. A total of four community-wide meetings were held between March and June 2021. Additionally, the Net Zero Team conducted dedicated sessions for both the Tribal elders and the Tribal youth. All of these meetings were facilitated by the Net Zero Team with the assistance of the Steering Committee and the Tribal Council.

The first two meetings were a critical input component of capturing the ideas, thoughts, and preferences of the Tribal membership. These were instrumental in the development of the Net Zero Project's guiding principles, vision, and confirmation of the Tribe's values. Additionally, they provided necessary guidance on technical solutions that were preferred by the community members. Lastly, these first two sessions directly influenced the priority areas for the Net Zero Project, as well as an understanding of the long-term needs and desired governance options. Through these meetings the community's knowledge of the Net Zero Project and ideas were gathered and enhanced, thereby positively impacting the future of the PIIC.

The second two meetings focused more on confirmation of the information and insights gained from the first two meetings. Again, facilitated by the Net Zero Team, these meetings presented the guidance received from the community on their preferences. Technical solutions were presented and shared, as was information on why some options may be preferred over others. These meetings and interactions allowed the community to ensure that their thoughts, ideas, and concerns had been appropriately captured and addressed. More importantly, awareness was generated and buy-in was created through the inclusion of the community's ideas.

The community meetings directly contributed to SWOT Analysis. Additionally, they provided specific guidance for the technical paths to achieve net zero emissions.

2.2.3.1 Elder Meetings

Within Tribal communities the elder population is looked to for guidance, wisdom, and connection to the traditional teachings and culture. Tribes often have very specific criteria for designation as an elder. It was of the highest importance to the PIIC's leadership that elder input was critical to the understanding, design, and success of the Net Zero Project.

Through an existing meeting structure with the Tribal elders, the Net Zero Team was able to have two focused meetings with the elders. Additionally, the Net Zero Team was able to interact with the elders at several other regular meetings. All of these were held virtually. Several of the Tribal elders also participated in the community-wide sessions, as well as the survey.

Specific input from the elders focused on a trust in the responsibility they had placed in their elected officials to make long-term, strategic decisions. The Tribal elders highly valued the positive impact this Net Zero Project could have on younger generations, as well as those generations to come. For many of those that had grown up and live on the Reservation, the reality of living in the shadow of a nuclear power facility was prevalent in their concerns and their hopes. Many personal stories were shared about how the facility and transmission lines and railway service had negatively impacted their lives. Other comments from the Tribal elders focused on environmental impacts and opportunities for younger Tribal members.

2.2.3.2 Youth Meetings

The Net Zero Team facilitated one face-to-face input session and one virtual input session with Tribal youth that focused on their knowledge of the Net Zero Project and ideas on the future impact to the PIIC. Gaining input from high school students was important for the Net Zero Project, since they will be adults during the build out of the Net Zero Project, and they will be affected by current decisions that impact their generation.

Nearly all of the students indicated that they didn't know what the Net Zero Project was, however, once the concept of Net Zero was explained, they took a keen interest and drew direct lines between net zero and cultural values, such as protecting Mother Earth. Many of the students stated that their favorite subjects in school were either math or science. From a workforce development perspective, there was sincere interest in jobs that would allow the students to work with their hands – potentially servicing the solar panels or other renewable energy generation systems.

Although the students had not been exposed to the Net Zero Project directly, their feedback and perspectives were strongly aligned with the feedback received from other stakeholder groups.

2.2.4 Survey

A 30-question survey was developed by the Net Zero Team, reviewed by the Steering Committee and the Tribal Council and communicated to the Tribal community. The purpose of the survey was to gain insight from the community regarding the Net Zero Project. There was a mix of both quantitative and qualitative questions included in the survey. The quantitative questions were designed to measure responses across a common scale. The qualitative questions were designed to allow community members to provide broader feedback that may not have been captured in the quantitative questions. Communication to the community occurred through several communication avenues including a mailing, members-only website, and the members-only Facebook page. A deadline was established for the community members to complete the survey. The survey process began on March 5 and closed on April 6, 2021. The deadline was extended to ensure all Members had a chance to take the survey. A total of 74 responses were received of 570 plus community members over the age of 18.

2.2.4.1 Quantitative

The results of the survey were used as a data point in conjunction with community meetings, stakeholder interviews, and document review to identify and confirm overall trends within the community at large. The sample size was not large enough to determine that any findings were statistically significant; however, when compared to other data points collected throughout this process, the survey results are directionally accurate.

The age groups with the highest response rates were 25-40 years old and 41-54 years old with over 36% and 32%, respectively. Just over 51% of respondents were female, about 44.5% were male, and 4% preferred not to disclose their gender. Although a significant portion of Prairie Island's population is under the age of 18, there were no respondents that indicated they belonged in that age group. Figure 3 represents the age breakdown of respondents to the community survey.

More than two-thirds of respondents were aware of the Net Zero Project. The top three priorities around energy were solar power (94.52%), wind power (58.9%), and power generated from water (57.53%). These priorities are shared in Figure 4. Nearly 71% and over 22% of respondents strongly agreed or agreed, respectively, with the statement, "It is important to me as a member of our Tribe for us to protect the environment with the implementation of any energy solution." Regarding community improvement, over 55% of respondents ranked casino and hotel operations as most important. Housing and existing land development were the second and third most important priorities, respectively.

Figure 3 – Age Breakdown of Survey Respondents

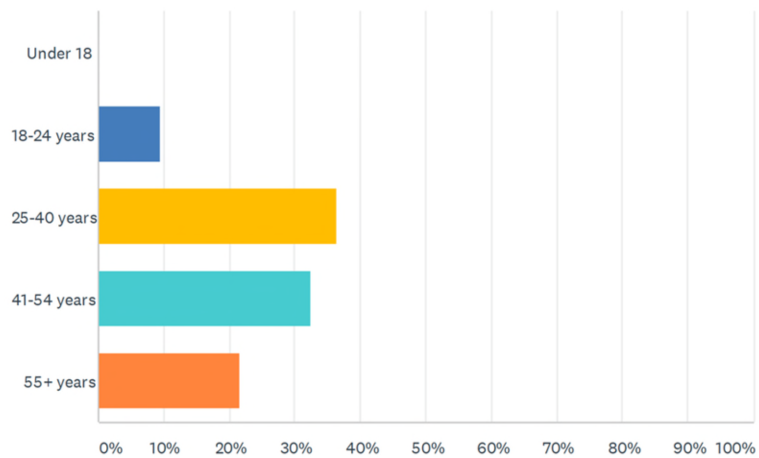


Figure 4 – Energy Priorities for the Community

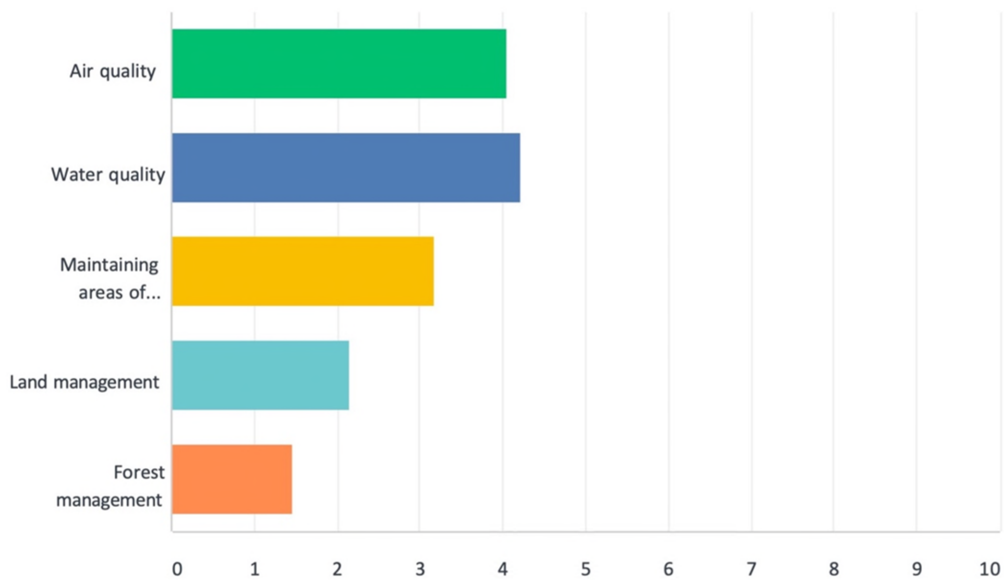
ANSWER CHOICES	RESPONSES	% of RESPONDENTS
Energy generation from water	42	57.53%
Energy generation from solar	69	94.52%
Energy generation from wind	43	58.90%
Energy generation from natural gas	14	19.18%
Energy generation from biogas / biofuel	5	6.85%
Electric energy storage	36	49.32%
Total Respondents: 73		

Nearly 3% of respondents lost power once a month or more. Over 56% of respondents indicated they lost power a few times a year or once a year. Almost 41% lost power less than once a year. When power is lost, almost 36% of respondents said it lasted less than five minutes, while over 61% indicated power was lost for an hour or two. With respect to home energy, "supplemental solar energy" was the highest ranked priority with a weighted score of 3.81. "Lowering monthly energy bill" and "keeping the lights on" were the next two highest priorities with weighted scores of 3.68 and 2.97.

Regarding environmental impact, almost 43% of respondents ranked water quality as the number one priority. Air quality was the second priority with over 38% ranking it first. These concerns around environmental impacts are shared in Figure 5. Over 86% of respondents strongly agree or agree with the statement, "It is important to me as a member of our Tribe that we create a PIIC Utility enterprise that reinforces energy sovereignty."

The top three priorities regarding economic development were sustainability of current Tribally owned enterprises (55.41%), sustainability of current Tribal programs and services (54.05%), and development of new Tribally owned enterprises (52.7%). Respondents indicated that clean energy (72.6%) and access to broadband (18.06%) were higher infrastructure priorities than natural gas (10%).

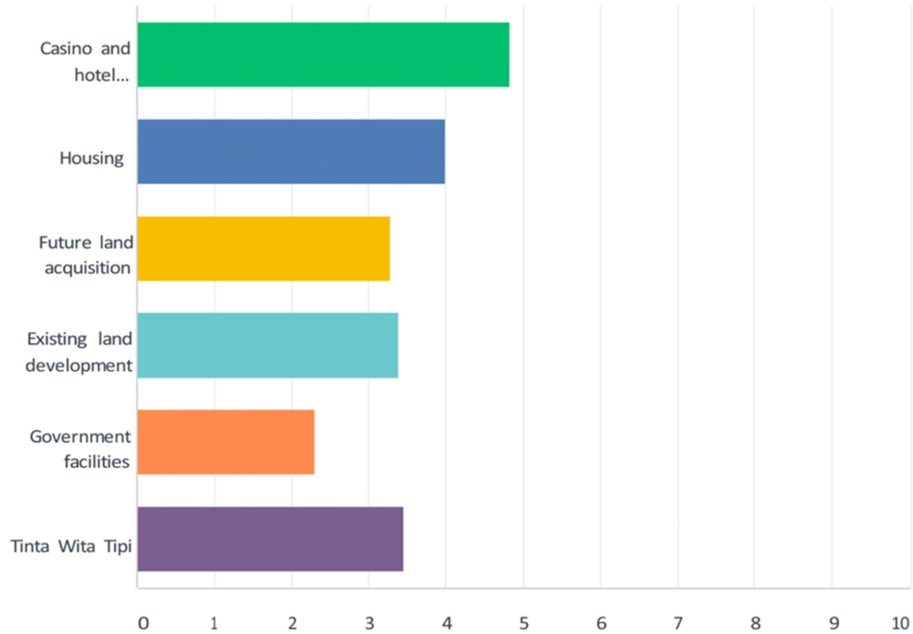
Figure 5 -- Environmental Impact Concerns



Where Tribal Members live affects both their views and priorities. For on Reservation respondents, 37.5% were 55+ and 34.38% were 41-54 years old, while 50% of off Reservation respondents were 25-40 years old and 30.95% were 41-54 years old.

Awareness of the Net Zero Project was nearly identical for respondents regardless of where they lived. The priorities around energy were very similar as well, and they revolved around solar power, wind power, and power generated from water. Regarding community improvement, 60% of respondents living on the Reservation ranked the Casino and Hotel operations as most important. Housing and existing land development were the second and third most important priorities for those living on the Reservation, respectively. For those living off the Reservation, Casino and Hotel operations, housing, and Tinta Wita Tipi were the top three priorities as reflected in Figure 6.

Figure 6 – Community Improvement Opportunities



Regarding home energy, “supplemental solar energy” was the highest ranked priority with a weighted score of 3.94 for those living on the Reservation. “Lowering monthly energy bill” and “keeping the lights on” were the next two highest priorities with weighted scores of 3.63 and 2.83. For those living off the Reservation, “lowering monthly energy bill” and “supplemental solar energy” were almost identical as far as highest ranked priority with weighted scores of 3.72 and 3.71, respectively. “Keeping the lights on” was the third priority with a weighted score of 3.08.

For respondents living on the Reservation, nearly 47% lost power a few times a year and over 3% lost power once a month or more. When power was lost, over 64% of those living on the Reservation said it lasted an hour or two and over 29% stated that it lasted less than 5 minutes. The on Reservation electricity resiliency is displayed in Figure 7. For those living off the Reservation, less than 13% lost power a few times a year. Less than 3% lost power once a month or more. When power was lost, almost 59% of respondents said it lasted for an hour or two, while over 41% indicated power was lost for less than five minutes. These results are captured in Figure 8. Although the results are not statistically significant due to the small sample size, it is important to acknowledge the differences in energy resiliency between those living on Reservation and those living off.

Figure 7 – Loss of Electricity (on Reservation)

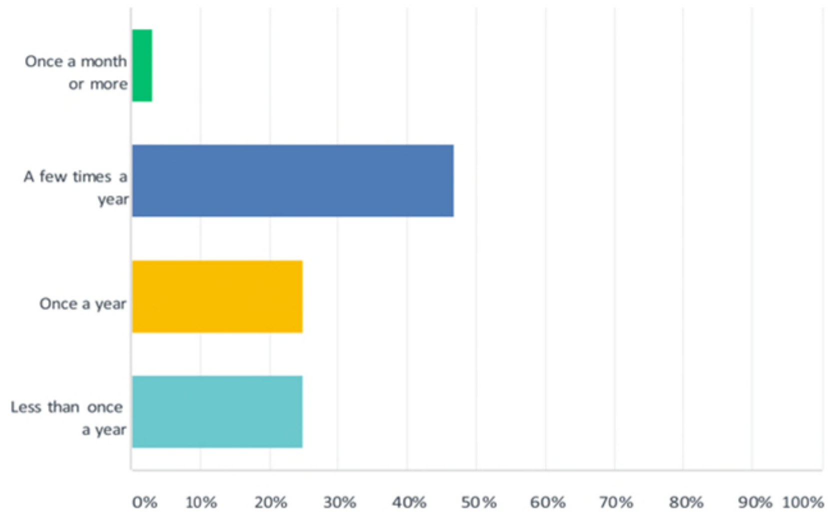
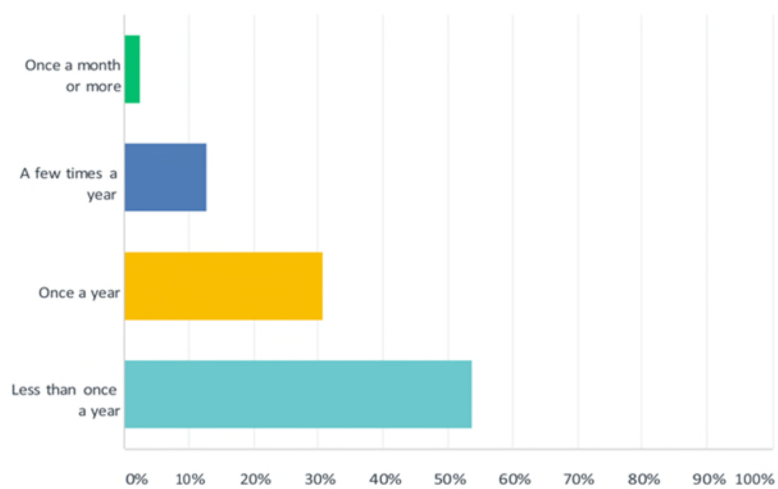


Figure 8 – Loss of Electricity (off Reservation)



With respect to environmental impact, 60% of respondents living on the Reservation ranked water quality as the number one priority. Air quality was the second priority with 30% ranking it first. For those living off the Reservation, water quality and air quality received the same weighted score of 4.08; however, nearly 45% ranked air quality first, while nearly 29% ranked water quality first.

The top three priorities regarding economic development for those living on the Reservation were sustainability of current Tribally owned enterprises (62.5%), sustainability of current Tribal programs and services (59.38%), and development of new Tribally owned enterprises (43.75%). The top three priorities regarding economic development for those living off the Reservation were development of new Tribally owned enterprises (59.52%), sustainability of current Tribally owned enterprises (50%), and sustainability of current Tribal programs and services (50%).

2.2.4.2 Qualitative

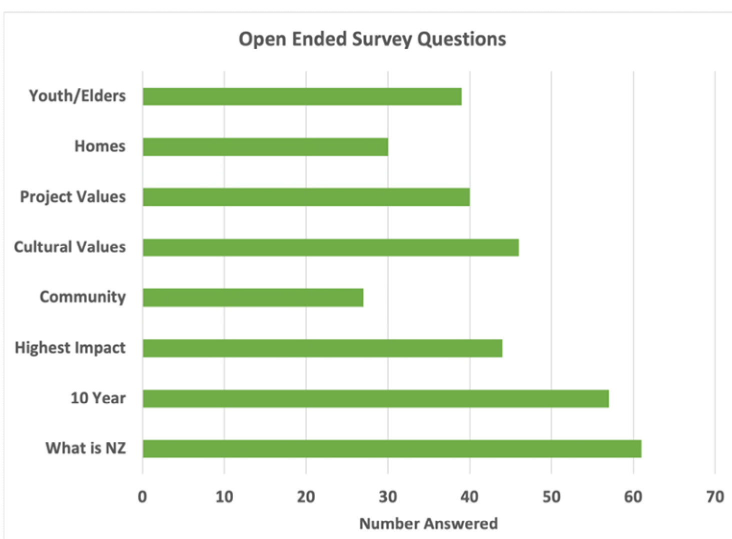
Of the 30 questions in the survey, eight provided the opportunity for an expanded narrative response. These questions were important to provide Tribal members an opportunity to answer in their own words, and not choose from a list of pre-selected options. These questions were strategically arranged and placed throughout the survey rather than only at the end. Collectively, the answers and responses from the Tribal membership provide a qualitative element of community input that will substantially influence the Net Zero Project vision, guiding principles, SWOT Analysis, and strategic paths, while also confirming the importance and presence of the core Tribal values.

The following questions provided the opportunity for an open-ended response:

1. What does Net Zero mean to you?
2. What would you like to see 10 years after this Net Zero Project is successfully completed?
3. Where is the highest impact to the PIIC resulting from the Net Zero Project?
4. If there is another community improvement you would like to see through this Net Zero Project, please specify below.
5. What are the cultural values of the PIIC?
6. What are the most important cultural values that should be considered by this Net Zero Project?
7. Are there other energy improvements that would be beneficial to homes in the long-term not listed above?
8. What impact can and should this Net Zero Project have on youth and elders' services?

All the open-ended questions received an adequate number of responses to influence the direction of the Net Zero Project. Figure 9 summarizes the number of responses per open-ended question. To highlight aspects of the qualitative data gathered from the survey instrument, an analysis of several questions follows. Community members were asked what net zero meant to them. This question was important to gauge understanding and provide a baseline awareness and understanding that can be revisited in future surveys. Approximately 82% of community members taking the survey responded to this question; of those that responded, over 88% provided an applicable response. Several themes and key concepts emerged through the responses, with the following being the most present: savings, self-sufficiency, carbon footprint, environment, and clean energy. More specifically, the responses around clean energy focused on solar and photovoltaic systems.

Figure 9 – Open Ended Responses



When engaging a community for an innovative Net Zero Project community buy-in is critical. The consideration of future impacts of the Net Zero Project are often a means to create that community ownership. The PIIC membership was asked, “What would you like to see 10 years after the Net Zero Project is completed?” and provided answers that influenced the formation of the Net Zero Project’s priority areas. Approximately 77% of those taking the survey completed this question, but over 91% of those responses were considered applicable. Key concepts emerging from the responses aligned with Tribal values, the guiding principles of the Net Zero Project, and are reflected in the strategic paths developed. The answers first focused on savings, particularly at the gaming operation. However, of most importance to the community was becoming self-sufficient as a Tribal nation. This was closely followed by ideas around economic development and sharing the successes with other stakeholder groups.

It was important to gauge the prioritization from a community perspective when evaluating results from the Net Zero Project. In essence, what did Tribal membership believe should be the focus of the Net Zero Project for the highest impact to the PIIC. For this question, approximately 59% of respondents provided an answer. Of those, 75% were considered applicable and usable for the purposes of analysis and evaluation. Three primary focal points were present in the responses: savings, sovereignty, and environmental stewardship. The replies being grouped into these categories substantially align with the Net Zero Project vision and priority areas. It was abundantly clear that the Tribal membership was first and foremost focused on financial and carbon savings from the Net Zero Project, closely followed with a desire for the Tribe to control its energy future. These were then grounded with a focus on the environmental impact and protecting Ina Maka (Mother Earth).

Alignment with cultural values helps for a Net Zero Project to be accepted within a community, while also ensuring the long-term sustainability even thru leadership changes. Tribal members were asked for their interpretation of what are the cultural values of the PIIC and provided the opportunity to convey this in their own words. Over 62% answered this question, with almost 87% of those responses being considered applicable. Three primary concepts were captured within the responses: a responsibility to Mother Earth, the importance of community, and a focus on future generations. The answers were then evaluated in relation to the core values drafted by the Tribal Council. More than 90% of the responses fit within the seven core values identified for the Tribe, demonstrating substantial alignment, and serving as confirmation of those values.

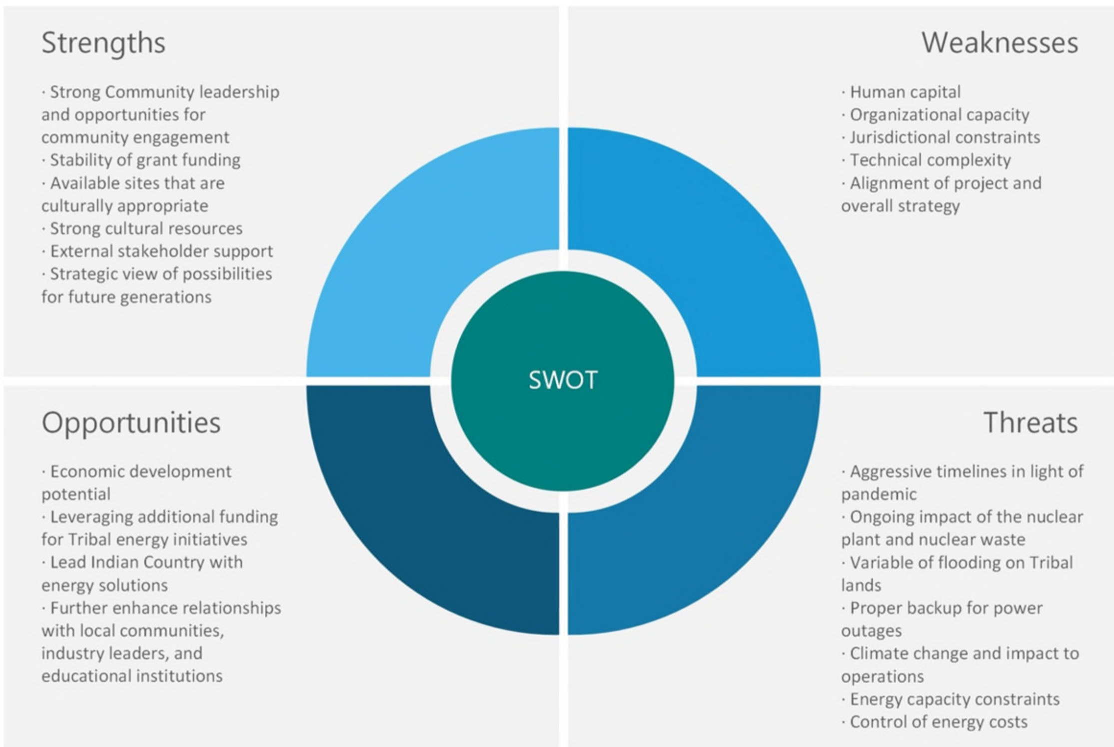
2.3 STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS

SWOT Analysis is a common planning tool used in a variety of analyses and community planning Net Zero Projects. The tool allows an objective evaluation of the strengths, weaknesses, opportunities, and threats that are present in a community or organization. Once identified, a successful SWOT Analysis realizes value in identifying ways to leverage strengths, mitigate weaknesses, capture opportunities, and defend against threats. Figure 10 is a summary representation of the strengths, weaknesses, opportunities, and threats facing the PIIC when focusing on a net zero solution. These were identified through the multi-tiered input process of data collection, evaluation, and analysis. More specifically, the individual listings within the SWOT were gathered through the document review, stakeholder engagement, and Tribal member survey.

The SWOT focuses on community aspects of the PIIC and does not fully account for the technical considerations. Through the multi-tiered evaluation and analysis, those components that appeared multiple times were prioritized for inclusion in the SWOT. Those components and considerations that were found to occur singularly in one input source may have not been included, as this often indicates an outlier. The identification of these strengths, weaknesses, opportunities, and threats will directly contribute to developing strategic paths that best position the community for accomplishment of their Net Zero Project vision.

- **Strengths** are considerations which are internal--within the direct control of the PIIC--and positive in their effect.
- **Weaknesses** are those internal influences that are negative in their effect.
- **Opportunities** represent positive considerations that are external to the community or organization.
- **Threats** are negative influences from externally controlled sources.

Figure 10 – SWOT Analysis



2.4 VISION, VALUES, AND GUIDING PRINCIPLES

2.4.1 Net Zero Project Vision

A vision statement represents a public acknowledgement of where a community or organization wants to be in the future. More importantly, it states where the organization can be based on its own setting and commitment. It is not a wish list of all the things that could come true under the best of circumstances, nor is it a collection of broad goals. A vision statement focuses attention on the type of strategic choices that will assist the organization in achieving a desired future state and helps measure progress along the way. It is a guide to making informed decisions and strategic choices.

The vision statement for this Net Zero Project was developed by the Tribal Council based upon the input from the stakeholder engagement efforts. It represents a Net Zero Project-specific focus, and not an overall vision for the PIIC as a sovereign nation. The Net Zero Project Vision is as follows:

To achieve energy sovereignty and sustainability while engaging our members, fostering innovation, honoring the past, and focusing on the next seven generations to create balance with Ina Maka.

2.4.2 Core Values

Core Values are foundational principles that stay constant regardless of changes in strategy, vision, or mission. They are not a list of attributes toward which to strive; rather, core values pervade all levels of a Tribal nation and its culture. Core values are foundational. They are not created; however, in some cases they need to be clearly articulated. For Tribal nations the core values are often inseparable from the culture and history. Many times, the values are rooted in the very existence of the tribe and are reinforced through creation stories, history, and oral traditions. They are interwoven through generations and are the fabric that define and hold the culture together.

Below is a list of the PIIC's Core Values:

Bdewakantuŋwaŋ
Those born of the water

Woksape
Wisdom

Wowaȟbada
Peace or Calm

Waciŋic'iya
Self-dependence

Akhidečheča
Equality

Wowacaŋtohnake
Generosity

Oahe
Foundation

2.4.3 Guiding Principles

In addition to the Net Zero Project Vision and Core Values, a set of Guiding Principles was proposed through work with Tribal leadership. These principles align with the core values and help to provide guidance toward obtaining the Net Zero Project vision. They are more specific and technical in nature than the Tribal values, while embodying those core concepts of the Nation. The solutions and strategic paths moving forward should align with these principles.

The Guiding Principles were created through the community engagement and stakeholder processes: the community meetings, membership survey, and stakeholder input sessions facilitated processes and conversations with Tribal leadership furthered these ideas into principles that would guide the development of solutions and the implementation of the Net Zero Project. These are summarized and represented as the Guiding Principles. They seek to provide truths that will be adhered to throughout the Net Zero Project. These Guiding Principles, referenced in Figure 11, are Net Zero Project-specific; however, they may be in alignment with other Tribal initiatives as well.

Figure 11 – Guiding Principles

Protect Mother Earth

The importance of protecting Ina Maka cannot be stressed enough. This is a core value and element of existence for the Dakota people.

Engage members, community, and partners

Community engagement throughout the project will be critical for sustained commitment of a true net zero effort.

Teach and share knowledge

A central practice of Dakota culture is to learn and share. This includes technical knowledge, history, and cultural understanding. It includes sharing from the elders and from the youth, in addition to all members and neighbors.

Energy Resiliency

The ability to keep necessary systems operating is of high importance to the tribe and membership.

Energy Sovereignty

As a sovereign nation, PIIC seeks to have authority and control over its energy use, creation, and future.

Provide for our Community

Community is our existence, without our membership we cease to exist. Providing for their needs is essential to everything we do.

Innovation

Innovation encompasses more than just new technologies, it includes new approaches and new ideas.

Secure a better future

Preparing for and taking care of future generations is part of who we are. This includes taking care of Ina Maka, perpetuating our culture and history, and supporting opportunities for our grandchildren's betterment.

3.0 ENERGY BASELINE AND SYSTEM STUDY

3.1 PROFILES OF UTILITY SERVICE AND CONSUMPTION

Formulation of a Net Zero Plan is promulgated on a basic understanding of the consumption profiles of purchased utilities and fuel. Purchased utilities include electricity and natural gas and represent the largest categories of energy consumption within the PIIC. Profiles have been developed from the 2019 usage for three general categories:

- Buildings and Purchased Utilities
- Fleet Vehicles
- Water

Buildings are primarily located in three areas: Prairie Island, Mount Frontenac Golf, and Oyate Place. The highest concentration of buildings and, correspondingly, the highest use of energy is within Prairie Island. Oyate Place is a property being developed at the junction of Highway 61 and 316 and is the location of an existing senior living center, Tinta Wita Tipi. Mount Frontenac Golf is the golf course property southeast of Red Wing.

Dakota Electric Association (DEA) provides electric service to Prairie Island. Xcel Energy provides electric service to Mount Frontenac Golf and natural gas service to Prairie Island and Oyate Place. Purchased fuels include propane, gasoline, and diesel. Propane is used at Mount Frontenac Golf and some residences on Prairie Island. The gasoline and diesel fuel consumption of both vehicle fleets used by the TIRC and Tribal Government are also included in the energy baseline.

3.1.1 2019 Base Year

The calendar year 2019, representing the last year not affected by restrictions due to the COVID-19 pandemic, was selected as the base year of the Net Zero Project. The base year consumption includes purchased utilities and fuels used by buildings and vehicle fleets of the Tribal government and TIRC.

3.1.1.1 Buildings and Purchased Utilities

Respective consumption is further delineated by major user groups: Casino-Hotel Resort, Tribal/Public Buildings, Residential, and Mount Frontenac Golf.

Figure 12 – Major Energy User Groups

Casino-Hotel Resort	Tribal/Public Buildings	Mount Frontenac Golf
Casinos 1 through 8	Community Center/Clinic	Clubhouse
Casino Offices	Elder Center	Main Maintenance Buildings
Event Center	Public Service	Remote Course Maintenance
Family Fun Center	Administration	
Water Park	Buffalo Exhibit	
Concert Venue	Softball Fields	
Marina	Pow Wow Grounds	
RV Park	Water and Wastewater	
Warehouse and Maintenance	Dakota Station and Car Wash	
	Tinta Wita Tipi (at Oyate Place)	

The residential user group is located on the Prairie Island Reservation in three general areas:

- Lower Island in proximity to the TIRC and Tribal Government buildings;
- Mato Circle; and
- Dakota Circle.

Mato Circle and Dakota Circle are located generally northwest of the Lower Island residences along County 18 (Prairie Island Boulevard).

Utility and energy consumption of TIRC, Tribal/Public Buildings and Mount Frontenac Golf is based on utility billing data. Residential consumption is based on average consumption patterns for Minnesota households. The average is applied to number of residences on Lower Island (46 residences), Mato Circle (26 residences) and Dakota Circle (24 residences) to yield an annual total estimate of residential utility consumption: electric, natural gas and propane. The propane estimate for residential consumption is based on a count of propane tanks in the respective residential areas: Lower Island, 19; Mato Circle, 3; and Dakota Circle, 8.

Figure 13 presents a summary of energy and purchased utilities in support of building operations, specifically electricity, natural gas, and propane. TIRC accounts for nearly 88% of base year electric consumption and 89% of base year natural gas consumption. Approximately 10% of base year electric consumption and 6% of natural gas consumption are by Tribal/Public Buildings.

Figure 13 – Base Year Utility Consumption by User Group

User Group	Electricity kWh	Natural Gas Therms	Propane Gallons
Casino-Hotel Resort	28,503,129	1,175,144	
Tribal/Public Buildings	3,186,341	80,881	
Residential	712,848	62,800	31,368
Mount Frontenac Golf	108,440		3,360
Total	**32,510,758**	**1,318,825**	**34,728**

Figures 14 through 16 illustrate the annual consumption patterns of the respective user groups for electricity, natural gas, and propane.

Figure 14 – Annual Consumption Patterns – Electricity

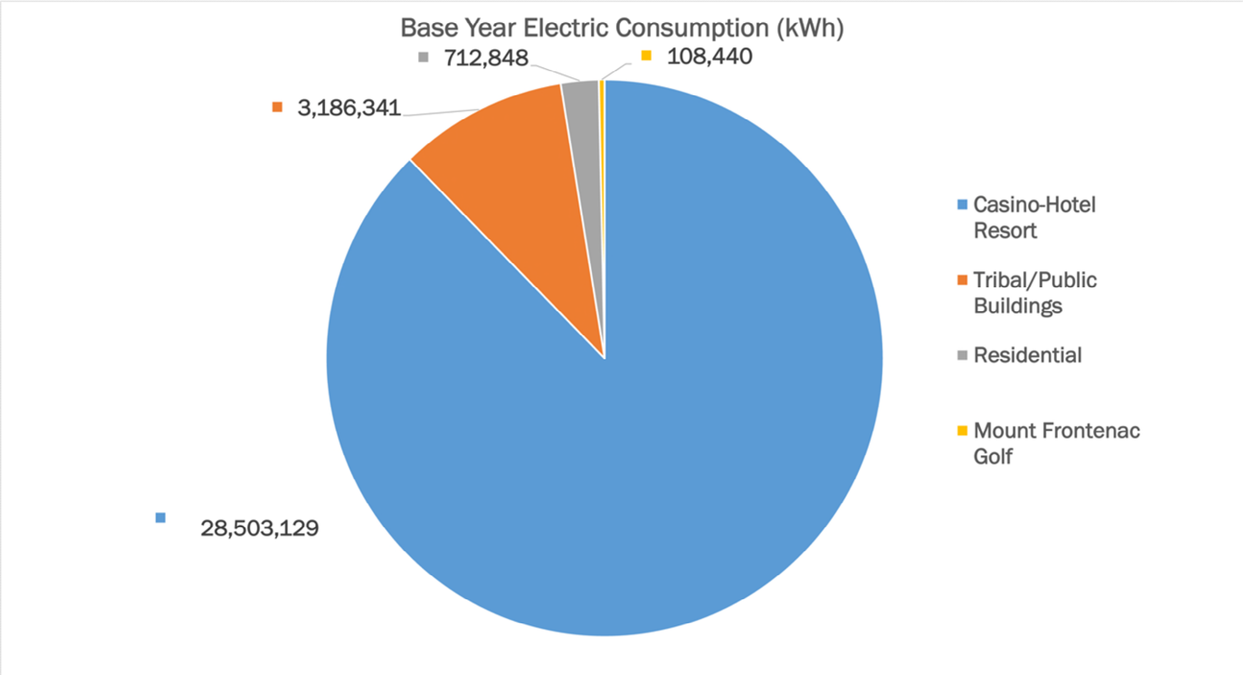


Figure 15 – Annual Consumption Patterns – Natural Gas

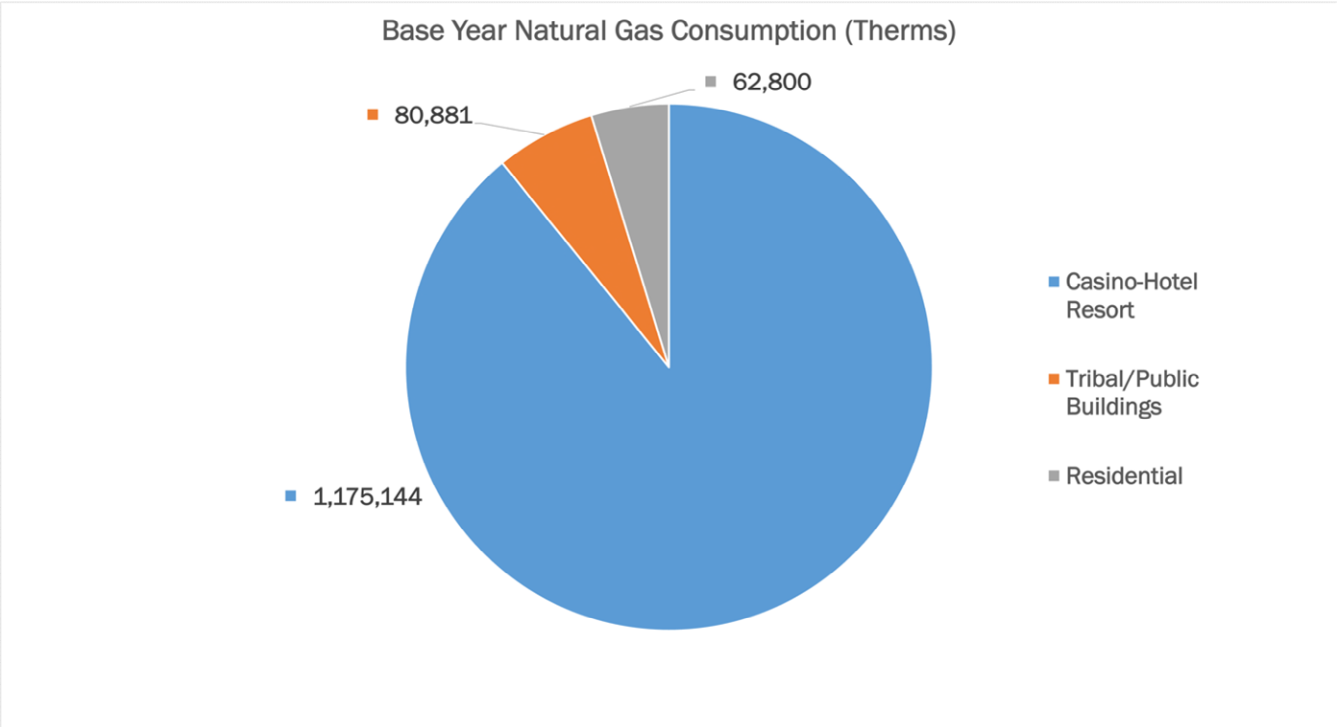
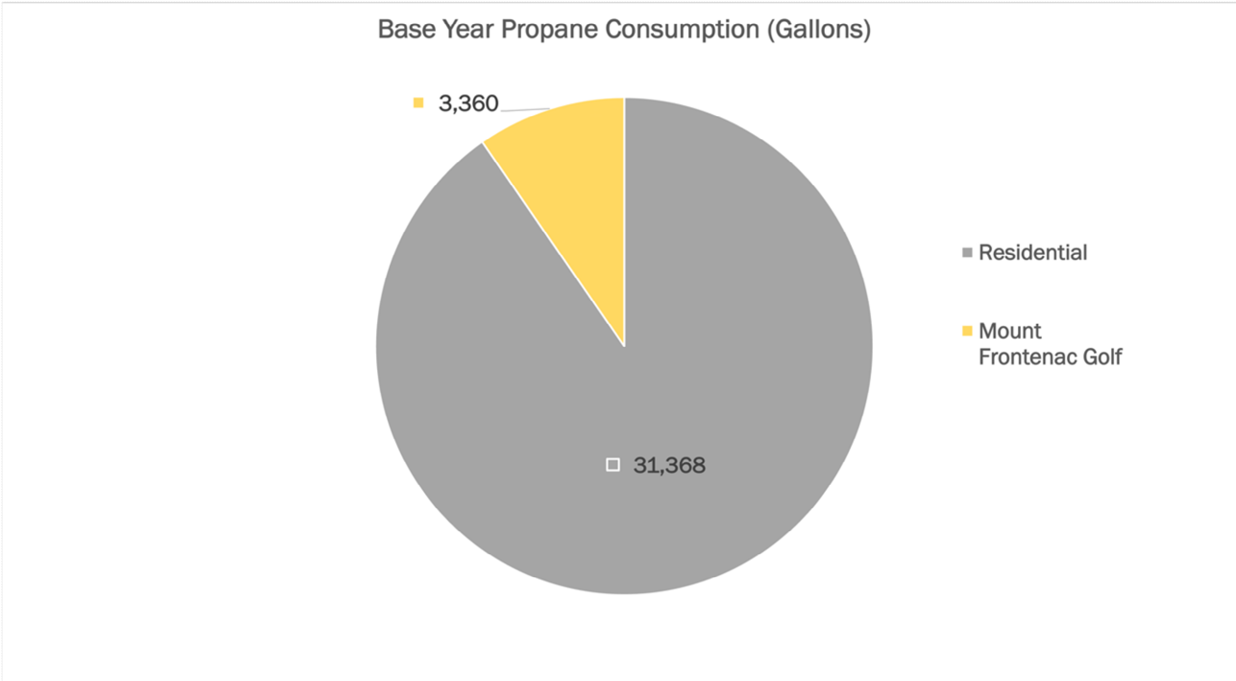


Figure 16 – Annual Consumption Patterns – Propane



3.1.1.2 Fleet Vehicles

Total Base Year (2019) fuel consumption of the vehicle fleets is 52,296 gallons of gasoline and 9,446 gallons of diesel. Figure 17 provides a breakdown of fuel consumption by application (street and non-road) and primary user (TIRC and Tribal Government). Virtually all diesel fuel is consumed by non-road vehicles.

The vehicle fleet of TIRC accounts for approximately 66% of base year vehicle fuel consumption, gasoline, and diesel fuel. The TIRC fleet consists of 28 street vehicles (sport utility vehicles, pick-up trucks, dump trucks, vans, and shuttle buses) plus non-road vehicles (golf carts, skid loader, payloader, lawnmowers, street sweeper, and Spirit of the Water yacht). The remaining fuel, approximately 33% of gasoline and diesel fuel, is consumed by the Tribal Government fleet. The Tribal Government vehicle fleet consists of 37 street vehicles (cars, police vehicles, vans, sport utility vehicles, pick-up trucks, fire truck and shuttle bus) plus non-road vehicles (tractor, skid loaders, all-terrain vehicles, mowers, and boats).

Figure 17 – Base Year Fuel Consumption by Vehicle Fleet

	Gasoline	Diesel	TOTAL
	in gallons		
TIRC			
Street	29,525.8	203.9	29,729.7
Non-Road	2,061.4	9,170.9	11,232.3
Sub-Total	31,587.2	9,374.8	40,962.0
Tribal Government			
Street	17,365.8	71.7	17,437.50
Non-Road	3,343.7		3,343.70
Sub-Total	20,709.5	71.7	20,781.20
Total	**52,296.7**	**9,446.5**	**61,743.2**

The maintenance department is the dominant user of the gasoline and diesel fuel consumed by the TIRC vehicle representing 40% of the total fuel used. Other major fuel users include transportation, marina, valet, and security representing 23%, 15%, 12% and 9% of fuel consumed by TIRC annually.

The Tribal Government vehicle fleet shows a similar pattern with consumption dominated by four departments:

- Police 42.9%
- Roads & Parks 16.9%
- Buffalo Exhibit 10.9%
- Family Services 8.7%

Figures 18 and 19 provide a general comparison of consumption for the fleet of both the PIIC Tribal Government as well as the Treasure Island Resort & Casino.

Figure 18 – General Comparison of PIIC Tribal Government Vehicle Fleet Fuel Consumption

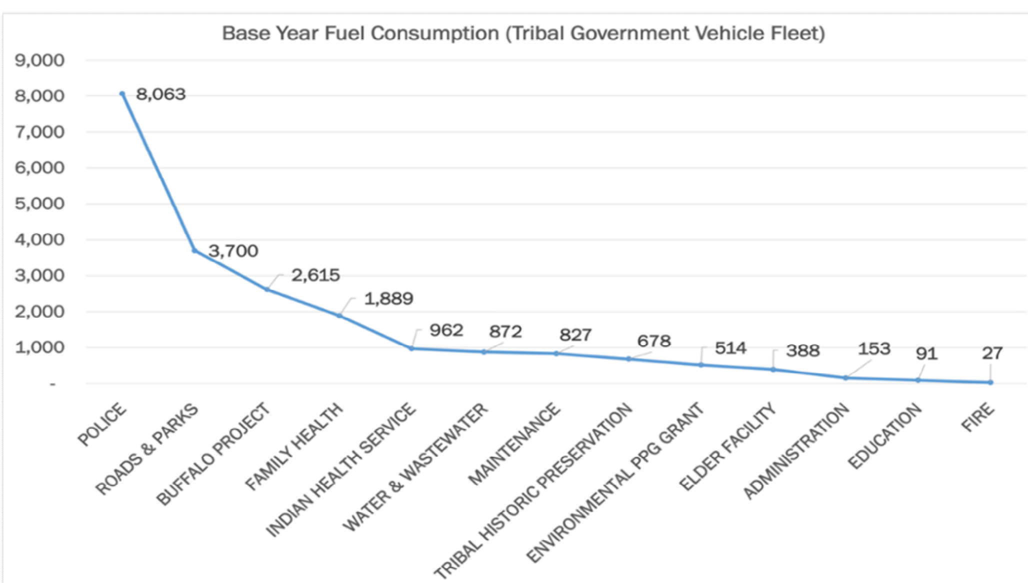
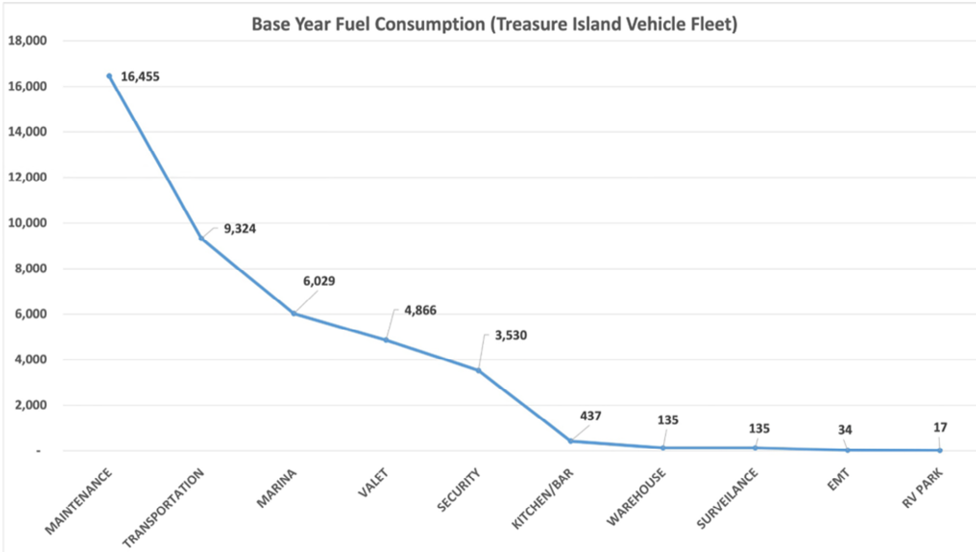


Figure 19 – General Comparison of Treasure Island Vehicle Fleet Fuel Consumption

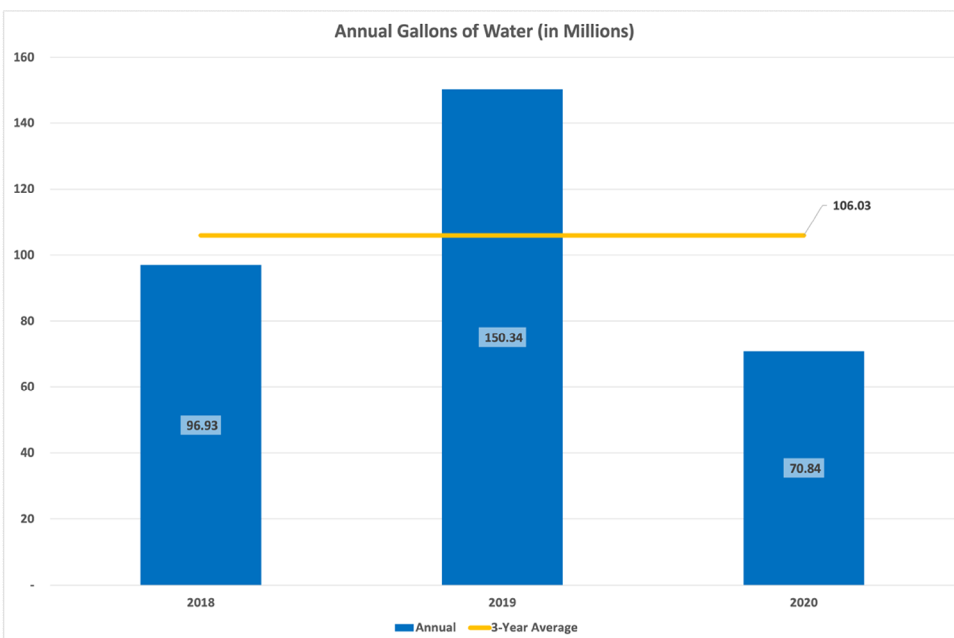


3.1.1.3 Water

Water is complementary to energy and associated emissions. Conservation and management of water consumption preserves a resource but also has implications for CO_2 emissions. Energy, primarily electricity, is required for production, treatment, and delivery of water to the end-user for consumption. Additional energy (electricity, natural gas or propane) is consumed to produce domestic hot water and to heat water (natural gas) used in heating systems within buildings. Subsequently, energy is required for wastewater treatment.

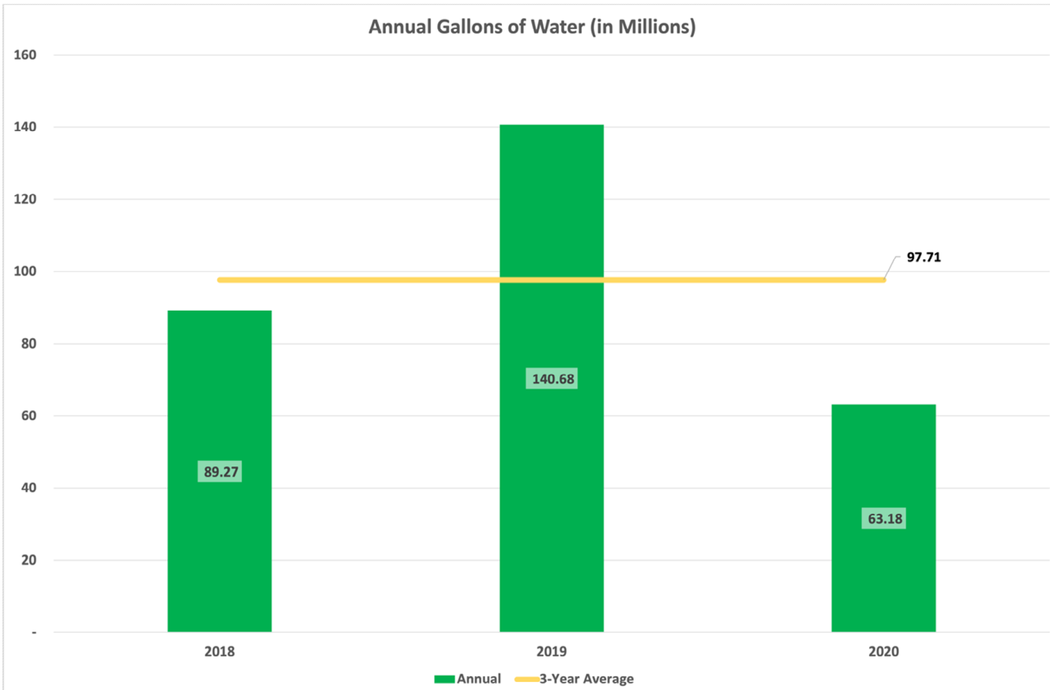
The water plant has produced an annual average of 106.03 million gallons over the period of calendar year 2018 through 2020. See Figure 20.

Figure 20 – Prairie Island Water Production



The TIRC consumed approximately 92% of water production, or 97.71 million gallons, as shown in Figure 21. The remaining 8% is presumed to be system losses and consumption by lower island residences. Residences at Mato Circle and Dakota Circle have private wells and are not served by the PIIC water plant.

Figure 21 – TIRC Water Consumption



3.1.2 Base Year Consumption and Emissions Benchmark

For the purpose of this initial analysis, net zero is measured in the context of CO_2 emissions. Factors for CO_2 emissions are presented in Figure 22. The factors shown for fuels in Figure 22 are default CO_2 emission values issued by the EPA. The factors for electric service were provided by the incumbent electric utilities: DEA and Xcel.

Figure 22 – CO_2 Emissions Factors

Type of Fuel	CO_2 Emissions Factor
Natural Gas LBS CO_2/Therm	11.71
Propane LBS CO_2/gallon	12.38
Gasoline LBS CO_2/gallon	19.42
Diesel LBS CO_2/gallon	22.58
Electric Service LB CO_2/MWh	
Dakota Electric Association	91.26
Xcel Energy	576

These factors are applied to the corresponding consumption of natural gas, propane, gasoline, diesel, and electric service to yield Base Year (2019) emissions benchmark of CO_2. These factors are also subsequently applied to changes in consumption associated with Net Zero measures for a quantifiable change in CO_2 emissions relative to the base year emissions benchmark.

3.1.2.1 Buildings and Purchased Utilities

Figure 23 shows the Base Year (2019) CO_2 emissions benchmark associated with the energy consumption of the PIIC buildings. Total CO_2 emissions are approximately 64.82 million pounds when considered on the basis of fuel and electric service. Electricity is the predominant component of CO_2 emissions, about 75%, followed by natural gas and propane: 24% and 1%, respectively.

Figure 23 – Base Year (2019) CO_2 Emissions Benchmark by User Group and Utility

User Group	Electricity	Natural Gas	Propane	TOTAL
Casino-Hotel Resort	42,982,718	13,760,936		54,743,654
Tribal/Public Buildings	4,805,002	947,117		5,752,119
Residential	1,074,974	735,388	388,336	2,198,698
Mount Frontenac Golf	84,583		41,599	126,182
Total	**48,947,277**	**15,443,441**	**429,935**	**64,820,653**

Figure 24 also shows the Target Year (2023) CO_2 emissions benchmark associated with the energy consumption of the PIIC buildings. Total CO_2 emissions are approximately 18.89 million pounds when considered on the basis of fuel and electric service, natural gas is the predominant component of CO_2 emissions, about 81.7%, followed by electricity and propane: 16% and 2.3%, respectively.

The difference between Base Year (2019) and Target Year (2023) electricity emissions is due to the aggressive carbon reduction procurement and/or generation strategies of the PIIC's serving electric utilities, which are reducing their portfolio's CO_2 emissions by 94%.

Target Year (2023) emissions benchmark attributable to the user groups follow the same general pattern as consumption, since CO_2 emissions is the simple product of consumption multiplied by a constant for the fuel or utility service. The Casino-Hotel Resort contributes about 86.6% of total CO_2 emissions.

Similarly, Tribal/Public buildings account for 6.6% of total CO_2 benchmark emissions. The Residential user group and Mount Frontenac Golf represent 6.3% and 0.6% of CO_2 benchmark emissions, respectively.

Figure 24 – Target Year (2023) CO_2 Emissions Benchmark by User Group and Utility

User Group	Electricity	Natural Gas	Propane	TOTAL
Casino-Hotel Resort	2,601,196	13,760,936		16,362,132
Tribal/Public Buildings	290,786	947,117		1,237,903
Residential	65,055	735,388	388,336	1,188,779
Mount Frontenac Golf	62,461		41,599	104,060
Total	**3,019,498**	**15,443,441**	**429,935**	**18,892,874**

For the purposes of this report, the Target Year (2023) CO_2 emissions benchmark by user group and utility total (18,892,874 lbs) is utilized moving forward as a key metric for the Net Zero Project emission reduction strategies highlighted in Sections 4 and 5.

3.1.2.2 Fleet Vehicles

Total Base Year (2019) CO_2 benchmark emissions attributable to the operation of fleet vehicles are about 1.2 million pounds. The tabulated emissions, shown in Figure 25, are the product of reported consumption by the fleet vehicles and the respective emission factor for gasoline and diesel provided by the EPA.

Figure 25 – Base Year (2019) CO_2 Emissions by Vehicle Fleet

	Gasoline	Diesel	TOTAL
	(Lbs. of CO_2)		
TIRC			
Street	573,519	4,605	578,124
Non-Road	40,041	207,102	247,143
Sub-Total	613,560	211,707	825,267
Tribal Government			
Street	337,319	1,619	338,938
Non-Road	64,949		64,949
Sub-Total	402,268	1,619	403,887
Total	**1,015,828**	**213,326**	**1,229,154**

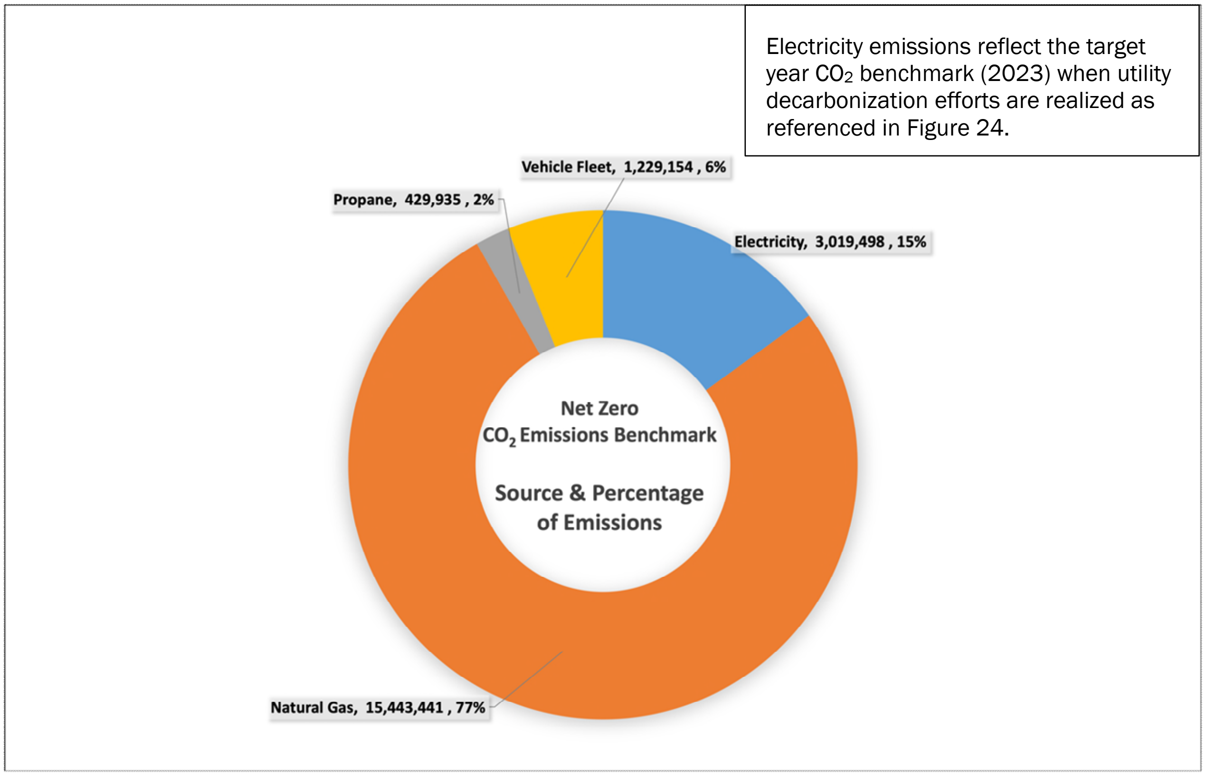
3.1.2.3 Net Zero Emissions Benchmark

Total Net Zero CO_2 emissions inclusive of electricity, natural gas, and propane to support residences and buildings, and gasoline and diesel used by vehicle fleets are 20,122,028 lbs (18,892,874 lbs buildings emissions + 1,229,154 lbs vehicle fleet emissions). See Figure 26.

- Electricity 3,019,498 lbs
- Natural Gas 15,443,441 lbs
- Propane 429,935 lbs
- Vehicle Fleet 1,229,154 lbs

As stated previously, electricity emissions (3,019,498 lbs) reflect the Target Year (2023) when the aggressive utility decarbonization efforts are realized.

Figure 26 – Total Net Zero CO_2 Emissions Benchmark



3.2 ENERGY ASSESSMENTS

The baseline energy profiles, and consumption data provide the foundation for evaluating potential energy management and emission reduction measures. This energy assessment process also included a review of the condition and operation of energy-intensive equipment found in heating and cooling systems, domestic hot water systems, laundry equipment, lighting and building controls.

The Casino-Hotel Resort was a primary focus of the assessment process, reflecting its predominant contribution to the Net Zero emissions benchmark. Other buildings included in the assessment process are:

- Community Center/Clinic
- Prairie Island Administration
- Dakota Station
- Elder Center
- Mount Frontenac Clubhouse
- Public Safety Building
- Residences
- Tinta Wita Tipi Senior Living Facility

Note that some facilities such as Tinta Wita Tipi and private residences were not accessible given health considerations during COVID-19. In these instances, the assessment process was a desk review of potential measures based on consumption data and energy performance standards for type, function, and location of buildings.

4.0 NET ZERO TARGET – INVESTIGATED MEASURES

4.1 ALIGNMENT WITH COMMUNITY AND STAKEHOLDER ENGAGEMENT

The Net Zero Team identified 46 measures for incorporation into the Net Zero Project. The measures are grouped within the three topical areas: energy efficiency, electrification, and renewable generation. Based on the results of community outreach conducted throughout the initial months of the Project, these measures are consistent with the ideals and culture of the PIIC as it relates to energy conservation and use.

4.2 ENERGY EFFICIENCY

Energy efficiency has a twofold effect for the Net Zero Target. Energy efficiency measures reduce Community consumption and provide a direct corresponding reduction of CO_2 emissions. Correspondingly, this reduction of energy use translates to a potential reduction in required local renewable generation and/or electrification measures and equipment. Thus, by deploying energy savings strategies first, the capital required for development of renewable generation assets is reduced. For simplicity in reporting, energy efficiency measures have been aggregated and organized by three major user groups:

1. Casino-Hotel Resort
2. Tribal Buildings
3. Residences

4.2.1 Casino-Hotel Resort

4.2.1.1 Kitchen Hood Controls

Kitchen makeup-air units (MAU) support fresh air ventilation by providing conditioned, constant volume air in the kitchen areas to make up for the air lost due to exhaust fans. The exhaust fans also provide a constant volume exhaust of air from the kitchens to maintain required ventilation. The site has a total of six MAUs located on the casino roof with the following assumptions on fan motor horsepower (HP) size:

- MAU-1: 5 HP
- MAU-2: 7.5 HP
- MAU-3: 5 HP
- MAU-4, MAU-5, & MAU-6: 3 HP each

The site also has a total of 24 kitchen exhaust hoods located on the casino roof serving different dining areas within the building. The MAUs and exhaust fans have a CAV (Constant Air Volume) fan, which supplies conditioned air to the space in fixed quantity, regardless of the air or cooling demand of the space. Also, the cooling demand of the space fluctuates due to the external heat gain (i.e., solar heat gain and conduction from surrounding walls) which vary throughout the day. The CAV fan operates at a constant speed to provide static air pressure to the system. The CAV fan is typically chosen as a design requirement to deliver static pressure for the air ventilation rate(s) in the room and cooling on the hottest day. Fan speed and associated energy consumption can be reduced because the ventilation rate depends on the occupancy or cooking schedule, and because the cooling demand will be lower relative to the hottest day for the remainder of the year, there is an opportunity to reduce the fan speed to further save energy.

The recommendation is to optimize the operating hours of exhaust fans serving kitchen hood based on operations and planned occupancy in the room. The type of cooking operations can be identified using flow proving switches on the gas supply, occupancy sensors, space temperature sensors, and smoke/CO_2 sensors. This will reduce fan running hours and increase energy savings as a result. Correspondingly, this extends to all MAUs serving the same space since reducing exhaust will allow a reduction in required make-up air introduced into the space.

The Net Zero Team also recommends retrofitting the CAV fans in both the Kitchen MAUs and exhaust fans inside the kitchen hoods with sensors and variable frequency drives (VFDs). The sensors will modulate fan speed according to cooking activity and occupancy to achieve both space temperature set point and proper volumes of outside air ventilation. With this change, the MAUs and exhaust fans will run at 100% speed when extensive cooking is taking place and at reduced capacity with medium cooking activity. Since fan energy use is proportional to how much pressure a fan creates to maintain flow, energy savings is realized when the fan's set point is lowered as a result of reduced need.

Better control of the kitchen hoods, as recommended, will decrease electric consumption by approximately 48,000 kWh annually. Key factors and assumptions driving energy savings are:

- Load factor of all units supply fan motor was assumed to be 80% and efficiency at 80% for baseline condition. Efficiency was assumed at 85% after addition of VFDs to the existing motors. An addition of VFDs would improve motor performance, and thereby increase efficiency.
- Each individual exhaust fan motor HP was assumed to be 1 HP.
- Baseline (current) condition: units are operating an average of 15 hours daily and on all 365 days at full (or 100%) fan motor speed.
- EE measure condition: units are operating an average of 10 hours daily and on all 365 days at variable fan motor speed, which depends on type of cooking activity being performed.

This measure will result in an estimated savings of $3,517 annually. The capital cost of this measure is estimated at $20,000.

4.2.1.2 Monitoring-Based Commissioning or Equivalent

The site audit presented various energy conservation opportunities to improve the existing equipment performance and help the site conserve and save energy. Monitoring-based commissioning (MBCx) is the integration of three components: permanent energy monitoring systems, real-time energy analysis, and ongoing commissioning. Since, MBCx is an ongoing performance analysis of an operational building that provides real-time equipment performance information to the building operators, it will allow the site to track its energy consumption, detect faulty equipment operations, and identify unusual energy or power consumption patterns as they occur.

An MBCx platform automatically analyzes data from automation systems, metering systems and other smart devices to identify issues, patterns, deviations, faults and opportunities for operational improvements and cost reduction. MBCx will help operators find important information in the data produced by their equipment systems, discovering the invisible issues, quantify the opportunities and form a management feedback loop. Many common issues such as negative pressurization, incorrect sensor readings, valves not stroking properly can be identified through MBCx. Implementation of occupancy schedules and controls improvement can also be done through MBCx.

MBCx could be extended to the other facilities to provide additional insights. Through discussions with the facilities Net Zero Teams, it has been identified that a controls upgrade is planned for various facilities outside of TIRC. By incorporating adjacent facilities into an MBCx platform, the selected vendor could provide additional insights to optimize energy spend and to ensure the controls systems continue to operate as intended during the warranty period and beyond. MBCx could also be utilized to provide a community facing dashboard to allow members of the public to see real time energy savings to track the success of the Net Zero Project if desired.

MBCx is expected to reduce electric consumption by approximately 1,248,000 kWh with a corresponding reduction in operating expense of $90,000 annually. MBCx is a subscription-based service carrying an estimated annual fee of $28,320 on a 60-month contract.

4.2.1.3 Lighting

The Net Zero Team recommends replacing all linear fluorescent lamps with high-efficiency linear LED tube lamps and replacing CFL lamps with LED screw-in lamps. These lamps offer longer life and better color rendering and will result in an approximate 60% reduction in average fixture wattage. This reduction in wattage will save approximately 1.36 million kWh saved annually and reduce operating expense of the Casino-Hotel Resort by $131,000. The estimated cost of these lighting improvements is approximately $325,000, yielding a simple payback of less than 2.5 years.

4.2.1.4 Lighting Controls

In addition to the LED lamp conversion recommended above, the Net Zero Team also recommends installing occupancy sensors and in all common area spaces and hallways of the Casino-Hotel Resort. The sensors and controls should be configured based on type of space, area (square feet), number of fixtures and required minimum light levels. This type of control will allow LEDs to reduce their output by 25-50% on average, with low-traffic spaces able to shut-off entirely.

The Net Zero Team estimates the approximate annual energy savings achieved by lighting controls to be approximately 226,000 kWh and with an associated expense savings of $21,700. The estimated cost of the lighting controls is approximately $178,000.

4.2.1.5 Exterior Lighting

The Net Zero Team recommends replacing all parking lot and street lighting fixtures with high-efficiency LED pole-mounted fixtures. These LED fixtures can provide much higher brightness levels and cutoff designs for reduced environmental impact, while operating at 50% less wattage. A full lighting design survey should be performed using light level analysis software. This tool will provide the correct cutoff requirements and lighting levels needed to efficiently light the intended areas.

The Net Zero Team expects the exterior lighting measures to save approximately 51,000 kWh and nearly $5,000 in annual electric expense. The estimated cost of the exterior lighting measure is $47,000.

4.2.1.6 Ventilation Energy Recovery

The requirement to ventilate and exhaust air from occupied spaces imparts an energy load on the HVAC systems serving the TIRC complex. This demand can be significant given the extremes of the local climate. The casino has currently installed three (3) rooftop Energy Recovery Units (ERU) that provide ventilation and exhaust air service to the Bingo Hall, Casino Floor #1 and Casino Floor #2. The Units handle approximately 54,000 cfm of air and include Energy Recovery Wheels (ERW) to transfer heat from the warm exhaust air to the cold ventilation air during the winter season. This process is reversed during the summer season, where heat is transferred from hot ventilation air to the cool exhaust air. The process in the hotel rooms is much simpler. Fans exhaust approximately 41,800 cfm of air from occupied spaces and specialized air handling units to heat or cool the make-up ventilation air. In these systems, no heat is recovered and therefore, there is no transfer of air between the ventilation and exhaust air streams.

Ventilation energy recovery is often the first strategy implemented in mechanical systems when energy and emissions are of concern. The equipment is commonly 50% to 65% effective in recovering and transferring air between air streams. This is a direct reduction in the energy required to heat and cool ventilation air. This equipment also has the secondary benefit, when the ventilation system is sufficiently distributed throughout the facility, the resulting outcome is a reduced overall size of the central heating and cooling plant.

The proposed solution takes advantage of ventilation energy recovery in two key areas of the facility. First, the three (3) existing rooftop ERUs serving the Bingo and Casino areas are refurbished for improved performance. The wheel media used to transfer energy between air streams is replaced with new media with low odor carryover properties. All bearings, belts and drive motors are replaced, and the equipment's controls are updated and integrated into the Building Automation System (BAS). Second, new ERUs are installed on all three hotel towers to recovery heat from hotel room bathroom exhaust air. The existing exhaust fans are removed, and new rooftop ductwork is routed to the ERUs. The pre-heated air from the ERUs is then ducted to the existing hotel make-up air handling units. Modern controls are provided for these systems and are integrated into the BAS.

The estimated cost of these measures is $787,000. These measures are expected to reduced annual operating expense by approximately $95,000.

4.2.1.7 Water Measures

Measures for reducing water consumption will provide associated savings in reduced energy consumption for production of domestic hot water and reduced electric consumption for delivery of water to point of use. Water-energy measures identified for the Casino-Hotel Resort include low flow showerheads, faucet aerators, pre-rinse spray valves, and EnergyStar ice machines. The aggregate effect of these measures is the reduction of natural gas and electric consumption by 44,800 therms, and 12,800 kWh, respectively; and 8.3 million gallons of water consumption. The estimated capital cost of these water measures is $59,000.

4.2.2 Tribal Buildings

4.2.2.1 Lighting

Lighting in Tribal and community public buildings was assumed to comply with ASHRAE 90.1 standards of Lighting Power Density. Considering the size and function of the respective buildings (office, clinic, sports, etc.) the lighting power density varies from 0.9 watts/sq ft to 1.2 watts/sq ft. The Net Zero Team assumed that approximately 10% of fixtures and lamps had already been converted to LED during routine burnout maintenance. From this basis the Net Zero Team estimated the annual energy consumption for lighting of the various Tribal and community public buildings (Community Center/Clinic, Elder Center, Public Safety, Tinta Wita Tipi, Dakota Station, Administration and Mount Frontenac Clubhouse) at approximately 603,000 kWh. The Net Zero Team recommends replacing all linear fluorescent lamps with high-efficiency linear LED tube lamps, and CFL lamps with LED screw-in lamps, which will result in an approximate 30-40% reduction in average fixture wattage. The reduction in wattage is calculated using current ASHRAE 90.1 LPD standards. This reduction in wattage will result in nearly 35,400 kWh saved or $3,400 in annual operating expenses. Overall, the Tribal and community building lighting retrofits will result in a 4.4-year measure payback with an estimated cost of $15,000.

4.2.2.2 Water Plant

Potable water is used for irrigation of TIRC grounds and the ballfields. The water is pumped from aquifers and treated to potable standards at the water treatment plant.

A recommended water saving measure is to use treated water from the wastewater treatment plant as a source for irrigation. Use of treated wastewater has multiple benefits including reduced freshwater use, reduced freshwater pumping and treatment costs, reduced energy use, and reduced treated wastewater discharges into the Mississippi River. This measure may save approximately 58,000 kWh and 38 million gallons of potable water each year. The Net Zero Project will entail installing new piping and reconfiguring the wastewater treatment plant water distribution system to convey treated wastewater to irrigation locations. The estimated cost of this measure is $350,000.

4.2.3 Residential

4.2.3.1 Energy Report and Monitoring

A key element of the Net Zero Project is encouraging changes in behavior at both the Tribal and individual member level in a manner that reduces and sustains lower carbon emissions. The Net Zero Team recommends implementation of a Home Energy Report (HER) program. Such programs provide utility customers with reports that compare their usage against others as a means to track individual consumption patterns but also to allow identification of additional opportunities to reduce energy use.

A HER program simply reporting Tribal members energy consumption is not likely to be practical, but one that includes decarbonization messaging with custom usage information and various energy savings tips may be possible. This type of program could have an implementation cost $100,000 but has the potential of reducing CO_2 emissions by 22,000 lbs. of CO_2 directly and could be used to encourage adoption of other energy savings and/or carbon reducing technologies for additional future savings.

4.2.3.2 Water Measures

Reducing water consumption often results in a corresponding reduction of energy consumption. Faucet aerators for kitchen and bathrooms and low flow showerheads are low-cost measures to reduce water consumption. Each residence is expected to reduce energy expense by about $50 per year saving over 17,000 gallons of water over the 10-year life of the measures.

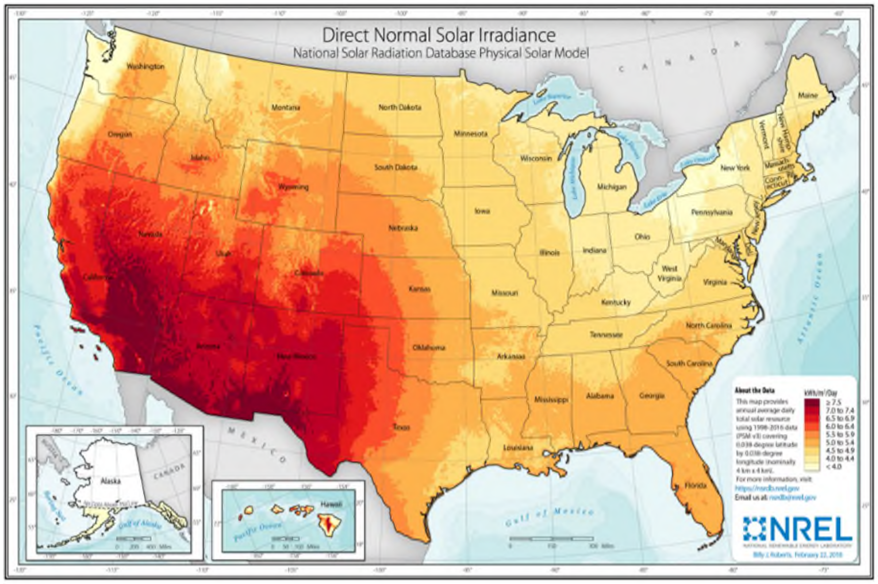
The total cost of the Net Zero Project is estimated to be $11,000.

4.3 RENEWABLE GENERATION

The Net Zero Team evaluated potential generation from various renewable technologies, considering known Tribal cultural and historical sites, resource availability, environmental, land-use, and electrical distribution system constraints. By reviewing the renewable technologies based off historical data in the region, the Net Zero Team was able to filter out non-cost-effective technologies and focus on only the most beneficial renewable Net Zero Projects. A summary of the resource assessment is included below.

4.3.1 Solar

Figure 27 – NREL Solar Irradiance Map



The amount of solar energy produced in a specific geographical area depends on the average daily solar irradiance. Solar irradiance is defined as the power per unit area (typically in Watts per square meter) received from the sun. More generally, it is a factor of how much solar energy is received over a pre-defined area. PV Net Zero Projects that receive a higher amount of annual irradiance produce a higher amount of energy.

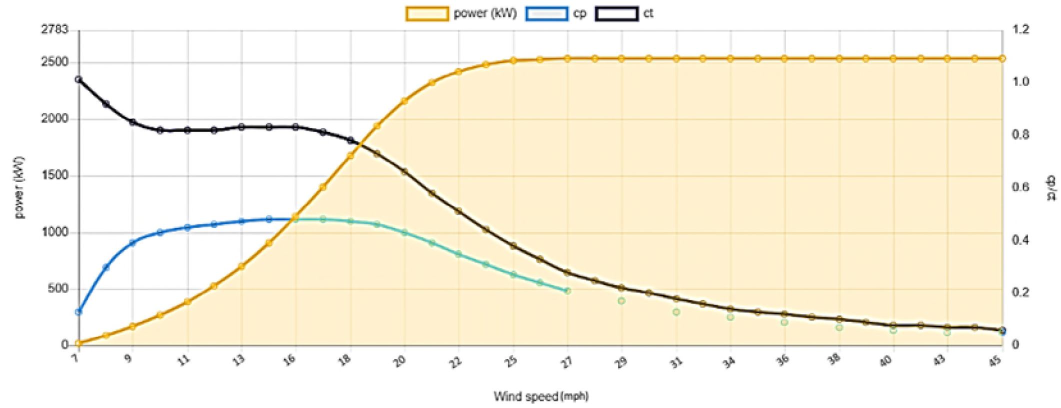
The PIIC Reservation receives a moderate solar irradiance. According to NREL's geospatial data map (Figure 27), the average daily irradiation averages between 0.371612 kWh/sq ft and .408773 kWh/sq ft. Additional validation for these daily irradiation levels comes from the NREL Solar Prospector website which calculates a daily average solar irradiance value of 0.396696 kWh/sq ft. In terms of energy, these figures indicate that every day for every square foot between .37 and .41 kWh of energy in the form of sunlight hits the earth.

While solar arrays in Minnesota do not produce as much electricity as in the Southwestern United States, total irradiance is only one consideration. There are additional constraints and factors involved including state incentives, utility regulations, and interconnection requirements that also contribute to the effectiveness of solar power. These factors are further discussed in the interconnection discussion.

4.3.2 On-Shore Wind

Wind power production is directly related to the average wind speed at the location of installation. Standard wind turbines typically reach nameplate power production at a wind speed of 22 mph to 27 mph. Because power production scales exponentially with wind speed, higher wind speeds produce power orders of magnitude greater than that produced at lower wind speed (see Figure 28).

Figure 28 – General Electric (GE) 2.5MW, 328' Wind Turbine Power Profile Curve



Determining this average annual wind speed is essential when creating the annual production system model. Without accurate wind speed data, it is impossible to accurately forecast the yearly production. For this reason, it is common for utility-scale wind Net Zero Projects to collect one to three years' worth of hourly wind speed data at the site location. This is achieved by installing a meteorological "met" station on a pole at the rotor height of the proposed wind turbine. The met station will record wind speeds throughout the day and upload this information to a server for use in modelling wind production.

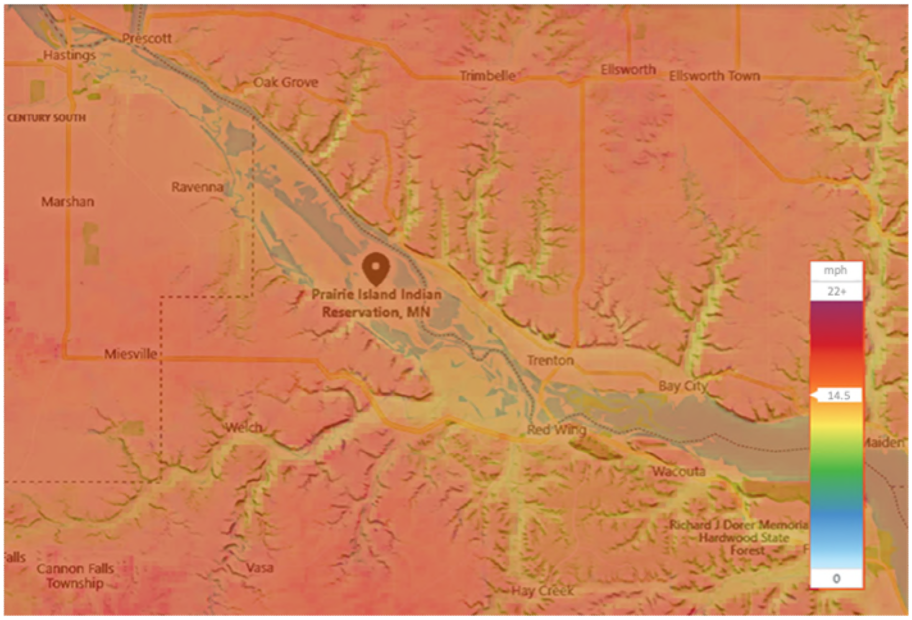
Absent this level of analysis and data collection, alternative methods exist to collect hourly wind speed data. The Net Zero Team utilized a variety of sources in determining the average wind speed at both ground level and a typical 328 ft. rotor height. The following section describes the methods for wind data collection.

4.3.2.1 Global Wind Atlas

The Global Wind Atlas is an online mapping tool developed by the World Bank in conjunction with the Department of Wind Energy at the Technical University of Denmark. It was created to help policymakers and investors identify potential high-wind areas for wind power generation anywhere in the world. The Net Zero Team chose the Global Wind Atlas as a data source based on its validation by real-world measurements, other wind atlases, and mathematical calculations.

Based on the Global Wind Atlas model, the average wind speed for the 10% windiest areas has been calculated at 16.8 mph at a rotor height of 328 ft.

Figure 29 – Average Wind Speed Map of the PIIC and Surrounding Area (Global Wind Atlas)

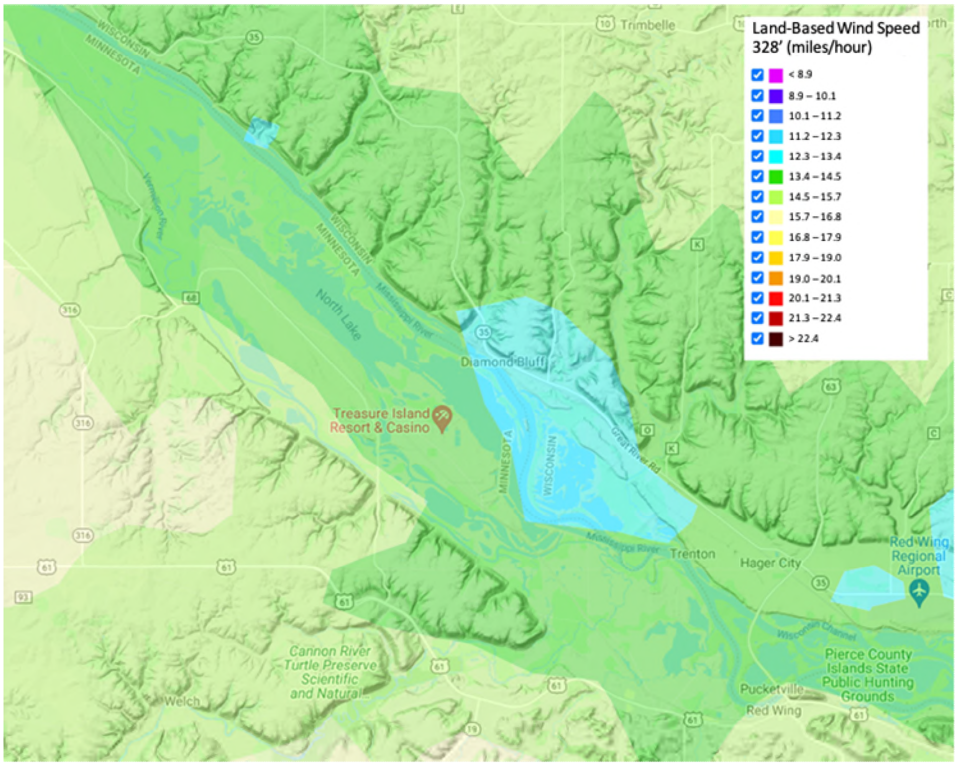


4.3.2.2 NREL Wind Prospector

The NREL Wind Prospector is an online mapping application built on the OpenCarto. The NREL Wind Prospector is known as one the industry benchmarks for preliminary wind speed analysis.

Wind Prospector offers a variety of data outputs depending upon the conditions chosen by the user. The most pertinent data for the purpose of modelling wind production are the wind speeds at a variety of heights and the wind class of the island. The Wind Prospector data indicates that the average wind speed on the island varies between 13.4 to 15.6 miles per hour at a height of 328 feet. At this wind speed, standard wind turbines output power at a 35% to 50% of their nameplate capacity. This lack of wind speed, plus the lack of local utility incentives, suggests that wind power is not cost-effective for the PIIC. Tribal Members also raised concerns about conventional wind turbines and the potential risk of killing eagles which are plentiful in this segment of the Mississippi River.

Figure 30 – Average Wind Speed Map of the PIIC and Surrounding Area (NREL Wind Prospector)



4.3.3 Hydroelectric Power

The proximity to several bodies of water and river systems makes the PIIC an interesting location for possible hydroelectric power production. When exploring the viability of this type of renewable generation, several different methodologies were considered. Storage systems, using dams and reservoirs, could be dismissed immediately because of intense capital cost and environmental impact. Low-head, run-of-the-river generation systems where little to no storage would be required, were looked at more closely. Ultimately these were determined to be less viable when compared to other renewable resources such as solar for the following reasons:

- Extremely low head pressures - The elevation change between any two points on the river within the PIIC is low and presents a significant challenge in siting inlets and turbines that establish enough pressure to generate energy in significant amounts.
- Regulatory and permitting costs - While FERC has worked to make the licensing and license exemption processes more efficient for developers of small-scale hydropower systems, there are significant challenges and fees associated with hydroelectric licensing. Additionally, there are additional areas of jurisdiction that require permitting and licensing-related studies to be performed. The upfront costs associated with the licensing and/or the license exemption processes are considerable.
- Construction expense - The cost of building hydro-generation can vary greatly and is hard to estimate without extensive and expensive studies. The cost of developing a reliable estimate with sufficient detail is not justifiable considering the likely benefits, or lack of, from hydroelectric generation in this area.
- The cost of transmission - The construction of power lines to move electricity generated nearby to load centers or distribution systems on the PIIC would face significant geological challenges.

These challenges in engineering and construction are likely to add significant expense above and beyond the benefit from constructing a generation facility.

While the flow rate of the river near the PIIC is considerable, and the energy associated with it, the ability for the PIIC to harness that energy is severely limited.

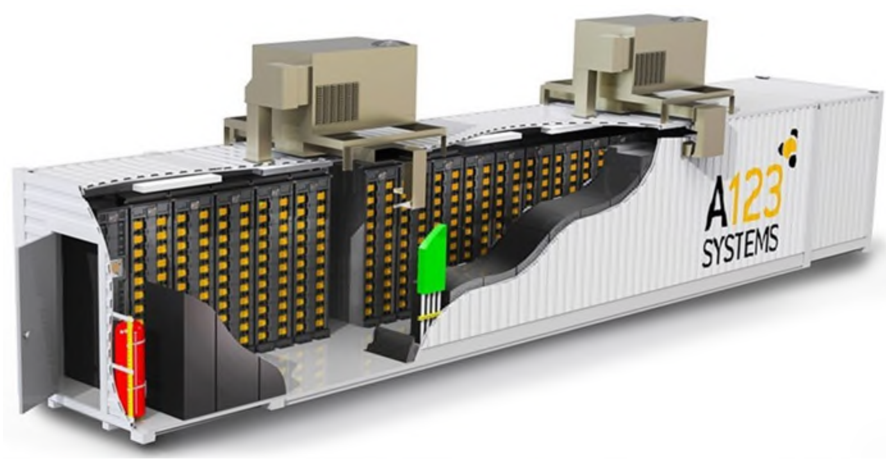
4.4 ENERGY STORAGE

The Net Zero Team evaluated energy storage as a supplemental technology used to complement renewable energy and provide backup power to the PIIC. Energy storage offers both financial and resiliency opportunities by interacting with both local generation and the larger utility grid. Many energy storage technologies are available including sodium-sulfur, lithium-ion, lead-acid (flow), flywheel, and pumped hydro. For this study, we focused on lithium-ion technology. This is due primarily to the maturity and track record of the technology and its effectiveness in renewable and backup power applications. It should be noted while lithium-ion is commonly installed in many applications, statistical data indicates lithium-Ion batteries are struggling to meet the demands of utility scale grids.

4.4.1.1 Lithium Ion (Li-ion)

Lithium-ion battery systems (shown in Figure 31) are among the most widely used grid-scale energy storage technologies deployed today. Li-ion boasts the greatest power and energy density of any close competitor in the market, and there has been a dramatic decrease in installed prices over the last ten years. This has led to Li-ion becoming the most popular and economic Battery Energy Storage System (BESS) technology installed for grid support and renewable energy production augmentation. Li-ion installations benefit from a wide selection of vendors with robust supply chains, as well as experienced contractors and service professionals to build and operate the systems. They are also a known quantity in terms of long-term performance, degradation, and full-lifecycle system benefits.

Figure 31 – A123 Systems, Inc. Lithium-ion Containerized BESS



4.4.2 Conclusion

Based on this preliminary analysis, it was found that solar energy is the most effective renewable resource for the PIIC. Solar arrays have the least engineering and construction complexity, the lowest barrier to entry for interconnection, and there is enough solar irradiance available to make the solar financially viable.

4.5 INTERCONNECTION OPTIONS

Meeting the Community's net zero goals requires involvement of both DEA and GRE. DEA and GRE are responsible for system performance and, as a result, must approve the PIIC to export renewable energy onto the grid. Additionally, both companies have technical and financial requirements that must be met in order to interconnect. DEA has presented a number of interconnection options for consideration by the PIIC. These options and programs are presented below.

4.5.1 Net Metering

Net metering is a billing mechanism that credits solar energy system owners for the electricity they add to the grid. Net metering allows a customer to offset their total electrical consumption via the total power their solar system produces. For example, if a customer consumes 100kWh of power over a 30-day timeframe, but they produce 100kWh of solar generation over the same timeframe, their energy bill is zeroed out (minus any associated fees or standby charges). Net metering lets a customer produce more solar than their facility can consume while still receiving financial credit for the overall production.

DEA has a net metering program available for solar arrays with capacity less than 40kW. This program applies on a per-service basis. DEA typically only allows one service (and therefore one net metering program) per site. However, since the TIRC has expanded over time and has multiple utility meters, there is an opportunity to utilize multiple net metering programs. A potential option would be constructing a large canopy or rooftop array and then interconnecting separate 40kW slices at different electrical service switchgear units. This method of breaking up the array would allow the PIIC to take full advantage of multiple net metering interconnections. Alternatively, smaller residential installations would also be eligible for net metering.

Since net metering allows a customer to offset their electrical bill at the same rate they pay for electricity, net metering can be a very lucrative program for the PIIC. Non-net metering programs typically require a customer to sell energy at wholesale prices, which are much lower than net metering prices. However, non-net metering programs can still be profitable depending on capital costs and other incentives. These programs would be applied to installations larger than 40kW (as net metering is only available for system sizes up to 40kW) and are described in the following sections.

4.5.2 Self-Generation

Under the self-generation interconnection option, the PIIC would design, construct, own, and operate local renewable generation with energy storage. Renewable Net Zero Projects such as rooftop, canopy, or ground-mount solar would generate electricity that would be immediately consumed. As an example, if the TIRC were to draw 1MW of power during the day and a solar array produced 600kW, the TIRC would draw 600kW from the solar array and 400kW from the utility (DEA). In this example, when 60% of the energy consumption is served with solar power and energy storage and, all things being equal, the utility bill would be reduced by 60%.

There are two major limitations to this type of installation. The first is that the solar system must be sized for the load of the TIRC. Since net metering isn't allowed under this scenario, any excess solar power that is produced and exported to the grid would be purchased at wholesale rates. This could be mitigated by installing utility scale energy storage to store excess renewable energy generated at that time and used later when electricity prices are high. If this mitigation is not implemented, the purchase of energy at wholesale rates is unlikely to make the project financially viable, so unless energy storage is used in conjunction with generation, the solar system will need to be sized to minimize export and maximize local consumption. In this scenario, the system sizing will likely be based on the minimum electrical draw. That is to say, the nameplate kW capacity of the solar array should not be larger than the minimum load drawn during peak solar hours. Financial modeling of these options will take place in Phase 2 of the study.

The second limitation is that DEA requires the PIIC to pay a standby charge. Despite generating some of their own power, on-site generation may be intermittent based on weather conditions or other causes. Additionally, the PIIC's generation may trip offline. Therefore, the PIIC will still need grid connectivity to ensure their electrical needs are met. A standby charge is used when the utility is required to keep additional power on "standby" to offset generation intermittency. Because DEA would be responsible for providing this standby power, they will require the PIIC to pay a fee for the service. This standby charge is proportionate based on the amount of power that DEA must have in reserve to offset generation losses. The standby fee must be included in the financial model when calculating profitability and payback.

4.5.3 DEA 5% Renewable Program

DEA has a contractual provision with GRE that allows the cooperative to acquire up to 5% of their annual system energy from renewable resources either owned by DEA or through a Power Purchase Agreement (PPA). The precise value of renewable generation in terms of $/kWh is yet to be determined but is expected to be higher than selling power back to GRE at avoided cost (wholesale) prices. This program has a number of criteria that must be met in order for the PIIC to qualify, including:

- The renewable generation must be located in DEA's service territory.
- The renewable energy must be delivered into the DEA distribution system and must stay on the distribution system. Under this condition, renewable energy is not allowed to back-feed (flow backwards) onto GRE's transmission system.
- Renewable generation is constrained by the amount of electrical load on the distribution line. The less electrical load, the smaller the renewable system must be.

Because the rate that DEA will pay for power is higher under this option than under an avoided cost option, this program is worth considering for a larger solar installation.

4.5.4 Wholesale Generation

Wholesale generation involves the direct sale of renewable energy generation to GRE or any other market participant. Under this model, any generation owned and operated by the PIIC that is producing in excess of the Dakota Electric Substation demand would export to the GRE transmission system. GRE would purchase energy directly from the PIIC. This would require direct connection onto GRE's transmission system, triggering Midcontinent Independent System Operator (MISO) engineering studies. GRE would purchase energy at their annually adjusted avoided cost rates (which typically hover around $0.03/kWh) and would likely require system upgrades for interconnection. This model is likely to be financially infeasible due to the low purchase price of energy.

4.5.5 Technical Considerations

There are a number of technical requirements to consider when interconnecting new generation onto the grid. Electrical system impact studies are used to quantify the effects of new generation. DEA and GRE have both provided preliminary technical feedback on costs and technical requirements for new solar. These findings should be considered preliminary, and more investigation is needed. However, they do provide a foundational overview of what can be expected when proceeding with the design phase. The findings are described below.

4.5.5.1 Great River Energy

At the request of the Net Zero Team and DEA, Great River Energy performed a preliminary Reliability Study Report for new interconnection near the Ravenna Substation. GRE modeled solar arrays ranging in size from 3MW to 50MW at full output connected on the distribution side of the Ravenna Substation. They found that 3MW of distributed generation would cause overload violations on several of the transmission lines and transformers. It was also found that if generation is higher than the minimum load of the substation (637kW), a 161kV breaker addition will be needed at Spring Creek. The minimum electrical load of the line throughout the calendar year is 637kW. Any amount of generation that crosses that minimum threshold could lead to back-feed, which triggers the breaker addition.

In addition to the new breaker, GRE stated that two transmission lines would also need to be upgraded. These lines include the Red Wing to Bay City line and the Red Wing to Spring Creek line. The estimated costs for all of these upgrades are shown in Figure 32.

Figure 32 – Distributed Generation Solar Program Summary

DER size	Transmission Impact	Estimated Capital Cost
Min load	No Impact	No additional cost
Min load - 50 MW	Breaker station at Spring Creek	$500,000
	Red Wing to Bay City line	$1,000,000
	Red Wing to Spring Creek line 2	$1,000,000

Additional conversations between the Net Zero Team, DEA, and GRE indicate that the PIIC may not be responsible for the transmission line upgrades and that they may only need to cover the $500,000 breaker replacement. These talks are ongoing and should be considered preliminary at this time. Additional information from DEA showed that daytime minimum load on the PIIC territory served by the Ravenna Substation is approximately 1,200kW. Since daytime minimum loading is more suitable for solar analysis, GRE may allow up to 1,200kW of solar export before requiring the $500,000 breaker addition. Another option could be to install a PV controller that curtails or disables PV generation during minimum loading times in order to avoid back-feed to the transmission system. Such a controller would reduce PV export when utility demand is low and allow for maximum export when utility demand is high. Again, mitigating back-feed can be accomplished via pairing energy storage solutions to charge the energy storage system for future electrical demand.

Ultimately, more collaboration between the PIIC, DEA, and GRE is needed. What seems clear, however, is that any large solar interconnection(s) (>1,200kW) will trigger a breaker addition upgrade costing approximately $500,000 and approximately 2-3 years to implement. This addition should be included in the financial model when calculating profitability and payback.

4.5.5.2 Dakota Electric Association

DEA has provided significant and valuable feedback on the interconnection technical processes. DEA conducted a preliminary engineering review in which they modeled solar generation impacts onto their distribution system. They found that a PV interconnection at Prairie Island Boulevard and County Road 18 (Mato Circle Triangle) is limited to approximately 2.0 – 2.5MW. Above this limit, the generation starts to cause power factor problems at the substation and intolerable voltage swings during cloud cover events. It is their recommendation that any array built at this location be constrained to the 2.0 - 2.5MW limit. They also recommend developing and constructing the array on the south side of the railroad tracks.

DEA also provided technical requirements for physical interconnection. When interconnecting larger PV directly to DEA's distribution lines, the system requires an electrically operated circuit breaker, a 12.5kV-480V transformer, a primary metering compartment and RTU controller, a 12.5kV pad mount switch, and primary cabling to the interconnection point. DEA can provide all of this equipment (excluding the electrically operated circuit breaker) and installation scope for approximately $350,000.

For smaller installations, such as the 40kW or smaller net metering option, DEA requires a disconnect switch with a visible break and a meter socket, provided by the customer. Both devices are industry standard for utility solar interconnections.

4.5.6 Solar Analysis

The previous sections outlined the resource availability and technical requirements for different types of solar Net Zero Projects. This section examines specific Net Zero Project siting and the associated pros and cons. On the Reservation, there are generally three possible installation categories: residential, distributed generation (building focused), and ground-mount. Each installation category was reviewed based on a combination of financial payback, engineering complexity, interconnection feasibility, visibility, and stakeholder input. These results are presented below.

4.5.6.1 Residential

Residential solar is highly viable for the PIIC. To approach Net Zero Project development equitably, the Team estimated that every home would receive rooftop solar and modeled 3kW systems for each of the 96 residences. Depending on the size of the residence, most residential rooftop solar installations range in size between 3kW and 10kW; 3kW therefore represents a conservative approach to the total amount of residential solar power available to the PIIC.

Since all residences have their own dedicated meters, each residential Net Zero Project would be eligible for net metering. As discussed in the previous section, net metering is a more financially viable method to interconnect solar and thus is more appealing than other utility programs. An additional add-on to this approach could be to add additional electric generation and energy storage to the system. Adding this would effectively create a residential microgrid. This approach will also be evaluated in Phase 2. The preliminary Phase 1 residential results without a microgrid are summarized in Figure 33.

Figure 33 – Residential Solar Program Summary

Net Zero Project Description	Total System Size	Estimated Capital Costs	Emissions Reduction (lbs CO_2)	Simple Payback
96 Three kW Residential Solar Arrays	288 kW	$901,000	35,357	18 years

As shown in Figure 33, the installation of residential solar power for the PIIC carries a simple payback of 18 years. This longer payback period is generally due to the low cost of electricity in Dakota Electric territory, low economies of scale for small residential Net Zero Projects, and moderate solar resource. However, one benefit of the residential program is that arrays are highly visible to the local community. The arrays are located on individual houses and residents can physically see power being produced during the day. The simple payback also does not factor in federal tax incentives such as the Solar Investment Tax Credit (ITC). If the residences are eligible to utilize the ITC, payback will occur more quickly.

4.5.6.2 Distributed Generation

Commercial-scale rooftop solar is very common throughout the United States and is generally the most cost-effective and least complex way for communities to harness renewable energy. Canopy solar Net Zero Projects are also very popular, particularly in the Southwestern US where parking lot shading is desirable. Canopy Net Zero Projects tend to be more expensive than rooftop Net Zero Projects due to the additional structural steel and labor needed to erect standing structures. Prairie Island owns multiple buildings and parking lots where distributed generation (DG) solar might be installed. As discussed in the interconnection discussion, there are multiple programs available for smaller scale interconnection. For Net Zero Projects up to 40kW in size, the Net Zero Project Net Zero Team modelled the financial payback using the net metering option. For Net Zero Projects larger than 40kW, the Net Zero Team modelled the financial payback using the self-generation option (including standby charges). The distributed generation results are summarized in Figure 34.

Figure 34 – Distributed Generation Solar Program Summary

Net Zero Project Location	Total System Size	Estimated Capital Costs	Emissions Reduction (lbs CO_2)	Simple Payback
Community Center Rooftop	31.5kW	$60,000	3,942	15 years
Public Safety Building Rooftop	12kW	$23,000	1,309	17 years
Heat Recovery Ground Source Plant Rooftop	175kW	$332,000	21,897	12 years
Tinta Wita Tipi Rooftop	33.6kW	$64,000	4,204	19 years
PIIC Administration Rooftop	43kW	$82,000	5,334	21 years
Mount Frontenac Golf Rooftop	17.6kW	$33,000	2,126	17 years
Dakota Station Canopy	40kW	$70,000	4,139	17 years
Elder Center Rooftop	30kW	$57,000	3,000	23 years

The paybacks range from between 12 years to 23 years. Larger arrays experience beneficial economies of scale and decrease the payback period. Similar to the residential analysis, solar payback suffers from the low cost of electricity, and a moderate solar resource. The use of energy storage will also need to be considered. Not captured here are potential economies of scale that may occur if all solar projects were bundled into one larger one. This bundling may reduce upfront capital costs and decrease the length of payback.

4.5.6.3 Ground-Mount

The PIIC is well positioned to take advantage of ground-mount arrays. They own hundreds of acres of land, some of which is very well suited for larger ground-mount solar. Ground-mount solar can often be the lowest cost configuration on a $/Watt basis. This is due to both the simplicity of installation and the economy of scale benefits seen for larger Net Zero Projects.

For installations at the PIIC, the Net Zero Team modelled the installation of a 2MW Net Zero Project with a direct interconnection onto DEA's distribution, and a 2MW Net Zero Project allocated proportionally to the casino's electrical service meters. The proportional allocation model splits the

2MW array into four separate interconnections, two of which are 600kW and two of which are 400kW. By breaking up the array into four individual interconnections, PIIC can take advantage of the self-generation interconnection option outlined in the interconnection discussion. The 2MW direct interconnection was modelled utilizing the wholesale generation process (see Wholesale Generation). There may be an opportunity to increase the payback of the 2MW direct interconnection depending on DEA's willingness to incorporate the array(s) into their 5% Options Program for Renewable Generation. This option will require further collaboration with DEA.

The ground-mount results without energy storage are summarized in Figure 35.

Figure 35 – Ground-Mount Solar Program Summary

Net Zero Project Location	Total System Size	Estimated Capital Costs	Emissions Reduction (lbs CO_2)	Simple Payback
2MW Mato Circle Triangle Ground-Mount Array	2MW	$4,671,000	252,500	90 years
2MW Frazier Street Lot Ground-Mount Array 400 kW to Casino 1 & 2 600 kW to Casino 3 & 4 400 kW to Casino 6 & 7 600 kW to Hotel Casino 5	2MW	$4,671,000	252,500	21 years

The paybacks for these large sites vary significantly depending on the method of interconnection agreement. The 2MW with direct interconnections take 90 years for the Net Zero Project finances to break even. This is due primarily to the very low price at which the Tribe can sell power back to GRE under the wholesale generation interconnection arrangement. Alternatively, allocating blocks of the 2 MW array for behind-the-meter connections within the Casino-Hotel Resort electric accounts may yield a simple payback of about 21 years. These connections assume an offset in the Tribe's cost of electricity; the self-generated power offsets utility power at a one-to-one rate after accounting for stand-by charges. This interconnection method also factors in standby charges, leading to a simple payback period of 21 years. It is clear that unless DEA can incorporate the 2MW array into their 5% Renewable Generation Program, the self-generation interconnection method is far more feasible than the wholesale generation interconnection method.

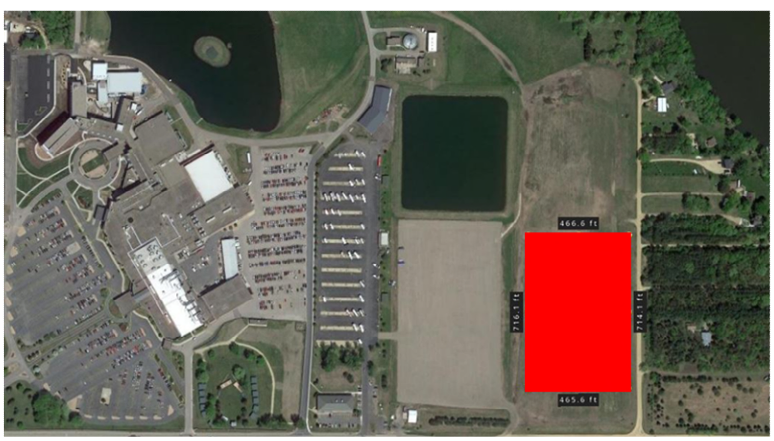
4.5.7 Potential Siting Map

The Net Zero Team worked in conjunction with the PIIC personnel from the Tribal Historic Preservation Office (THPO) and Environmental Office to evaluate sites. Preliminary sites were chosen based on the absence of known culturally sensitive areas, existing disturbed ground, and proximity to existing distribution systems. Sites were then narrowed down to the most likely to be electrically feasible, and further reviewed with the PIIC Tribal leadership and community members. The sites chosen for potential solar development sites are in three separate locations on the Reservation, as shown in Figure 36.

Figure 36 – Aerial View of the Three Potential Array Locations on the PIIC

The specific size and precise location for these generation sites will be determined during Phase 2; however, 2MW for each array is used for these examples based on the likely capacity for the nearby distribution system. Figure 37 is near the TIRC. This location provides several opportunities to connect to either the distribution system running underground adjacent to TIRC, or directly to the existing DEA substation nearby to the South.

Figure 37 – Location of a Potential 2MW Array Adjacent to TIRC



Figures 38 and 39 are twin sites located across from one another on County Road 18 and near the PIIC residences of Mato Circle. Because of existing system capacity, it is likely only one of these sites would be chosen; however, the size of the array might be scaled up to 3MW or more to meet existing capacity. This will also be determined in Phase 2.

Figure 38 – One of Two Potential 2MW Arrays Near the Mato Circle Residences

Figure 39 – The Second of Two Potential Arrays Near the Mato Circle Residences

4.5.8 Transpired Solar Thermal

Buildings are typically heated and cooled with distributed air through air handling units. These units typically rely on gas or electricity to heat the air during cooler seasons. The cost of heating as well as the energy used can add up over a cold winter. Additionally, commercial buildings use a significant amount of outdoor air, which further increases the energy and or electricity use as the cold winter air needs to be heated.

Transpired Solar Thermal Collectors (TSTC) typical consist of a dark-colored, perforated façade installed on the building's south-facing wall. A fan in the ventilation system draws in air through the wall to the air handling unit's outdoor air intake. The dark panels of the wall absorb solar energy during the day and heat the air as it passes through. The TSTC can pre-heat air by as much as 40°F. The panels continue to collect energy at night as the heat lost through the exterior of the building is recaptured.

The proposed solution involves installing a 1,250 sq ft TSTC on the south wall of the Buffalo Hotel tower. The collector design coordinates with windows and HVAC equipment on the existing façade. The system also includes rooftop ductwork, in-line fans and controls integrated into the BAS. The collector supplies 5,000 cfm of pre-heated ventilation air to the hotel tower ventilation system. This equates to 574,000 kWhs of annual solar thermal energy generation. The system reduces ventilation air system operational energy costs by 90% and prevents 286,000 lbs of annual CO_2 emissions.

4.6 ELECTRIFICATION

Electrification of natural gas loads is an important consideration of the Net Zero Project given the noted and successful decarbonization efforts of the Minnesota electric utility industry. Consequently, measures for electrification potentially offer greater reductions of CO_2 emissions than Renewable Generation measures per dollar of capital invested. Although it may seem intuitive to continue to use a natural gas system and/ or appliance until end of life, when carbon emissions reduction is the primary goal, the sooner the electrification happens the faster emissions reductions are realized.

4.6.1 Casino-Hotel Resort

4.6.1.1 Laundry Washer/Extractor Washwater

The laundry facilities serving TIRC include five (5) commercial grade laundry washer/extractors. These units are Milnor 160-lb units; capable of 300 G of extractor force. Together, these units sum to a total facility washer/extractor capacity of 800 lbs. Domestic Hot Water (DHW) to serve the washer extractors is generated via two (2) brazed plate heat exchangers. Building heating water at 160°F heats circulating DHW from three (3) 200-gallon storage tanks. This system heats and stores DHW to 140°F and serves both the laundry facilities as well as nearby hotel spaces.

DHW accounts for the majority of the energy and emissions associated with washing laundry. This energy enters the washer/extractors as DHW and is drained at the conclusion of the wash cycle, making this system an excellent candidate for the application of energy recovery equipment. In this case, a Drain Water Heat Recovery (DWHR) heat exchanger would extract remaining heat from the flow of wastewater and use it to pre-heat the fresh DHW. However, these heat exchangers must be installed vertically with a drop in elevation to allow for the wastewater stream to form a thin film along the piping walls within the heat exchanger to achieve adequate heat transfer rates. The modifications to the facility's sanitary piping infrastructure required to install this system would be extensive. Although DWHR systems can be very effective in new construction or when existing conditions are accommodating, the Team's analysis determined that a DWHR system would be impractical and too capital intensive for this application when compared to alternative solutions.

The Net Zero Team's proposed solution re-purposes all of the existing laundry washing and water heating equipment and installs new equipment to achieve significant CO_2 emissions reduction. DHW is first pre-heated by the existing brazed plate heat exchanger from 47°F or colder ground water temperature by the new 120°F building heating water. DHW from the existing storage tank flows into a new package tank-style Air Source Heat Pump Water Heater (ASHPWH). To safely store DHW, a system must maintain a minimum temperature of 122°F to avoid Legionella growth. As the building heating water is below this temperature, the ASHPWH is included to bring the DHW to a final storage temperature of 140°F. The ASHPWH is powered by electricity and concentrates waste heat from the laundry facilities room air at a greater than 400% efficiency. Finally, DHW mixing valves and plumbing to the washer/extractors will be modified to utilize 75°F DHW from the existing storage tanks as "cold" water to mix with 140°F DHW to minimize high temperature demand required to achieve desired temperatures.

In addition, a significant amount of energy use can be avoided at a favorable cost by switching to cold water enzyme washing detergent technology. These detergents maintain the same cleaning performance at 100°F wash water temperature as traditional detergents do at 120°F wash water temperature. This 20°F reduction represents a 27% reduction in required heating energy. Further benefits may also manifest from decreases in water volume and linen replacement rates from high temperature damage.

Although the switch to new detergent involves an increase in operational costs for the laundry facilities, the reduction in DHW demand results in a net 14.6% decrease in operational material and energy expenses. This measure has the potential of a net reduction in annual operating expense, approximately $19,000, with an estimated capital cost of $47,000.

4.6.1.2 Laundry Dryers

The laundry facilities serving the TIRC include six (6) commercial grade tumble dryers. Five (5) of these units are Huebsch 200-lb units; moving 2,150 cfm of air and consuming 425,000 btu/hr of natural gas while in operation. The remaining single (1) unit is a Huebsch 170-lb unit; moving an identical 2,150 cfm of air while consuming 395,000 btu/hr of natural gas while in operation. In addition, outside air supply to the tumble dryers is pre-heated during winter months by a RuppAir make-up air unit consuming 513,000 btu/hr of natural gas. Together, after converting to the common measure of therms, the laundry drying plant has a peak natural gas consumption capacity of 30.3 therms/hr while handling 1,170 lbs of laundry per hour.

The Net Zero Team developed an estimate for annual dryer service using standard design guidelines for laundry facilities. The model load profile assumed 919 hotel rooms being served, with 20 lbs/day of laundry per room at a 0.263 room occupancy rate. These inputs produced an estimated average 201 lbs/hr of laundry to be handled by the laundry facilities. Using local climate data, the modeled laundry facilities consume 42,200 therms of natural gas, representing an annual fuel cost of $23,600 and annual emissions of 494,000 lbs CO_2. In perspective, 3% of the annual natural gas consumption for the Treasure Island Casino complex is accounted for by the laundry tumble dryers.

Drying laundry is a seemingly simple task but presents a complex and fascinating engineering challenge if system emissions are to be reduced or eliminated. In developing an engineered solution to meet this challenge, the Net Zero Team reviewed the fundamental physical principles guiding the operation of a tumble dryer systems. Initially, the Net Zero Team noted that all tumble dryers do consume electricity to power control electronics, exhaust fan(s) and rotating drums. Although new equipment would make incremental improvements to energy consumption of these components, the portion of total energy consumption this represents is negligible and the associated electrical waste heat only aids in drying performance of the system. Therefore, the Net Zero Team has omitted the electrical energy consumed by these accessory components from this discussion.

The vast majority of energy consumed, and emissions produced by a tumble dryer comes from the task of heating a relatively large flow of air. This air is first pre-heated from outside ambient conditions to approximately room temperature, before it is then heated to 175°F by the dryer and brought into contact with tumbling laundry. In Minnesota, winter outside ambient air temperature conditions can reach -10°F or lower. This is a relatively energy intense process that is further exacerbated by the fact that 100% of the airflow and energy consumed by the tumble dryer system is exhausted and wasted back to the outside environment. This compares to a typical HVAC air handling system taking in mixed room and outside air at 55°F and heating it to 90°F to heat a building.

Reducing CO_2 emissions from a natural gas fired tumble dryer can be achieved with heat pump technology to actively remove moisture from the airstream, heat transfer components to maximize overall system efficiency.

The proposed split Heat Pump Air Dryer (HPAD) system converts the TIRC's laundry tumble dryers to a closed system. A 12,900 cfm Air Drying Air Handling Unit (ADAHU) is installed outside adjacent to the laundry drying room. Natural gas is disconnected from the tumble dryers and the heating elements are disabled. Warm & wet exhaust air at 90°F & 53.7% RH from the tumble dryers is ducted into the ADAHU where it is first filtered to prevent lint build-up within the unit. The filters used are a combination of screens and metal mesh that are fully washable and reusable. The air stream is then pre-cooled to a fully saturated state (67.9°F dry-bulb temperature (DB), 68.8°F wet-bulb temperature (WB)) by a series sensible-only plate-frame heat exchanger. A direct exchange (DX) cooling coil cools the air stream leaving the heat exchanger to condense, or "wring out", water from the system. Air leaves the DX cooling coil fully saturated (49.2°F DB, 49.2°F WB) where it passes back through the opposing circuit of the heat exchanger where it is re-heated to (80.1°F DB, 61.4°F WB). The final section of the ADAHU returns all the waste heat from the DX system compressors to the supply air stream. Hot & dry supply air at 143°F & 5.55% RH leaves the ADAHU and is ducted back to the tumble dryers. A local control system is installed to operate the ADAHU and control airflow to various tumble dryers.

The HPAD system struggles to match the drying power of natural gas and takes 45 to 70 minutes of drying time when all six (6) dryers are in operation. However, the split design of the system out-performs the existing gas system when four (4) or fewer dryers are in operation, taking less than 30 minutes of drying time. The estimated capital cost of the HPAD system is $247,000 with about a $9,000 reduction in annual operating expense.

4.6.1.3 Electric Stovetops and Ovens

Cooking equipment can be a considerable source of CO_2 emissions because of its reliance upon natural gas as a high temperature heat source. This problem is exacerbated by the fact that natural gas cooking equipment is inefficient at transferring heat energy from natural gas to food. Commercial natural gas ovens typically transfer only 7% of the heat energy to the food, while an electric oven can achieve 14% heat energy transferred. Similarly, commercial natural gas ranges transfer only 30% of heat energy to food, while an electric induction range can achieve 85% heat energy transferred.

The Net Zero Team proposes replacement of eight (8) natural gas ovens with equivalent electric ovens, and replacement of eight (8) natural gas ranges with equivalent electric induction units. These investments result in a net increase of $17,600 in operational energy expenses. However, the conversion to electricity as the primary energy source would reduce emissions by 354,000 lbs of CO_2. The estimated capital cost of this measure is $239,000.

4.6.1.4 Air Source Heat Pumps

A number of stand-alone HVAC systems serve areas of the TIRC and are not connected to the central heating and cooling plants. Specific to the warehouse area, a single (1) rooftop air handling unit is supplied directly with natural gas to heat a large area with relatively low internal heat loads. Additionally, this unit is located at an impractically far distance from hot and chilled water piping from central heat and cooling plants. It was found, when considering long distance piping costs, that replacing this system with a stand-alone high-performance Air Source Heat Pump (ASHP) would be the most economical approach to electrify and reduce the system's emissions. The proposed solution replaces the existing rooftop air handling unit with a new commercial grade air handler and associated high performance ASHP outdoor unit.

The performance of this new system is expected to result in an increase of annual operating expense, about $7,440, but will also reduce CO_2 emissions by 176,000 pounds. The sir source heat pump has an estimated capital cost of $376.000.

4.6.1.5 Heat Recovery Ground Source Heating Plant

Heat pump technology powered by electricity has the potential to significantly reduce CO_2 emission attributable to natural gas consumption at TIRC for heating loads.

Two types of heat pump applications are available: Air-source & water-source heat pumps. Both are made of four components: a refrigerant compressor, a condenser coil, an expansion valve, and an evaporator coil. The compressor heats the refrigerant during compression, the heat is dissipated in the condenser and transfer that heat to the surroundings, then the refrigerant gas is de-pressurized and cooled in the expansion valve, followed by warming of cold refrigerant in the evaporator coil by the surroundings. As such, the refrigerant compression uses electrical energy to move heat from the evaporator to the condenser. This is an important point as the coefficient of performance (COP), which typically ranges from 1 to 6 depending on temperatures and load served, demonstrates that one can achieve more heating or cooling than the energy put into the system. These COP levels highlight the point that the system moves energy rather than converting it from chemical energy to thermal energy as is the case when burning fossil fuels.

Air-source heat pumps must use the air temperature as a source or ‘sink’ of heat. While the air temperature varies, the interior temperature is relatively constant. In the summer, the difference can be in the range of 30-40°F, while in the winter, the difference is 80-100°F. This difference is also called ‘lift’ and simply put, the larger the temperature difference the lower the COP.

In Minnesota, and the upper Midwest in general, ambient temperatures can reach below 0°F for days and sometimes even weeklong stretches, with little solar thermal resource available. While an air-source heat pump would work, the efficiency would be lower than a geothermal system where the ground temperature is fairly constant more than 20 feet below grade throughout the year and the temperature is usually 50-55°F. The dominant heating and cooling system at TIRC is based around a standard 4-pipe arrangement, a supply and return pair for heating and supply and return pair for cooling. To produce chilled water, the ground temperature is rather similar to the chilled water temperature vs the current air temperature, a lift of only ~10-20°F vs. 50-60°F in summer conditions. This represents an improvement in COP over air source heat pumps. On the heating side, the production of 120°F hot water for building loads is proven in many new construction projects and is what is proposed for this Net Zero Project. The lower temperature allows for a heat pump to be used thereby eliminating natural gas combustion by the conventional boilers. The benefit of a geothermal system is the ground temperature is much higher than the ambient with a lift of only 50 - 60°F vs. in some cases 110 - 120°F. Like the cooling mode, this lower lift represents an improvement in COP.

Because the upper Midwest experiences the extremes of climate through the year, a high relative humidity cooling season and low sunlight frigid winters, a system must be designed to operate in both extremes. During the shoulder seasons of March to May and September to November, the temperature can fluctuate and regularly require heating and cooling within the same 24-hour period. Additionally, during the summer months when cooling is the major HVAC load, the TIRC requires domestic hot water for cooking, cleaning, showers, etc. and therefore, there exists a simultaneous load. Ideally when chilled water is produced and heat is removed from it, it can be used to heat water for use elsewhere in the facility. For the reasons above, heat recovery is the most efficient means of satisfying the loads of the facility, essentially serving two loads with only one energy input.

For this study, a conceptual layout has been established for a heat recovery and geothermal plant built adjacent to the casino. The reasoning for this location is because the current boiler and chiller plant is completely full of equipment and is currently serving the ongoing loads of the facility. Modifications to this aging equipment design will not be cost effective when planning the energy use of this facility far into the future. Additionally, by not modifying the equipment, it can remain operational and support the loads while new systems are built and function as backup during extreme weather events.

The location chosen for the heat recovery geothermal plant is on the north end of the staff parking lot for these reasons:

- Adjacency to existing central utility plant (minimize underground piping)
- Adjacency to available geothermal wellfield location, the dry camping grounds
- Adjacency to the north portion of the complex (minimize underground piping)
- Minimal impact of existing operations

The proposed plant consists of three 800-ton heat recovery chillers with a fourth as a spare, thermal energy storage tanks (exterior of plant building), and primary/secondary pumping configuration between heat recovery chillers and sources/loads. Ideally, the default mode of operation is for the heat recovery chillers to produce hot and chilled water simultaneously to charge the tanks and no exchange with the geothermal wellfield. This mode represents the highest COP possible while also the most flexible chiller configuration. When the seasonal loads require more heating or cooling than the heat recovery operation can match, the heat recovery chillers are operated as regular heat pumps with the valves in the system directing water to the appropriate location.

On the load side, the hot and chilled water is dispatched to the building automatically by monitoring the system differential pressure with the secondary pumps controlled by variable frequency drives. Chilled water is produced at 42°F and returned at 52°F or 54°F with better controls on the air handler coils. Heating water is produced at 120°F and returned at 100°F. Both temperature differences can utilize the existing facility piping but the Net Zero Team would encourage, in future renovations, to increase the diameter of piping to be as large as possible to minimize the electricity used to circulate hot water.

Nominally the plant is sized for 2,400 tons of heat recovery chiller capacity which is lower than the peak cooling load but higher than the continuous peak heating load. This sizing was and is intentional to maximize investment in highly usable infrastructure rather than minimally utilized infrastructure only needed during peak times of the year. For new equipment, this takes the form of replacement of peak geothermal and heat recovery chiller capacity with investment in thermal energy storage tanks and continued use of existing equipment. In the case of load growth or equipment outages, the existing heating and cooling systems can still be operated and can supplement the heat recovery geothermal system but will do so at higher operating expenses and emissions.

The inclusion of thermal energy storage tanks offers a number of benefits:

- Low or equivalent capital cost – By investing capital in the thermal storage tanks instead of peak capacity of heat recovery chillers or wellfield, Net Zero Project funding can be spent in a more effective way.
- Low complexity - Production of the heating water and chilled water is simpler as the heat recovery chiller is not required to vary its output to meet load and can be optimized in its efficiency, normally found around 80% of full capacity. The thermal energy storage tank acts as a buffer allowing operators to stage the units on/off manually but a production schedule could easily be programmed into the system based on tank level and time of day to manage the chillers automatically.
- Lower operating cost - The thermal storage tanks allow for off-peak production of chilled and hot water to reduce demand charges currently experienced and set by existing HVAC equipment. This feature allows for the electrical demand profile to be 'flattened' by moving loads from the peak of the day and filled into the lows when power prices are cheaper.
- Demand response – Because the heat recovery chillers present a large electrical load when operating, during times of peak demand on the grid, the heat recovery chillers could be installed as part of a demand response scheme with Dakota Electric and disabled for a number of hours to reduce electrical loads. During these events, only the chillers would be disabled while the thermal storage tanks (thermal batteries) continue to function with the secondary pumps to meet the ongoing thermal demands of the buildings. This demand response capability would provide additional stability to the grid as well as incremental income to the Tribe.

The wellfield necessary to support the ground source plant will consist of 1,200 vertical bores. Each bore is expected to have a depth of 300 feet. The suggested location of the wellfield is the area now used for over-flow for the RV park. The number and depth of bores will be confirmed through subsequent geotechnical analysis of the site. Development of the wellfield will not preclude use of the area for RV park overflow.

The total capital cost for developing the heat recovery ground source plant is significant with estimate approaching $23.45 million. This estimated cost is inclusive of site preparation, equipment procurement and installation, well-field, coils in air handling units for lower supply temperature and temperature and Net Zero Project soft costs (e.g., design, system commissioning, contingencies, contract overhead and construction management fees). However, this capital cost also represents the largest single source of CO_2 emissions as natural gas for facility heating is virtually eliminated. The heat recovery ground source heat plant is expected to reduce operating expense by approximately $400,000 annually.

4.6.1.6 Temperature Modification of Heating System

The system supply temperature of the heating system will be modified to accommodate the operating characteristics of the heat recovery ground-source plant. A heating water supply temperature of 120°F has been determined for the following reasons:

- 120°F is well within the production range of heat pumps (135°F is the practical maximum)
- 120°F is suitable for replaced heating coils throughout the facility and where higher flows are required to meet historical heating loads, a thicker coil with more surface area should be employed to reduce water flow rates and thus improve heat transfer performance of the coil
- 120°F is very close to the domestic hot water setpoint and based on the way those sub-systems are operating controls can be implemented to do a majority of work in raising cold water temperature to the desired hot water temperatures. Where higher temperatures are needed, heat pump water heaters can provide that temperature at those locations rather than using energy for an unnecessarily higher temperature requirement across the entire system.

The lower supply temperature will require new coils in air handling units throughout the casino-resort-hotel complex. This capital cost, approximately $231,000, will be included in the total cost for developing the heat recovery ground source heating plant.

4.6.1.7 Domestic Hot Water

The new supply temperature will also necessitate changes to the domestic hot water system. The domestic heating water system(s) throughout the facility is a combination of heat exchanger with the heating hot water supply used by the HVAC system and some conventional tank water heaters scattered throughout the facility.

Four domestic hot water heaters serve small loads within the facility. The Net Zero Team recommends these units be replaced with heat pump hot water heaters. Domestic hot water for larger loads within the facility is produced through the heat exchangers. These heat exchangers have not been designed for the new hot water supply temperature of the heating system, and so will not perform as well. This anticipated effect can be mitigated by:

- Maintaining continuous circulation between storage tanks and heat exchangers
- Changing heating water control valves to maintain storage tanks at the highest temperature possible in anticipation of high loads. When the temperature drops 5 degrees below setpoint, the controls should open valves fully to recover the storage tank temperature as fast as possible. (The heat recovery system will have plenty of capacity to serve these loads)
- Adding heat pump water heater(s) in series outside of the circulation loop ahead of the thermostatic mixing valves if or where the water temperature is insufficient. In these locations, the heat exchangers are the first stage while heat pump water heaters are second stage to boost the supply temperature and provide a smaller buffer volume maintained at a higher temperature. Priority in the heating should be given to the first stage as it is the highest efficiency and thus lowest cost to operate. An important point here is that the heating water temperature could be raised to improve the future performance of the existing heat exchanger, but this trade-off will come at the expense of operating cost for edge cases better suited to dedicated and specialized equipment.

The estimated cost of these modifications to the domestic hot water system is approximately $93,000. The incremental electric load associated with these modifications will result in a slight increase of operating expense, about $6,200 annually.

4.6.2 Tribal Buildings

4.6.2.1 Heat Pump Water Heaters

Existing Domestic Hot Water (DHW) heating equipment in the Tribal Administration, Community Center and Public Safety buildings are tank-style natural gas water heaters. Each water heater is approximately 80% efficient at transferring heat from the combustion of natural gas to DHW. The water heaters are typically paired with a recirculation pump to keep the DHW piping system charged and a thermostatic mixing valve to regulate DHW supply temperature.

Emissions reduction for these systems requires conversion of their primary energy source from natural gas to electricity. Across all three buildings, eight (8) package 120-gallon air source Heat Pump Water Heaters (HPWH) are installed with minimal piping modification as required. The existing recirculation pumps and thermostatic mixing valves are retained. This equipment is powered by electricity but sources and concentrates a majority of the DHW heat from the air in the mechanical rooms in which the HPWHs are installed. The efficiency of the heat pump cycle results in no net change operating expense. The estimated capital cost of the heat pump water heaters is $110,000.

4.6.2.2 Air Source Heat Pumps

Heating and cooling loads in the Community Center and Public Safety buildings are provided by natural gas boilers and air-cooled chillers. This equipment presents a significant source of CO_2 emissions which can be avoided by converting to an electrified heat pump system. Availability of access to land for a geothermal well field is limited at these locations, leaving a high-performance Heat Recovery Air Source Heat Pump (HRASHP) as the most attractive option. The system consists of eight (8) 22-ton heat recovery Variable Refrigerant Flow (VRF) outdoor units. Heat is extracted from outdoor ambient air rather than a wellfield. Commercially available air source heat pumps are capable of operating in outdoor conditions warmer than minus 35°F.

All building air handling equipment will be outfitted with new changeover Direct Expansion (DX) coils. Terminal units are replaced with new VRF compatible equipment. New VRF branch boxes serve as a control point between the outdoor units and indoor equipment. Additionally, performance is improved by a sensible thermal storage system. A DX to water hydronic conversion unit, coupled to a hot water thermal storage tank with back-up electric heating elements, serves as a heat sink and/or source to maintain system performance during peak ambient temperature conditions. All new VRF and existing equipment is outfitted with modern controls and integrated into a new BAS. Together, the systems serving these buildings increase operational energy costs by 6% while preventing 473,000 lbs. of annual CO_2 emissions.

4.6.2.3 Ground Source Heat Pumps

Heating and cooling loads in the Tribal Administration building are provided by a natural gas boiler and air-cooled chillers. Given the proximity of this building to the wellfield of the new Heat Recovery Ground Source Heat Pump (HRGSHP), the opportunity is available to install an HRGSHP in the Tribal Administration building at minimal additional cost relative to an air source heat pump system. The solution includes demolition of the existing boiler and air-cooled chiller plant equipment. Geothermal well piping mains are routed 1,000 ft from the new HRGSHP well field to the Tribal Administration building mechanical room. A new 90-ton water-to-water modular HRGSHP plant provides all building heating and cooling loads. The system also includes new pumps, associated piping & specialties, air handling equipment, replacement coils, and modern controls integrating the new & existing equipment into a new BAS. The upgrades reduce operational energy costs by 5% and prevent 165,000 lbs. of annual CO_2 emissions.

4.6.3 Residential

The community has 96 private residences: 46 on Lower Island, 26 at Mato Circle and 24 at Dakota Circle. The Net Zero Team did not conduct on-site assessments of the private residences due to concerns for COVID-19 exposure and spread. A desk-top analysis was performed using approximate square footage, average residential consumption profiles, fuel source, and presumed installed equipment.

Approximately 69% of the properties are assumed to use natural gas for space and water heating, as well as cooking appliances. The remaining 31% are assumed to use propane for those end uses based on propane storage tanks visible on properties.

The residential properties are assumed to have standard electric space cooling equipment, and natural gas or propane fired appliances for space and water heating, cooking ranges and ovens, and laundry drying. These natural gas and propane appliances represent the majority of residential GHG emissions, and options exist to convert these appliances to electric where economics, building characteristics, and user satisfaction warrant.

The residences are assumed to have 3-ton SEER14 split-system direct expansion (split-DX) units for space cooling, combined with 80% efficient forced air gas/propane furnaces for space heating. Additionally, standard 40-gallon 58% efficient domestic hot water storage tanks, gas/propane ranges and ovens, and gas/propane dryers are also assumed installed for each property.

4.6.3.1 Heat Pump Water Heater

The Net Zero Team recommends that any residential gas storage hot water heater be replaced with a 3.09+ UEF electric heat pump hot water heater. These water heaters are typically 4+ times more efficient than the gas storage water heaters and provide additional optionality for scheduling and vacation controls to maximize the efficiency.

Heat pump water heaters have the potential of saving the average residence about 225 therms. However, after accounting for the expense of the incremental electric load of the heat pump water heater the average residential utility expense increases by approximately $150. The estimated installed cost of a heat pump water is about $2,560 per residence.

4.6.3.2 Electric Stovetops and Ovens

Electric induction cooktops and electric element ovens can result in a reduction of CO_2 emissions. Induction cooktops use magnetic fields to generate heat in ferrous metal cookware, heating only the cookware itself instead of the air and can be quickly turned on or off. Induction cooktops are intrinsically safer: there are not hot cooking elements since only the cookware is heated.

Each induction cooktop and electric oven is expected to offset approximately 43 therms of natural gas consumption. Yet similar to the heat pump water heater, annual utility expense will increase slightly, about $20 per year, after accounting for the incremental electric load. The average cost of the induction cooktops and electric ovens is about $1,200 per residence.

Note: Induction cooktops will require new ferrous-metal cookware which may cause additional financial burden on homeowners using copper or other cookware not compatible with induction cooktops.

4.6.3.3 Electric Dryers

Replacing gas heated clothes dryers with efficient electric heat pump clothes dryers can also yield a reduction in CO_2 emissions. Heat pump clothes dryers typically do not require venting like gas-heated dryers and thus can be installed in more locations in the residence. However, although manufacturers are starting to increase production of heat pump clothes dryers in North America, stock is still limited due to the products being newer.

Each heat pump clothes dryer may reduce average residential gas consumption by about 12 therms per year. Yet similar to other residential electrification measures, annual utility expense will increase slightly, about $30 per year, after accounting for the incremental electric load. Additionally, homeowners should be informed that the drying time for heat pump clothes dryers is typically longer than gas heated dryers. The average cost of the heat-pump electric dryer is about $2,700 per residence.

4.6.3.4 Air Source Heat Pump

The Net Zero Team recommends that existing SEER14 air conditioning unit and 80% efficient forced air furnace be replaced with a SEER15 air-source electric heat pump unit. The heat pump unit should be properly sized based on existing equipment size and specified to operate in cold-weather conditions below 40 °F. This heat pump will provide both space cooling during summer months and space heating during winter months, including an installed electric resistance supplementary unit which may be required for peak design day conditions.

Each air source heat pump is expected to reduce annual natural gas consumption of the average residence by about 200 therms, or a savings of about $215. The annual expense of the incremental electric load to operate the air source heat pump is about $246, indicating that total annual energy expense will increase by about $31. The average estimated cost of the air source heat pump is about $7,360 per residence.

4.6.4 Vehicle Fleets

CO_2 emissions from the vehicle fleets of the Tribal Government and TIRC represent approximately 6.1% of the PIIC Net Zero Emissions Benchmark (1,229,154 lbs of 20,122,028 lbs). Vehicle electrification offers a reduction of CO_2 emissions, providing both a visible and tangible demonstration of the Net Zero program.

The Net Zero Team reviewed the existing PIIC and TIRC vehicle fleets in their entirety and selected eleven vehicles for electrification. Selection is based on vehicle use as indicated by tracked data from annual total fuel purchases. Secondary considerations are the relative age of vehicles (older, likely less fuel-efficient vehicles were given preference) and commercial availability of electric or electric-hybrid vehicles suitable for anticipated use. Off-road vehicles were not considered for electrification.

Five vehicles from the list of Tribal Government fleet of street vehicles were selected for electrification. It is suggested that the Ford Interceptors be replaced with electric-hybrid police interceptor models. All-electric cross-over utility vehicles are suggested as a replacement of the Ford SUVs.

Vehicle	Replaced by
One 2013 Ford Interceptor	One Electric-hybrid Police Interceptor
Two 2015 Ford SUV	Two All-Electric Cross-Over Utility Vehicle
One 2016 Ford Interceptor	One Electric-hybrid Police Interceptor
One 2017 Ford Interceptor	One Electric-hybrid Police Interceptor

Each of the five vehicles are used by the Tribal Police Department and are highlighted with blue shading on Figure 40:

Figure 40 – PIIC Tribal Government Fleet of Street Vehicles

Tribal Government Fleet of Street Vehicles		Use Metrics	
Number	Year/Make/Model	GAL/YR	Fills/YR
110	2007 DODGE CARAVAN	64.3	6
118	2018 FORD EXPLORER	691.8	58
122	2019 FORD TRANS 350	31	2
335	2019 FORD F450	174.8	18
102	20 06 F150 4X4	169	7
113	2011 FORD F150	288.6	16
117	2018 FORD EXPLORER	875.6	74
513	2008 CHEVY IMPALA	62.7	6
519	2009 CHEV TAHOE	248.6	19
120	2018 CHEV SUBURBAN LS	702.3	41
108	2006 FORD ECONO V	91.1	5
301	2005 CHEV FLATBED TR	750.7	46
334	1998 DODGE	71.7	3
335	2019 FORD F450	270.6	18
326	2011 FORD F350 PU	827.2	38
310	2002 PICKUP	256.5	10
311	2005 CHEV CK3500	248.4	10
325	FORD F350 PU	1,078.3	48
332	2016 F450 DUMP TRK	640.3	30
327	2012 F250 CREW CAB	584	30
520	2010 CHEV TAHOE	305.8	19
522	2011 CROWN VICTORIA	33.3	3
524	2013 FORD INTERCEPTOR	420.5	68
525	2012 CHEVY TAHOE	1,297.6	140
526	2010 CHEVY TAHOE	1,038.5	171
527	2015 FORD SUV	989.6	104
528	2015 FORD SUV	913.6	81
529	2015 CHEV TAHOE	978.7	58
530	2016 FORD INTERCEPOR	667.7	113
531	2017 FORD INTERCEPOR	554.6	85
531	2018 CHEV 3500	142.5	7
532	2017 CHEVY TAHOE	721	96
116	2007 FORD FUSION	91.9	10
512	2008 CHEVY IMPALA	61.6	6
601	2014 FIRE TRUCK	26.9	1
119	2018 GMC 4WD CREW	678.5	30
121	2006 E450 BUS	387.7	14

Six vehicles from the list of TIRC fleet of street vehicles were selected for electrification. Two of the vehicles are used by TIRC Security and four vehicles are used by Transportation.

Vehicle	Replaced by
One 2012 Ford F150	One All-Electric Cross-Over Utility Vehicle
One 2016 Ford Explorer	One All-Electric Cross-Over Utility Vehicle
One 2012 Ford E350 Valet	One All-Electric E450 (Ford OEM)
One 2008 Ford E450	One All-Electric E450 (Ford OEM)
One 2017 Ford E450 Bus	One All-Electric E450 (Ford OEM)
One 2012 Ford E450 Bus	One All-Electric E450 (Ford OEM)

The six vehicles are highlighted below. Blue shading indicates Security vehicles while yellow shading is used to highlight Transportation vehicles in Figure 41.

Two vehicles used by TIRC Security (Ford F150 and Ford Explorer) could be replaced by electric cross-over utility vehicles. The suggested replacement for TIRC Transportation vehicles is an electric shuttle bus built on a Ford E450 platform.

The estimated capital cost of the suggested vehicle electrification is $1.25 million inclusive of vehicles and charging stations: $863,000 and $388,000, respectively. Three level-3 and five level-2 charging stations are included in this estimate. Level-3 stations can typically recharge vehicle batteries in 2 hours. A level-3 station is allocated to TIRC Security, TIRC Transportation and Tribal Police. Level-2 charging stations can typically recharge a vehicle battery within 8 hours. Three level-2 charging stations will be installed at the TIRC to support Transportation and Security, while two more will be installed for Tribal Police.

Vehicle electrification will eliminate emissions created from burning approximately 14,678 gallons of gasoline per year. This change will increase the electric load of TIRC and the PIIC Tribal Government by an estimated 186,000 kWh per year. The anticipated reduction of annual operating expenses is approximately $24,750. It is important to note that the electricity used for initial fleet vehicle electrification will come from predominantly renewable.

Figure 41 – Treasure Island Fleet of Street Vehicles

Vehicle		Use Metrics	
Number	Year/Make/Model	GAL/YR	Fills/Yr
36	2012 FORD F150	936.8	60
37	2015 GMC SIERRA	761.8	63
38	2016 FORD EXPLORER	972.4	95
40	2018 GMC SIERRA	859	69
1	2001 FORD F350 WHITE	139	5
22	2015 FORD F350 PICKUP	508.8	23
24	2013 CHEV SILVERADO	530.2	26
25	2000 DODGE RAM 1500 GRN	8626	197
26	2012 FORD F350 PICKUP	160.8	7
27	2007 CHEV 3500 RED	442.3	14
30	2017 FORD F350	541.5	26
328	2011 E750 FORD DUMP	397.5	17
61	1985 FORD 8000 DUMP TRK	203.9	7
52	CATERING VAN	391.5	20
50	CHEVY VAN	45.9	2
1	2001 FORD E150 VAN VALET	109.1	7
10	2012 FORD E350 VALET	4,475.1	241
	2008 FORD E450	4,058.2	154
1	2006 FORD E350 BUS TRA	454.1	23

Vehicle		Use Metrics	
Number	Year/Make/Model	GAL/YR	Fills/Yr
11	2015 FORD E450	717.6	31
2	2017 FORD E450 BUS	920.6	37
3	2019 FORD F450 STARCRAFT	169	7
4	2011 FORD VAN TRANS	382.4	45
5	2016 FORD E350 BUS TRANS	421.3	24
8	2012 FORD E450 BUS	1,022.7	42
9	2018 FORD E450	1,178.4	73
	2008 CHEV 25 BOX TRUCK	135.1	5
39	2009 CHEVY TAHOE	33.6	2
12	2018 FORD PANEL	135.1	8

4.7 PERFORMANCE AND EMISSIONS

4.7.1 Potential Reduction of Purchased Utilities and Energy

Electrification of natural gas loads will increase electric consumption by nearly 4.1 million kWh and corresponds with a reduction in natural gas, propane and gasoline consumption by 1,245,578 therms, 15,861 gallons and 14,768 gallons, respectively. This increase of electric consumption is more than offset by reductions attributable to energy efficiency and renewable generation measures. Overall consumption or purchases of electric service is expected to be reduced by 5.33 million kWh. Total natural gas consumption is expected to be reduced by more than 1.57 million therms.

Figure 42 – Anticipated Changes in Purchased Utility Energy

Type of Measure	Electricity (kWh)	Natural Gas (Therms)	Propane (Gallons)	Gasoline (Gallons)
Energy Efficiency	-2,984,721	-306,752		
Electrification	4,065,435	-1,245,578	-15,861	-14,768
Renewable Generation	-6,412,043	-24,501		
Total	-5,331,329	-1,576,831	-15,861	-14,768

4.7.2 Potential Reduction of CO_2 Emissions

The measures identified and evaluated by the Net Zero Project Team and selected by the Tribal Council for implementation offer a potential reduction of annual CO_2 emissions exceeding 19.4 million pounds.

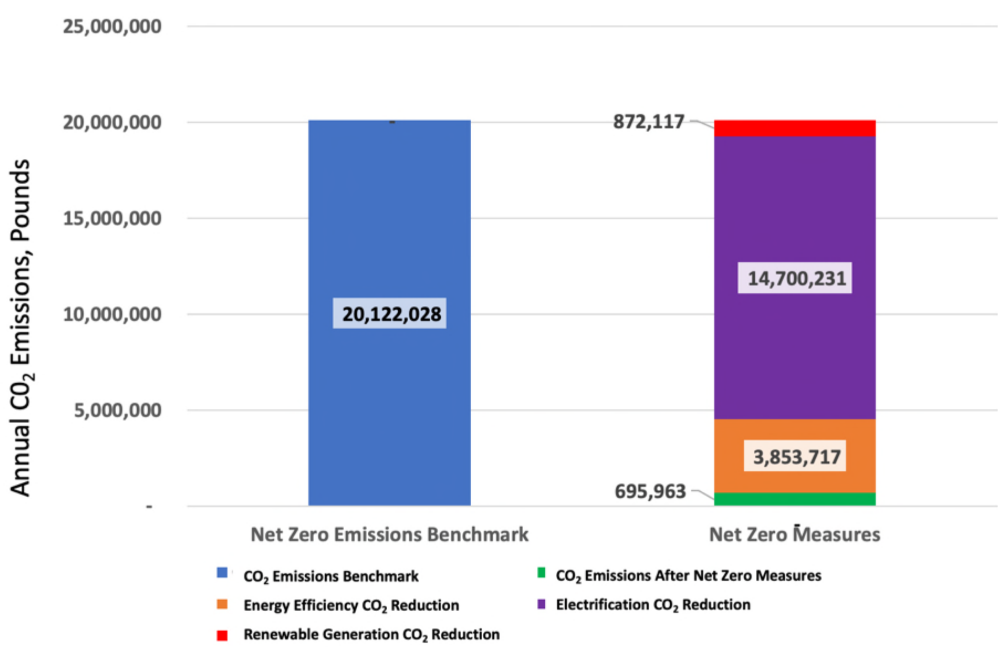
Figure 43 – Potential CO_2 Reduction Based on Selected Net Zero Projects

Type of Measure	Reduction of CO_2 Emissions	
	Pounds	%
Energy Efficiency	3,853,717	19.8
Electrification	14,700,231	75.7
Renewable Generation	872,117	4.5
Total	**19,426,065**	**100**

Energy efficiency measures are expected to yield about 20% of the emissions reduction, while electrification measures represent nearly 76% of the reduction. Measures for renewable generation provide less than 5% of the reduction of CO_2 emissions, reflecting the previously noted decarbonization efforts of the electric utilities.

The aggregate effect of these measures is a 97% reduction of CO_2 emissions relative to the Net Zero emissions benchmark. The remaining carbon will be reduced further with future renewable generation or sequestered through planting native vegetation.

Figure 44 – Benchmark and Anticipated Reductions Based on Selected Net Zero Projects



4.8 OPINION OF CAPITAL COST

The total estimated cost of the measures selected for the Net Zero Project is approximately $42.54 million as shown in Figure 45. Measures for electrification is the predominant segment of the estimated cost at $28.95 million or 68% of the anticipated total Net Zero Project cost. Renewable generation measures account for about 27% of the total cost, or $11.49 million. The remainder of the Net Zero Project cost is for energy efficiency measures: $2.10 million or 4.9% of total Net Zero Project cost.

The energy efficiency measures may represent only 4.9% of estimated cost, however, these measures are expected to yield 23% of overall energy reduction (on BTU basis) and nearly 20% of the reduction of CO_2 emissions. Renewable generation measures represent about 13% of overall energy reduction, generally offset of purchased utilities, but less than 5% of CO_2 emission reduction. Electrification measures will provide 64% of anticipated overall energy reduction and about 76% of the reduction of CO_2 emissions.

Figure 45 – Estimated Capital Costs

Type of Measure	Estimated Capital Cost	% of Total
Energy Efficiency	$2,100,000	4.9%
Electrification	$28,945,000	68.1%
Renewable Generation	$11,494,000	27.0%
Total	**$42,539,000**	**100%**

4.9 COMPLEMENTARY ACTIONS FOR CO_2 EMISSIONS

The Net Zero Project focus on CO_2 emissions directly attributable to the consumption of purchased utilities and energy, and the energy performance of the Casino-Hotel Resort, public and government buildings and vehicle fleet, and the private residences of Tribal members. The following set of actions support and expand overall CO_2 emission of the PIIC.

4.9.1 LEED and Building Codes

Leadership in Energy and Environmental Design (LEED) Certification, sponsored by the U.S. Green Building Council (USGBC) is the most widely recognized green building certification and refers to buildings that have been designed, built, and maintained using green building and energy efficiency best practices.

LEED Certification can be obtained for both existing buildings, based on both structure improvements and modifications in operations and maintenance, and new construction, based on design and materials. There is also a certification for a community as a whole. Certification is based on points earned for performance related to nine basic areas that address key aspects of green buildings:

- Integrative process
- Location and transportation
- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation
- Regional priority

Based upon the number of points earned, a building can obtain one of four certification levels: Certified, Silver, Gold, or Platinum. LEED itself does not reduce carbon emissions; however, it can be used as a guide to encourage improved design and operations that do result in reductions in energy and water use as well as CO_2 emissions. Further LEED Certification would provide a visible means of communicating the Tribe's commitment to environmental stewardship.

The Net Zero Team estimates USGBC costs to certify the TIRC at $16,000 and the costs associated with feasibility studies, data collection, and certification to be an additional $30,000 for a total of approximately $46,000.

4.9.2 Locally Sourcing Food

The food supply chain and food waste have a role on overall CO_2 emissions of the community. Local procurement and processing of food reduces the CO_2 emissions of the food supply chain by essentially eliminating emissions associated with transport and delivery. On-site treatment and management of food waste can mitigate landfill disposal and associated methane emissions. The PIIC is working to shorten supply chains, expand local production, and develop an energy self-sufficient food hub. These efforts will be complemented by agroforestry, caning operations, meat processing, produce preparation, and controlled environment agriculture. A comprehensive strategic plan is expected to be available later this year.

4.9.3 Sequestration—Forest and Prairie Flora

Additional carbon reductions or offsets can be realized through a program of sequestration. Such a program might feature reforestation and/or development of native prairie flora. Planting trees is often noted as a means for absorbing and storing carbon. One sliver maple tree can absorb 455 lbs of CO_2 per year over a 55-year growing cycle. One acre could contain about 48 trees if planted on a 30 ft/ grid, absorbing up to 15,288 lbs of CO_2 per acre-year over a 55-year growing cycle and 70% survival rate. However, prairie grasses may offer a more effective and resilient method for establishing a carbon sink. Most of the carbon absorbed by trees is above ground and is vulnerable to losses through fire and drought. The majority of carbon stored by prairie grasses by contrast is underground as the root system may extended up to 15 ft. Much less carbon is released to the atmosphere in the event of fire. A tall grass prairie can store from 2,200 to 13,933 lbs of CO_2 per acre-year.

4.9.4 Green Power Options

Green power electricity products are supplied from renewable energy resources that provide the highest environmental benefit. Green power is generally defined as capacity or resources that rely on fuel sources that are replenishable and do not diminish appreciably over time. These fuel sources include sun, wind, biomass/biogas and the heat of the earth (geothermal or ground source exchange). Procurement of green power can be a means of realizing carbon reduction benefits without the capital risk of developing green power systems. Green power sold by regulated utilities is often referred to as green pricing or green marketing.

4.9.4.1 Renewable Energy Certificates

Also known as green tags, green energy certificates, or tradable renewable energy certificates (RECs). RECs represent the technology and environmental attributes of electricity generated from renewable sources. RECs are usually sold in 1 MWh units. A certificate can be sold separately from the underlying generic electricity with which it is associated. Once the REC is sold separately from the underlying electricity, the electricity is no longer considered renewable. RECs provide buyers flexibility to offset a percentage of their annual electricity use when green power products may not be available locally.

The Wellspring program, offered through DEA, is an example of purchasing renewable energy certificates. DEA customers can purchase renewable energy certificates in 100-kilowatt-hour blocks. Customers have the two options for purchasing these certificates:

- Purchasing the same number of 100 kW blocks each month. The number of blocks cannot exceed the minimum monthly consumption of the previous 12 months, OR
- The number of blocks each month will vary with energy consumption.

Customers can also designate if the renewable energy certificate is created by wind or solar resources. The present cost of renewable certificates through Wellspring is $0.20 per block from wind resources and $2 per block from solar resources. Participation requires a minimum commitment of 12 months.

Maximum procurement of renewable energy certificates through Wellspring is limited to 10,000 MWh per customer. For example, TIRC could purchase up to 10,000 MWh of renewable energy certificates from wind resources for an annual expense of $20,000, representing an approximate reduction of 912,600 lbs of CO_2 emissions.

4.9.4.2 Purchased Power Agreements (PPA)

A PPA is a type of contract for procurement of energy from a specific generating facility. These types of contracts yield a long-term revenue stream for the facility developer and a steady, predictable cost of energy for the customer. Such an agreement with the developer of a renewable energy facility can also provide a quantifiable and credible source for reducing CO_2 emissions. These opportunities will also be evaluated during the next two phases of the report.

4.9.4.3 Shared Renewable Resources

Participation in the development of renewable energy resources as a co-developer can be another means for obtaining green power and or revenue streams from the sale of green power. Unlike a PPA, the PIIC may have an opportunity participate in a shared renewable resource that will require a capital investment with a predetermined return on the investment (ROI). However, similar to the PPA the participation in the shared renewable resource will provide a quantifiable and credible source for reducing CO_2 emissions.

4.10 FUTURE GROWTH

4.10.1 Residential

Oyate Place consists of 256 acres near the junction of US Highway 61 and Minnesota Highway 316. The senior living facility, Tinta Wita Tipi, is presently the only occupied facility located at Oyate Place. Planning for up to 50 single family residences on one-acre lots is nearly complete. Construction is expected to begin the fall of 2021. Relative placement of the homes should be cognizant of PV installations and electric infrastructure should have capacity to support vehicle charging stations and the homes main electrical panel should be designed and installed to accommodate electric generation and energy storage.

Future development of Oyate Place might include up to 90 additional single-family residences, and 120 multi-family units plus a water utility and community septic system. Space is also available for a solar farm and commercial development along Highway 61.

4.10.2 Commercial and Tribal

The Elk Run property consists of approximately 1,200 acres along US Highway 52 between Oronoco and Pine Island. Formal, specific plans have not been prepared; however, the property offers significant potential for residential and commercial development and development of renewable generation paired with energy storage in addition to stand alone energy storage.

5.0 NET ZERO IMPLEMENTATION PLAN

Over the last several months, the Net Zero Team has been actively involved in community and stakeholder engagement, discussions with leadership, and conducting the technical analyses to develop a set of measures for the Net Zero Project.

The measures the Tribal Council has selected are consistent with community goals and objectives and place the Tribe on the path to net zero.

5.1 PRIORITY AREAS

The Net Zero Team and stakeholders determined that the Net Zero Project should include three priority areas that would provide high-level guidance for selecting the final recommended strategic path. These priority areas provide structure and overarching themes for the Plan, while also capturing requirements to guide the ongoing and future progress of the Net Zero Project. Generally, the broad-scoped priority areas were developed from the SWOT analysis portion of the Net Zero Project.

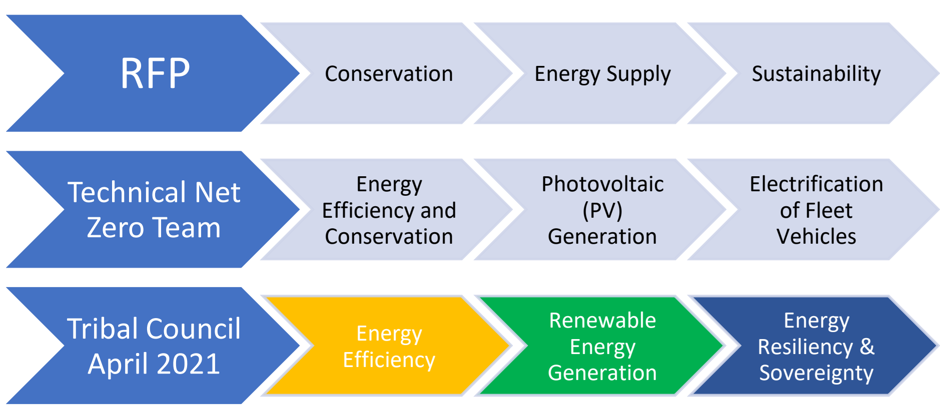
The Tribe's original Request for Proposals (RFP) for "Technical Services for Development of the Prairie Island Net Zero Project" referenced three areas of focus for the Net Zero Project: conservation, energy supply, and sustainability. Over the course of Phase 1, these areas evolved as input was gathered from the community and stakeholders. The areas further shifted as the technical analysis was completed.

As discussed in Section 2, the community survey helped clarify the Net Zero Project's priority areas. This direct community input served to identify those items and concepts that were of the highest interest to the Tribal membership. This input also informed the technical analysis and enabled the Net Zero Team to develop the list of preferred potential solutions.

The RFP, the technical Net Zero Team, and the community used different terminology and various levels of scoping to group the focus areas. Some of these areas were broad and others were very specific. Ultimately, the Tribal Council determined that the Net Zero Project would have three focus areas:

- Energy Efficiency
- Renewable Energy Generation
- Energy Resiliency and Sovereignty

Figure 46 – Focus Areas



5.1.1 Energy Efficiency

A central theme that emerged from the community and stakeholder engagement was that maximizing financial benefits to the Tribe was very important. Energy efficiency generally means using less energy to accomplish the same output, thus eliminating energy waste and reducing costs. Energy efficiency is also a direct path to lowering carbon emissions because it reduces energy requirements, thereby also reducing the need for energy resources (fossil-fuel generated electricity, natural gas, propane) to meet the requirements. Implementing measures that improve energy efficiency reduce the Tribe's carbon footprint, save the Tribe significant financial resources, and improve the environment for the benefit of current and future generations. Through facilitated conversation, based upon the community and stakeholder input and potential technical solutions, the PIIC Tribal Council selected Energy Efficiency as a priority area that encompassed the concepts of energy efficiency, energy conservation, cost savings, and increased electrification of vehicles.

5.1.2 Renewable Energy Generation

From the outset, the PIIC and Tribal leadership stressed the importance of respecting and caring for Ina Maka (Mother Earth). A key component of this was the focus on clean, renewable energy resources to generate electricity for the Tribal community. More specifically, the Tribe prioritized the ability to create or re-create energy based on natural processes that evolve from Mother Earth. This is reflected in the Tribe's core values and the Net Zero Project's guiding principles. The connection between Tribal members and Mother Earth is inseparable. It is a part of the PIIC's existence and who they are as a people.

The original RFP identified energy supply as a key focus area. This was echoed during community and stakeholder engagement with members expressing a keen interest in solar energy. Wind energy was of some interest to the community; however, concerns about the local eagle populations and the fact that the PIIC is within a significant flyaway zone, influenced leadership to not prioritize that option. Several options related to photovoltaic electricity production emerged from the technical analyses and are included in the Selected Net Zero Projects. While technically accurate, the terminology seemed limiting when considering all options for renewable energy generation. The PIIC Tribal Council seemed most comfortable with creating a priority area around the larger concept of Renewable Energy Generation.

Another component of the guiding principles and community input was the desire for innovation and a science-based approach. Again, this interest emanates from the focus on traditional teachings and values of knowledge sharing and understanding that we can do more to protect Mother Earth. Although innovation may seem disconnected from the typical traditional perspective, emphasizing innovation is important to the community and mirrors the PIIC as a people and their story. Before contact and colonization, the ancestors harnessed the power of Mother Earth in a sustainable and respectful manner. This can be continued through natural processes that are replenished constantly from solar, wind, water, geothermal, biofuels, and hydrogen. Part of the goal of the Net Zero Project is to identify the most prevalent resources and create cutting-edge, high-tech renewable energy systems that not only provide expanded energy sources, but also 'improve the world we live in' which we heard very clearly from the Tribal youth.

5.1.3 Energy Resiliency and Sovereignty

The Net Zero Project itself represents a continual effort, not a one-time Net Zero Project or goal that is achieved and then forgotten. The Net Zero Project will result in a significant investment in new technology, infrastructure, equipment, and more for the PIIC. Therefore, a key item that must be considered during the planning process is how the PIIC will address operations, management, and maintenance of the Net Zero Projects and initiatives that enable the Tribe to achieve and sustain net zero. Additionally, this Net Zero Project provides an opportunity for the PIIC to truly progress down the path towards energy sovereignty and independence.

It is important for the PIIC to have a reliable, regular energy supply and resilient system that can withstand power failures or outages. Finding ways to become more resilient to manage through changing conditions, such as power surges, inclement weather, natural disasters, accidents, and even equipment failure will help the PIIC to create strategies and further the concept of energy sovereignty. This was a recurring area of importance to the Tribal membership, as indicated through the community meetings, stakeholder sessions, and membership survey.

For instance, the question of governance is central to the future direction of the Net Zero Project. The consideration of a potential governance structure to oversee all aspects of the current and future operation should be at the forefront of conversations. There are many forms this could take, but in general a clear understanding of the broad responsibility for maintenance, management, strategy, as well as the development of potential future partnerships should be a key consideration. This will ensure that the investment is well-managed in alignment with long-term strategies for the PIIC and their efforts to continually exercise their sovereignty.

The initial RFP included sustainability as a focus area. During Phase 1 discussions, it was apparent that the concept of sustainability was closely linked with resiliency and sovereignty. These were key insights gained from the community engagement, but they were also necessary concepts because the Net Zero Project is owned by a sovereign nation. The notion of sovereignty brings forward a different level of consideration than a Net Zero Project owned and operated by a private corporation, a non-profit organization, or even a local government or utility. The Tribal Council felt it necessary to consider all aspects of operations, maintenance, upkeep, and management through a lens of resiliency and sovereignty.

5.2 IMPLEMENTATION PLAN

The measures selected for implementation (Selected Net Zero Projects, see Appendix) based on technical analyses and active community input represent a total estimated capital cost of nearly $42.54 million. The technical performance of the measures will be confirmed with the preliminary engineering to be conducted in Phase 2 of the Net Zero Project. The preliminary engineering will also provide the detail required to solicit contractor bids. The results of this bidding process will be used to develop the Net Zero Project certified cost report that is to be submitted to the State of Minnesota by January 1, 2022.

Three cycles of implementation are anticipated. Each cycle is intended to align with distribution of funds from the Xcel Energy RDA. Each cycle is presumed to be 12 months; however, the respective durations may be extended to accommodate availability and delivery of equipment, and mobilization of contractors for implementation of measures.

The total estimated cost of measures assigned to Cycle One is $14.42 million. This cycle consists primarily of Energy Efficiency and Electrification measures. Cycle One also includes development of the wellfield of the heat recovery ground source heat pump system. See Figure 47.

Figure 47 – Cycle One Implementation

Measures	Buildings	Estimated Capital Cost
Energy Efficiency		
Water/Energy Improvement	Casino	$ 59,000
Commercial Lighting - Replace with LED	Casino & Tribal Buildings	$ 340,000
Lighting Controls	Casino & Tribal Buildings	$ 355,000
Wastewater Reuse for Irrigation	Water Plant	$ 350,000
Exterior Lighting	Casino	$ 47,000
Monitoring Based Commissioning	Casino	$ 28,000
Exhaust Hood Controls	Casino	$ 20,000
Refurbish original ERUs	Casino	$ 136,000
Bathroom Exhaust ERUs for Makeup Air	Casino	$ 651,000
Various Water/Energy Measures	Residential	$ 11,000
Reports & Monitoring: Electric & Water	Residential	$ 103,000
Electrification		
Heat Recovery GSHP Wellfield	Casino	$ 8,424,000
Heat Pump Water Heaters	Community Center/Clinic	$ 64,000
	Administration	$ 23,000
	Public Safety	$ 23,000
	Casino-Hotel Resort	$ 93,000
	Residential	$ 246,000
Air Source Heat Pump	Casino	$ 376,000
Fleet Vehicles	Casino & Tribal Government	$ 1,251,000
Generation		
South Facing Solar Thermal	Casino	$ 532,000
Photovoltaic	Community Center/Clinic	$ 60,000
	Dakota Station	$ 70,000
	Elder Center	$ 57,000
	Mount Frontenac Golf	$ 33,000
	PIIC Administration	$ 82,000
	Public Safety	$ 23,000
	Residential	$ 901,000
	Tinta Wita Tipi	$ 64,000
Cycle One Total		**$ 14,422,000**

The corresponding estimated capital cost for measures implemented in Cycles Two and Three are $16.13 million and $11.99 million, respectively. Cycle Two includes completion of the heat recovery ground source heat pump system, installation of an air source heat pump system in the Community Center/Clinic, and dryer heat recovery and electrification at the Casino-Hotel Resort. Cycle Three activities include installation of the remaining renewable generation measures and remaining electrification measures. See Figures 48 and 49.

Figure 48 – Cycle Two Implementation

Measures	Buildings	Estimated Capital Cost
Electrification		
Heat Recovery Ground Source: Balance of Plant	Casino	$ 15,032,000
Dryer Heat Recovery and Electrification	Casino	$ 247,000
Air Source Heat Pump	Community Center/Clinic	$ 849,000
Cycle Two Total		$ 16,128,000

Figure 49 – Cycle Three Implementation

Measures	Buildings	Estimated Capital Cost
Electrification		
Electric Stoves/Ovens	Casino	$ 238,000
	Residential	$ 116,000
Electric Dryers	Residential	$ 254,000
Washwater Heat Recovery	Casino	$ 47,000
Air Source Heat Pump	Public Safety	$ 339,000
	Residential	$ 707,000
Ground Source Heat Pump	Administration	$ 615,000
Generation		
Large Array: 2 MW	Casino	$ 4,671,000
Large Array: 2 MW	Community	$ 4,671,000
HRSG Plant	Heating Plant	$ 331,000
Cycle Three Total		$ 11,989,000

6.0 NET ZERO PROJECT PROCUREMENT PLAN

The PIIC Net Zero enabling legislation requires that the PIIC "obtain bids to construct the proposed Net Zero Project from no fewer than three separate contractors and must enter into one or more contracts to complete the Net Zero Project and must submit the certified total cost to the commissioner no later than January 1, 2022." It further specifies that 'certified total cost' means the total cost of all contracts the Prairie Island Indian Community enters into with contractors to complete the Prairie Island Net Zero Project." The law anticipates that the PIIC will put in place a plan and process for soliciting projects that will enable the Tribe to meet its Net Zero goals. Implementation of this process must be completed from July to December 2021. This section of the Plan describes the plan, process and procedures the PIIC will use to procure the necessary resources to meet the requirements of HF 1842 and ensure that the funds are prudently spent to maximize benefits to the PIIC and the State.

6.1.1 SCOPE OF SOLICITATIONS

The scope of the solicitations is driven by the Selected Net Zero Projects list as described in Section 5. The Procurement Team expects to issue a series of solicitations beginning in the third quarter of 2021 to select and begin implementing the Net Zero Projects discussed in Section 5.2.

6.2 GUIDING POLICIES

The PIIC has developed a Procurement Plan to guide the solicitations and ensure that the process is prudent, fair, and transparent and reflects Tribal priorities. The Procurement Plan is built upon the PIIC's existing purchasing procedures, recognizing the unique scope of the Net Zero Project. In place for nearly three decades, the PIIC Procurement and Property Manual has enabled the PIIC to build a state-of-the-art casino and numerous Tribal-owned properties in a manner consistent with the Manual's purpose: Establish and enforce purchasing procedures which assure the best price for performance and performance guarantees, all while staying within the Net Zero Project(s) budget.

The Tribe has also adopted policies specifically related to procurement and contracting using Federal or State funds. These "Procurement and Contracting with Federal and State Funds" guidelines are particularly relevant. Since the operative grant that funds the Net Zero Project is provided by the State of Minnesota, the policy included at the beginning of the guidelines applies:

> "When contracting or procurement with federal or state funds, the Tribe will use their procurement procedures and shall conform, to the extent possible without infringement upon Tribal Sovereignty, to procurement and contracting requirements made by the grantor/agency as detailed in the fully executed contract or grant agreement. In the absence of such language in a contract or grant agreement, the Tribe will follow Tribal procurement policy and procedures and applicable laws and the procurement standards pursuant to the 2 Code of Federal Regulations (CFR) Uniform Guidance."

The Tribe believes it is important to create a specific Procurement Plan and processes for procuring the necessary projects. The following subsection describes in more detail the plan's structure.

6.3 PROCUREMENT PLAN OBJECTIVES AND STRUCTURE

The Procurement Plan aims to achieve the following outcomes:

- Selected proposals establish the certified total cost required by HF 1842.
- Selected proposals offer the best balance between technical solution, price, and Net Zero Project(s) performance guarantees.

- Whenever possible and prudent, the selections promote the PIIC's goals of Tribal and local economic development.
- The procurement process is conducted in a fair and efficient manner.

It is very important to the PIIC that the Procurement Plan and process help the Tribe achieve a number of key objectives, in addition to selecting contracts and contractors to implement the Selected Net Zero Projects. These key objectives, also discussed in Section 2, include promoting Tribal economic development, respecting the PIIC's Vision and Values, establishing an approach to net zero that is sustainable for more than seven generations, and fostering opportunities for non-PIIC members, minorities, and women.

6.3.1 PIIC Principles

As described above, the procurement guidelines that will direct specific solicitation and contracting requirements include elements designed to support the PIIC principles. Specifically, RFPs and contracts will contain language similar to the following:

- Bidder is expected to comply with applicable preference in employment and contracting, such as Indian Preference, certified Disadvantaged Business Enterprise (DBE), Minority Business Enterprise (MBE), Small Disadvantage Business (SDB) and Women's Business Enterprise (WBE) firms as partners, subcontractors and suppliers.
- The work to be performed under this scope is subject to the Indian Self-Determination Act (25 U.S.C. 450), that requires to the greatest extent feasible, and all parties will comply with the provisions of the Indian Self-Determination Act. Bidder will include this clause in every subcontract in connection with the Net Zero Project.
- Work performed will meet or exceed current State and Federal construction codes and regulations.

The Bidder Outreach Plan has been developed to both provide the Net Zero Project with competitive bids from qualified firms and to promote the Net Zero Project's resulting economic development to Tribal and local businesses; however, outreach will be balanced with the need for a speedy procurement process as defined by HF 1842 without jeopardizing quality of materials or workmanship.

6.3.1.1 General Outreach

For overall Net Zero procurement communications, the Procurement Team will promote contracting opportunities to both the broad vendor community as well as specifically to local businesses. The Procurement Team will work with the PIIC to leverage existing Tribal communication methods. In addition, the Procurement Team will contact state and local agencies responsible for decarbonization activities and related trade organizations to request their insights on how best to reach qualified contractors.

It is expected that general contracting opportunity announcements will be made to the PIIC business community, local business communities, and decarbonization contractors using the following means:

- The PIIC press announcements
- Relevant email distribution lists
- Advertisements in local/relevant newsletters

6.3.1.2 PIIC NZ Net Zero Project Procurement Website

The Procurement Team, in coordination with the PIIC, will establish a website dedicated to the Phase 2 procurement activities. This website will provide potential bidders with general information about the Net Zero Project, a means to express interest in Net Zero Project types, and information related to specific competitive solicitations.

6.3.1.3 Specific Solicitation Outreach

The Procurement Team will establish a vendor bidder list using information from the PIIC, the State of Minnesota, trade organizations, and the Net Zero Project Procurement Website. For specific solicitations, the Procurement Team will establish a list of appropriate contractors and invite them, via email, to participate in the solicitation.

6.4 SOLICITATION PROCESS

For each of the Selected Net Zero Projects, the Procurement Team will hold a competitive solicitation. In some cases, similar Net Zero Projects may be grouped into a single solicitation if doing so provides efficiencies for both the Procurement Team and bidders. Each solicitation will generally be comprised of the elements described further in this section.

6.4.1 Solicitation Planning

An overall Phase 2 solicitation schedule will be proposed by the Procurement Team, reviewed by the PIIC Steering Committee, and implemented as approved by the PIIC. This Procurement Plan will be developed to stagger the release of solicitations and their subsequent evaluation to the extent possible and consider the various solicitation constraints, the primary being the need to develop technical specifications to a sufficient degree to allow firm proposals from bidders.

6.4.1.1 Bid Package Categories

The Procurement Team will develop and present specific bid package categories and the applicable procurement rules for such categories. It is anticipated that there will be at least three categories. Major Net Zero Projects will require a full RFP process including an interview with a shortlist of bidders. Medium Net Zero Projects will require an RFP process but without an interview. Minor Net Zero Projects will use an expedited procurement process, but still comply with the PIIC procurement procedures or direction.

6.4.1.2 Simplified Procurement Process for Minor Net Zero Projects

Given the overall size of the Net Zero Project and the large number of individual Net Zero Projects that comprise the Selected Net Zero Projects, this plan anticipates creating a simplified procurement process for Minor Net Zero Projects. This process would replace an RFP with either a simple Request for Quotation (RFQ) of standard materials or services from a number of qualified contractors or, in some cases where a simple RFQ from multiple bidders is not practical, a sole-source award. Minor Net Zero Projects will be defined as having an aggregate contract value of less than an amount approved by the Tribal Council. The Procurement Team will review the simplified acquisition threshold established by the Office of Management and Budget Guidance for Grants and Agreements. All selections based on this simplified process would still require the PIIC's approval.

6.4.1.3 Net Zero Project Packages

To allow for an efficient procurement process, minimize the effort for bidders, and streamline the approval process for the PIIC, individual Net Zero Projects will be aggregated into Net Zero Project packages whenever doing so is technically feasible and generally reasonable. An example of a Net Zero Project package might be to combine the various roof-top solar Net Zero Projects into one package for solicitation, contracting, and installation purposes.

6.5 SPECIFIC SOLICITATION PLANNING

For each specific solicitation, the Procurement Team will develop a schedule which will include the appropriate bid package categorization, the anticipated RFP release and evaluation schedule, the announcement/invitation method(s) to be used, required technical input, and the identification of the solicitation evaluation team.

6.5.1 RFP Development

the Procurement Team will develop one or more RFP templates based on the Net Zero Team's experiences with similar scopes. To speed the development and evaluation process of each solicitation, the template(s) will be approved by the PIIC Steering Committee. The appropriate template will then be modified for each specific solicitation.

It should be noted that for many of the solicitations, the key element of each RFP will be the technical specification of the scope. Elements included in each RFP will include:

- The PIIC Background and Guiding Principles
- Purpose of Solicitation
- Scope Definition, including Technical Requirements
- Performance Guarantees
- Product Guarantees
- Inspection/Verification
- Cost/Pricing
- High-Level Evaluation Criteria
- Description of the PIIC Procurement Preferences

In addition to the elements listed above, bidders may be asked to submit pricing based on defined options which may include expanded or reduced scope and/or a larger or small installation size or number of units. These pricing options may be used to optimize the individual project composition of the overall Net Zero Project.

6.5.2 Bidder Conferences

To improve communication with bidders and thus promote enhanced competition, innovation, and clear communication of the PIIC's goals and priorities, the Procurement Team will hold a bidder conference for each solicitation, or, in some instance, a group of solicitations. Bidder conferences may be held in person but will always include a remote attendance option.

6.5.3 Scoresheet Development and Evaluation

The Procurement Team assigned to each solicitation will score each proposal received in response to an RFP using a scoresheet developed for the specific solicitation. The Procurement Team will establish the scoresheet prior to receiving (or at a minimum opening) any proposals. The recommendation for selection of a bidder for contracting will be based upon the total score received by each bidder using the scoresheet. Each scoresheet will be developed to ensure technical competency, past performance, installation schedule assurance, material supply chain, product guarantees, performance guarantees, pricing, and compliance with the PIIC principles and procurement preferences.

6.5.4 Shortlist Interviews

For Major Net Zero Projects, the Procurement Team, and the PIIC representatives will conduct interviews with a shortlist of bidders who have provided the most competitive proposals. The purpose of these interviews will be to clarify elements of the proposals and to gain a better understanding of how each bidder would partner with the PIIC to advance the objectives of the Net Zero Project.

6.5.5 Selection and Use of Proposal Data

Once the Steering Committee has reviewed and approved the recommended proposals, the Procurement Team will create the Phase 2 Certified Cost Report using selected scopes and associated pricing.

6.6 PERMITS AND AUTHORIZATIONS

Net Zero Projects that affect buildings, land, water, or air are generally subject to federal and state statutory and county or local permitting and ordinance requirements. Since tribes are sovereign nations, the PIIC has the authority of a political entity to govern itself, including determining its own government structure and laws. As such, the applicability of federal and state laws and county and local requirements depend on the location of the Net Zero Projects discussed in this report. As currently proposed, all Net Zero Projects will be on trust land and, therefore, certain laws and county and local requirements do not apply. However, the PIIC has committed to follow federal requirements, where applicable, and be guided by state, county and local requirements with the goal of meeting or exceeding industry standards on Net Zero Projects that affect electrical infrastructure, buildings, land, water, or air. The Tribe uses third-party inspectors and reviewers to confirm compliance and self-regulates Net Zero Project operation.

Solicitation documents will require that bidders incorporate into their proposals and Net Zero Project designs compliance with all federal and state laws and, when applicable, county, and local ordinances. The Tribe's own inspectors and reviewers will confirm compliance with applicable requirements and require that selected implementers remedy any identified deficiencies. The Tribe will manage ongoing Net Zero Project implementation and ensure that Net Zero Projects remaining in compliance.

6.7 CONTRACTING

At the conclusion of each solicitation, the Procurement Team will recommend contingent contract awards to one or more successful bidders. After the PIIC approval, bidders will be notified of the outcome of the solicitation and negotiations with those selected for contracting may begin; however, final contracting will depend upon delivery of the Certified Cost Report to the State. All contracting will also be conducted in compliance with the PIIC procurement procedures.

7.0 FUTURE CONSIDERATIONS

The magnitude of the Net Zero Project and initiative cannot be understated. Not only is it a financially significant Net Zero Project, but it is also a transformational Net Zero Project when looking at the long-term impact. However, it is important to keep in mind that the Net Zero Project is not being completed in a vacuum, as the PIIC has multiple priorities to consider when plotting their strategic path forward. This will necessitate a prioritization of resource commitment, as well as strategic alignment of the Net Zero Project with other operations, long-term strategies, and economic development opportunities. Many of the specifics of these will be finalized as the Net Zero Project progresses through bidding and implementation; however, consideration of these facets must be made now.

7.1 GOVERNANCE AND OPERATIONS

The investment from the Net Zero Project necessitates consideration of oversight, management, and governance on the part of the PIIC. More specifically, decision considerations may include, but not limited to:

- Oversight and management structure
- Authority and independence considerations
- Define expertise of internal management versus the need for external resources
- Short-term and long-term funding considerations
- Investment structure considerations
- Re-investment considerations

Taking on the Net Zero Project will likely require expanded resources for the PIIC to appropriately manage the process and evaluate the required infrastructure and elements of the Net Zero Project. These elements may extend beyond maintaining systems to implementing new infrastructure. This new infrastructure and systems will establish a new minimum baseline for future operations. Creating ideas and conceptual thoughts is one part of the Net Zero Project; however, creating systems that promote and enhance the forward movement of energy resiliency and sovereignty then become a vital part of the Net Zero Project and will impact other considerations in the future. The PIIC will manage each element of the operations, and as the processes evolve, the PIIC must also be prepared to adjust its internal functions accordingly.

7.1.1 Governance Structures

The Net Zero Project will require the PIIC to thoroughly evaluate several operational decisions to ensure a stable structure and operating path for the long-term benefit of the PIIC. There are several options that may best fit the need; however, Tribal leadership must consider in detail the benefits of each to determine the structure or arrangement that makes the most sense. It is the responsibility of Tribal leadership to establish and implement an appropriate governance structure and it is critical that the appropriate steps be taken to ensure a strong foundation for any governance structure. Whatever path is chosen, it is likely that amendments or additions to Tribal Ordinances will be necessary. In Phase 1, the Net Zero Team identified the various options at a high level and will proceed with Phase 2 in a manner that evaluates in detail the positive and negative attributes of each option.

7.1.1.1 Tribal Business Entities

Tribal governments often directly control or participate in business activities through unincorporated instrumentalities of the tribe. These are often referred to as ‘economic arms’ of the tribe. These instrumentalities or arms of Tribal government are not considered to be distinct legal entities. A Tribal enterprise is a common example of one of these entities. Tribal governments also leverage other business entities in order to conduct business. These business entities are often considered distinct legal entities. In many of these cases, Tribal governments will seat a board of directors in order to provide oversight and direct a chief executive or general manager. Tribally chartered LLCs and Section 17 Corporations are some, but not all, examples of Tribal business entities.

7.1.1.2 Tribal Utility

A Tribal utility can be structured very similarly to a Tribal enterprise where Tribal government maintains control through an unincorporated instrumentality of the Tribe, or they can be structured with a board of directors that directs a manager who oversees operations. These are often referred to as 'utility arms' of the Tribe. These instrumentalities or arms of Tribal government may not be considered distinct legal entities. Tribal utilities are a common example of one of these entities.

7.1.1.3 Tribal Department

A Tribal department is structured within the Tribal organizational structure and is typically under the direct control of the Tribal government. The control includes the management and the allocation of fiscal resources to operate the department. A Tribal department is not considered a distinct legal entity.

7.1.2 Operations and Maintenance

Many of the considerations for operations and maintenance depend on numerous strategic business decisions. For example, operations and maintenance looks very different for a utility if the focus is on off-Reservation investment rather than on-Reservation generation. Keeping this in mind, the major operations and maintenance decisions that need to be explored include staffing requirements, site requirements, customer service, and funding considerations. If on-Reservation generation is a goal, a robust staffing plan will need to be developed to service the generation assets. This ongoing maintenance will take place both during regularly scheduled times, as well as times when there are power outages. Another consideration is not only the amount of land necessary for generation, but also the space necessary for warehousing and workshops for the utility maintenance department. Customer service and clear communication will be essential for smooth operations, especially during adverse weather conditions. Funding considerations for ongoing operations and maintenance is necessary to clearly understand the financial implications of generating electricity. Opportunities to partner with local utilities may provide mentor protégé programs that can slowly develop the O&M Net Zero Teams.

7.1.3 Oversight

In addition to the selected operating structure and operations, it is important to clearly articulate the oversight function and appropriately map out responsibilities. This will include strategic decisions to ensure compliance with applicable regulations. Depending on operating structure, Tribal Council could act in the oversight role, or it could be a board of directors. Based on the nature of operations, the oversight role could be exceedingly complex. Regardless of the strategy, it will be necessary to map out responsibilities regarding oversight and regulatory compliance.

7.2 LONG TERM STRATEGIES

The Net Zero Project does not stop when Phase 3 is completed. Decisions made now will influence decisions that will be made in the future. The Net Zero Project represents a significant endeavor undertaken by the PIIC. While impactful in the immediate term, the longer-term commitment and considerations must be contemplated now. Any specific considerations from the Net Zero Project must align with other strategic initiatives and priorities of the PIIC. The interplay of long-term Net Zero considerations and long-term strategic needs of the PIIC must be appropriately balanced going forward.

As part of the Phase 1 process, the Net Zero Team engaged in conversation around future economic development that identifies multiple avenues for the PIIC to consider that potentially benefits the community in the future. The current stakeholder input sessions and technical analysis along with our experience in Indian Country have helped us to identify a framework to further evaluate future economic development opportunities. The following outline examines the opportunity on-site and off-site that helps the Tribe to take advantage of future economic possibilities as owners or partners:

- On-site Energy Generation
    - Grid-facing opportunities and solutions
    - Utility scale generation on trust property
    - Generation on acquired land (may be deeded or in trust)
    - Behind-the-meter opportunities and solutions
    - Community housing
    - Existing construction
    - New construction
- Off-site Energy Generation
    - In-state
    - Out-of-state
    - Considerations of ownership, investment, distribution, etc.
- Storage as a Service
    - On-site
    - Off-site
- Partnership considerations through Special Purpose Entities
- Evaluating local and regional energy partnerships

In addition to these potential strategies, the community and stakeholder engagement process identified several considerations to guide long-term strategies. Some of these are reflected in the Net Zero Project's guiding principles, but others go beyond the strict scope of Net Zero and Phase 1. It is important to allow these thoughts, although not conclusive, to guide future long-term strategies, whether those be regarding the Net Zero Project or more comprehensive plans. These are best understood as community-based considerations, financial considerations, and energy-specific thoughts and the Tribe's long-term vision.

Figure 50 – Community Input Guiding Long-Term Strategies

Community

- We must better our community
- We must make our community more knowledgeable around energy and the environment
- Our community is young, we must build infrastructure to impact future generations
- We cannot wait 10,000 years for waste to be safe, we must move ahead while balancing important decisions for cost v/s benefit options
- Land Use - current, future considerations, potential acquisitions

Financial Considerations

- We must find ways to utilize the energy infrastructure to create more business opportunities
- It is imperative that we put financial resources into our infrastructure
- Focus on ways to lower monthly power costs to community members
- Save a dollar, make a dollar
- Evaluate and consider financial and non-financial costs
- Consideration of human resources is as important as financial resources, must be based on needs and demand

Energy-Specific

- Energy improvements are critical for the future
- Solar is what our people relate to and there are good examples
- Distributive wind systems may be a good path to explore
- Solar is path of least resistance, however solutions must account for down months
- Energy partnerships are of interest, but must create value

7.3 ECONOMIC OPPORTUNITIES

The Net Zero Project will have substantial ancillary benefits in addition to the primary benefit of reducing emissions. A key component of the RFP was to evaluate and identify economic development opportunities that may result from the Net Zero Project. In short, economic development opportunities are wide-ranging with a host of short-term and long-term options. It is of critical importance that these opportunities be evaluated and considered in a manner respectful of the PIIC's sovereign status. Incorporating the strategic, competitive, and comparative advantages of the Tribe would benefit the PIIC as they execute their long-term vision.

The potential for economic development emerges in the Net Zero Project from several areas:

- Potential savings realized allows for a reallocation of resources within the Tribe.
- The necessity of governance and oversight provides new opportunities for separation of business or quasi-business functions from the central government of the PIIC.
- The generation of electricity through clean and renewable sources requires a mechanism for distribution, which allows the potential for revenue.
- The new systems and technologies, as well as the construction phase, brings forward workforce development and career path opportunities alongside potential entrepreneurship.

Many of these decisions will be based upon more specific information that comes forward during Phases 2 and 3 of the Net Zero Project. However, consideration and understanding of the decisions that are forthcoming is helpful. Additionally, many of these considerations, as mentioned earlier, should align with the Tribe's future planning.

7.3.1 Leveraged Funding

As stated previously, the Net Zero Project should be viewed as the beginning of an effort that will be sustained over multiple generations. From a financial perspective, there are significant opportunities to leverage the existing funding to continue to grow and expand the intent and purpose of the Net Zero Project. More specifically, opportunities exist to leverage the funding to secure additional grant resources. These grants could enhance or supplement the current state funding, thereby extending and broadening the impact of the initiative. As a sovereign nation with a government-to-government relationship with the United States, the PIIC is eligible for grants, direct awards, and other programs. Key to leveraging the existing funding is a robust and sophisticated approach to grant applications, relationships with federal agencies, eligible Net Zero Projects, and the capabilities to establish a compelling narrative. On the back end, the compliance, and fiscal components of managing a grant will prove necessary.

The primary categories to explore include federal grants, state and local grants, private foundations, and other federal funding resources. Each of these have multiple agencies and opportunities that align with the strategic opportunities brought forward in the Net Zero Project. Many of these funders will require some type of match funding, which the Net Zero funds could serve as a leveraging resource. Regarding federal grants and other funding resources, several paths are offered that deserve further exploration. These include competitive grants, direct funding or allocation, formula allocation, and loan guarantee programs (when the Net Zero Projects are considered financeable).

The following is a potential list of grant agencies that have been contacted or will be contacted in the future to evaluate any potential funding opportunities:

- US Department of Energy, Office of Indian Energy
- US Department of Energy, Energy Efficiency & Renewable Energy
- US Environmental Protection Agency
- US Department of Agriculture
- US Department of Interior - Bureau of Indian Affairs, Office of Indian Energy and Economic Development
- US Department of Commerce - Economic Development Administration
- US Department of Health and Human Services – Administration for Native Americans

8.0 SUMMARY CONCLUSION

The PIIC Net Zero Comprehensive Project Plan provides a path to 97% reduction of Prairie Island Indian Community's carbon footprint. This will benefit the environment and future generations to come by helping them to prosper and live a healthier life. With the conclusion of Phase 1, which emphasized stakeholder engagement, technical analysis and development of an implementation plan, the Project now moves into a second phase. Phase 2 adds additional technical analysis, project costing and preparation of a certified cost report. Phase 2 will begin July 1 and conclude with the delivery of a certified cost report due to the Minnesota Legislature by January 1, 2022.

9.0 APPENDIX

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Appendix: Selected Net Zero Projects

Priority Area	Description of Measure	Location of Measure	Change in Consumption					Estimated Capital Cost	Avoided Expense	CO2 Emission Reduction (LBS)	Simple Payback (years)
			Electric (kWh)	Nat Gas (Therms)	Propane (Gal)	Gasoline (Gal)	Water (Gal)				
Energy Efficiency	Refurbish original ERUs	Casino	188,674	(155,145)				$136,000	$(68,628)	(1,799,810)	2.0
Energy Efficiency	Equipment Monitoring and Assumption Verification	Casino & Hotel	(1,248,093)					$28,000	$(90,000)	(113,901)	0.3
Energy Efficiency	Bathroom Exhaust ERUs for Makeup Air	Hotel Towers	280,523	(95,960)				$651,000	$(26,734)	(1,098,265)	24.4
Energy Efficiency	Commercial Lighting - Replace with LED	Hotel, Casino Main	(1,447,583)					$340,000	$(166,623)	(132,106)	2.0
Energy Efficiency	Lighting Controls	Hotel, Casino Main	(448,904)					$355,000	$(43,059)	(40,967)	8.2
Energy Efficiency	Exterior Lighting	Hotel, Casino Main	(51,543)					$47,000	$(4,944)	(4,704)	9.5
Energy Efficiency	Various Water/Energy Measures	Hotel/Casino	(12,810)	(44,842)			(8,326,889)	$59,000	$(26,296)	(526,355)	2.2
Energy Efficiency	Exhaust Hood Controls	Kitchen	(48,766)				-	$20,000	$(3,517)	(4,450)	5.7
Energy Efficiency	Various Water/Energy Measures	Single Family Homes	-	(8,997)			(1,657,845)	$11,000	$(5,461)	(105,365)	2.0
Energy Efficiency	HER for Electric & Water	Single Family Homes	(14,131)	(1,808)			(3,796)	$103,000	$(2,896)	(22,465)	35.6
Energy Efficiency	Wastewater Reuse for Irrigation	Water Treatment Plant	(58,383)				(37,809,000)	$350,000	$(5,967)	(5,328)	58.7
Electrification	High performance ASHP	Back of house	159,200	(16,302)				$376,000	$7,439	(176,403)	NA
Electrification	HPWH: Modify DHW heating system	Casino & Hotel	64,872	(8,854)				$93,000	$6,223	(97,773)	NA
Electrification	Heat Recovery Geothermal Plant	Casino & Hotel	2,132,341	(1,022,375)				$23,456,000	$(407,784)	(11,779,271)	57.5
Electrification	Treasure Island: Transportation	Casino & Hotel	157,474			(10,477)		$657,000	$(17,594)	(189,130)	37.3
Electrification	Treasure Island: Security	Casino & Hotel	15,011			(1,909)		$218,000	$(2,543)	(35,715)	85.7
Electrification	Heat Pump Water Heater	Community Center/Clinic	37,625	(6,419)				$64,000	$(40)	(71,742)	1598.1
Electrification	Air Source Heat Pump	Community Center/Clinic	285,386	(38,274)				$849,000	$5,152	(422,217)	NA
Electrification	Convert to Electric Stoves	Kitchen	262,385	(25,366)				$99,000	$10,989	(273,132)	NA
Electrification	Convert to Electric Ovens	Kitchen	114,373	(7,805)				$140,000	$6,608	(80,971)	NA
Electrification	Washwater Heat Recovery	Laundry	58,372	(25,183)				$47,000	$(19,352)	(289,613)	2.4
Electrification	Dryer Heat Recovery & Electrification	Laundry	154,052	(42,155)				$247,000	$(8,788)	(479,648)	28.1
Electrification	Heat Pump Water Heater	Public Safety	3,957	(675)				$23,000	$(4)	(7,544)	5461.3
Electrification	Air Source Heat Pump	Public Safety	34,405	(4,634)				$339,000	$695	(51,133)	NA
Electrification	Tribal Government: 210, Police	Public Safety	13,379			(2,382)		$376,000	$(4,616)	(45,054)	81.5
Electrification	Res Heat Pump Water Heater	Residential	216,000	(14,850)	(7,418)			$246,000	$14,381	(246,062)	NA
Electrification	Res Electric Stove/Ovens	Residential	60,839	(2,841)	(1,419)			$116,000	$1,844	(45,291)	NA
Electrification	Res Air Source Heat Pump	Residential	185,748	(13,228)	(6,608)			$707,000	$3,058	(219,800)	NA
Electrification	Res Electric Dryers	Residential	25,936	(834)	(417)			$254,000	$2,565	(12,560)	NA
Electrification	Heat Pump Water Heater	Tribal Admin	6,389	(1,090)				$23,000	$(7)	(12,183)	3382.0
Electrification	Geothermal Heat Pump	Tribal Admin	77,692	(14,693)				$615,000	$(1,662)	(164,992)	370.1
Renewable Generation	South Façade Solar Thermal	Buffalo Tower	14,676	(24,501)				$532,000	$(12,288)	(285,614)	43.3
Renewable Generation	400 kW Allocation of 2 MW PV Array	Casino 1 & 2	(553,365)					$934,000	$(44,032)	(50,500)	21.2
Renewable Generation	600 kW Allocation of 2 MW PV Array	Casino 3&4	(830,047)					$1,401,000	$(66,050)	(75,750)	21.2
Renewable Generation	400 kW Allocation of 2 MW PV Array	Casino 6&7	(553,365)					$934,000	$(44,032)	(50,500)	21.2
Renewable Generation	31.5 kW Roof Mount	Community Center/Clinic	(43,190)					$60,000	$(3,871)	(3,942)	15.5
Renewable Generation	40 kW Pump Canopy	Dakota Station	(45,352)					$70,000	$(4,075)	(4,139)	17.2
Renewable Generation	30 kW Roof Mount	Elder Center	(32,878)					$57,000	$(2,461)	(3,000)	23.2
Renewable Generation	17.6 kW Roof Mount	Frontenac Golf	(23,296)					$33,000	$(2,019)	(2,126)	16.3
Renewable Generation	600 kW Allocation of 2 MW PV Array	Hotel Casino 5	(830,047)					$1,401,000	$(74,045)	(75,750)	18.9
Renewable Generation	175 kW PV Roof Mount	HR HRSG Plant	(239,946)					$331,000	$(26,898)	(21,897)	12.3
Renewable Generation	2 MW Larger Capacity	Near Mato Circle	(2,766,824)					$4,671,000	$(51,653)	(252,500)	90.4
Renewable Generation	43 kW Roof Mount PV	PI Administration	(58,451)					$82,000	$(3,975)	(5,334)	20.6
Renewable Generation	12 kW Roof Mount	Public Safety	(16,454)					$23,000	$(1,309)	(1,502)	17.6
Renewable Generation	3 kW Roof Mount	Residential	(387,434)					$901,000	$(49,733)	(35,357)	18.1
Renewable Generation	33.6 kW Roof Mount PV	Tinta Wita Tipi	(46,070)					$64,000	$(3,288)	(4,204)	19.5
		TOTALS	(5,207,623)	(1,576,831)	(15,862)	(14,768)	(47,797,530)	$42,539,000	$(1,237,290)	(19,426,065)	

Note: Totals may not sum due to rounding of values.