Envisioning the Next
Twenty Years (2021-2041)

# Green Campus Master Plan

Red Deer Polytechnic

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# 1.0 Executive Summary

Over the last two decades, Red Deer Polytechnic (RDP), formally Red Deer College has taken progressively greater steps to improve energy conservation, reduce energy costs, and reduce greenhouse gas emissions. A few noteworthy projects have recently been completed that have furthered these sustainability goals.

First, the Alternative Energy Initiative (AEI) was completed in 2018 which included the Alternative Energy Lab. This building was awarded a Leadership in Energy and Environmental Design (LEED) Silver certification and was designed to further the study and development of alternative energy technologies. This project also included the installation of a 1 Megawatt (MW) combined heat and power (CHP) unit, an upgrade of exterior lights to LEDs, and the installation of 3,645 solar panels across campus.

Second, 2018 also saw the completion of the Gary W. Harris Canada Winter Games Centre. This building was awarded LEED Gold and displays interpretive signage to outline the sustainable efforts that were taken within this facility (e.g. water efficient fixtures, demonstration geothermal units, etc.).

Third, the new residence building was completed in 2019 and was built with 545 vertical solar panels on three sides of the exterior, acting as the exterior rain screen and providing a means of electricity generation for the institution. These additional panels bring the cumulative total for the campus to 4,190 panels.

These various alternative energy initiatives assist RDP in becoming more economically and environmentally sustainable. Specifically, it means that the campus can produce approximately 8,000-megawatt hours (MWh) per year of electricity from alternative energy sources. This allows RDP to offset grid electricity usage from pre-2019 levels by approximately 60%. This electricity is equivalent to powering 13,000 average Alberta homes, and saves the equivalent amount of emissions as removing 1,200 cars off the road per year.

Though Red Deer Polytechnic has already achieved a great deal, the institution’s sustainability journey is not complete. RDP is now targeting the goal of becoming a Net Zero Energy campus within a decade and Net Zero Carbon by 2041.

The Green Campus Master Plan (GCMP) identifies six sustainability pillars that form the dominant strategies to achieve these goals.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Emissions Reductions** | **Energy Generation** | **Energy Storage** | **Waste Reduction** | **Energy Efficiency** | **Educational Opportunities** |

These goals are divided into short-term, for the next five years (2021-2025), mid-range, for the five to ten-year range (2026-2030), and long-term, which extend to a twenty-year horizon (2031-2041). Each stage outlines targets for reducing greenhouse gas emissions, electricity use, natural gas use, water consumption, and waste, and sets to improve waste management and increase the use of alternative transportation, compared to a 2019 baseline year.

To achieve these sustainability goals, the GCMP outlines multiple potential project opportunities in the following areas across campus:

- LED lighting upgrades
- Combined heat and power unit(s)
- Solar power
- Wind power
- Water conservation
- Recycling, composting, and biomass/biogas energy
- Alternative transportation and equipment
- Building envelope and building systems
- Geothermal energy
- Battery storage
- Campus planning and capital project delivery
- Operational opportunities

The next stage of this plan will be to conduct detailed feasibility reviews for these various opportunities. This will provide preliminary costing and business case data to determine the return on investment for each potential project. To assist with this stage, RDP has established a group of internal and industry professionals, leaders, and partners in the areas of sustainability, facility management, and energy markets. This panel, and the feedback they provide, will allow RDP to make informed decisions on prioritization and implementation of the various projects noted. The details of this next stage will be presented to the RDP Executive and Board within the next twelve to eighteen months.

Finally, the institutions new 2022-2027 Strategic Transformation Plan also identifies “The Sustainable Polytechnic” as one of its three primary areas of focus. Subsequently, the Green Campus Master Plan ensures that the environmental component identified within this sustainability goal are being met.

## 2.0 RDP in Context

For over 50 years, Red Deer Polytechnic has been proudly serving communities in Central Alberta by offering more than 100 different degrees, certificates, diplomas, and skilled trades programs to 7,500 full-time and part-time credit students each year. There are also more than 30,000 youth and adult learners enrolled in the School of Continuing Education each year. Alberta Venture magazine named RDP as one of Alberta's most innovative organizations for its Centre for Innovation in Manufacturing, and RDP has become a focal point for applied and industry-led research. A detailed overview of the history of RDP is contained in Appendix 6.1 RDP Campus History.

RDP recognizes that the campus is situated on Treaty 7 land, and it serves Treaty 6, the territories of the Blackfoot and Cree peoples and the Metis. Through the GCMP, RDP intends to continue the incredible stewardship of these lands and our environment that has been exemplified by our First Peoples, who have lived here since time immemorial.

In March of 2018, RDP began to re-envision the type of post-secondary institution it could evolve into. In May 2021, the Government of Alberta confirmed that RDP would transition from a college to a polytechnic institution. This opportunity is exciting for RDP, its students, and surrounding communities as it unlocks a great deal of potential for the institution. Estimates of growth suggest that in ten years the complement of students enrolled at RDP could double. As student population grows, demands on campus infrastructure and fiscal resources will create opportunities for further innovation in sustainable growth.

In the fall of 2021 the institution was formally renamed Red Deer Polytechnic. Concurrent to this, the institution drafted an updated 2022-2027 Strategic Transformation Plan (STP) which identifies three goals, all of which support enhancing and improving the "teaching and learning" at RDP. The third goal of creating "the sustainable polytechnic" identifies a number of areas including environmental sustainability that must be addressed. Subsequently, the GCMP is ideally positioned to support the environmental mandate outlined in the STP, and help ensure the institution is both an operational and academic leader in environmental sustainability initiatives.

In terms of opportunity, the market demand for alternative sustainable technology and energy is growing and society is increasing its awareness of environmental issues. As a polytechnic, RDP will play an even greater role in helping educate its students and community about these types of issues. The Green Campus Task Group, and the existing sustainability projects, will work together as a catalyst to assist in the creation of new educational programs and opportunities. This will help further RDP's sustainability goals, as well as identify ways to increase our alternative energy production on campus.

The growth of the polytechnic may increase utility demands for the campus. Fortunately, many of the AEI's projects have already helped reduce operational and utility costs. Additionally, with increasing expectations for post-secondary institutions to become more financially self-sufficient, there is an even greater rationale to support expanding alternative energy projects to further reduce costs, and potentially create new revenue opportunities for the institution. Subsequently, an updated GCMP will be needed to outline project and planning opportunities to help lower facility, utility, and waste/recycling costs as the institution grows.

RDP recognizes that as a utility user in Central Alberta, we cannot control energy costs beyond negotiating rates within the narrow bands that are dictated by the world and local markets. In addition, one cannot control how provincial energy is generated or delivered. Alberta currently has an electricity generation mix that is primarily reliant on natural gas generation plants, resulting in an electricity grid that is relatively high in carbon dioxide emissions.

Thus, the intent of this GCMP is to develop a program to provide sustainable energy for the campus that will reflect the core commitments of RDP. This encompasses the promotion of environmental stewardship through the application of sustainable and energy-efficient technologies that allow interpretive and educational interaction by the staff, students, and the community.

## 2.1 Work Already Undertaken by RDP

Since the late 1970s, RDP has worked to develop infrastructure in a sustainable and energy efficient manner, becoming a leader in green initiatives. Starting over a decade ago with our Four Centres building, the first LEED certified building on campus, this project spurred the creation of the Green Campus Task Group on campus, which is a working group that explores alternative transportation, recycling, energy conservation, and utility reduction opportunities.

Over the last three years, RDP has experienced the most rapid infrastructure growth and expansion in the history of the institution. It is worth highlighting that all these projects included a sustainability element as part of their core design, and two of the three buildings have achieved a LEED certification.

The first project, completed in 2018, was the Alternative Energy Initiative (AEI), which evolved from the previous master planning document: the 2017 Green Energy Master Plan (GEMP). The AEI project consisted of four major components that are summarized below:

1. **Exterior LED Street Lighting Upgrades**
   This project replaced virtually all the existing exterior streetlights on campus, which reduced electricity consumption relative to the previous lights by 58%.

2. **Combined Heat and Power (CHP) Unit**

This one-megawatt (MW) unit helps reduce transmission and distribution costs by producing electricity on campus using natural gas to drive an electrical generator. The heat that is generated from this process is used to supplement the heating needs of the buildings on campus.

**3. Alternative Energy Lab (AEL)**

The two storey AEL was positioned on the south side of the campus adjacent to the School of Trades and Technologies. This facility was constructed to LEED Silver status, and specifically designed to further the study and development of alternative and sustainable technologies.

**4. Solar Arrays**

Photovoltaic solar panels are present on the rooftops of the Gary W. Harris Canada Games Centre (GWHCGC), the solar pedway linking this facility to the main campus, three roofs on the south side of the School of Trades and Technologies, and three sides of the new student residences building. Cumulatively, RDP has nearly 4,200 PV panels on campus, which have an installed capacity of approximately 1.6 MW.

RDP's continued commitment to sustainable building practices led to the development of the Gary W. Harris Canada Games Centre, which opened mid-2018, and is a LEED Gold certified building. The majority of the flat roofs of this building are covered with solar panels, as noted above.

Finally, the new five-story residence building was opened in early 2019 that has a unique exterior photovoltaic exterior skin. These black exterior panels collect solar light energy and convert it to electricity for the campus to use. With 545 panels, this building is one of the largest PV clad structures in all of Canada.

## 2.2 Green Campus Master Plan Introduction

The GCMP is an evolution of the aforementioned Green Energy Master Plan (GEMP) drafted in 2017. The focus of the GEMP was to identify alternative energy opportunities to reduce utility consumption on campus, as well as create alternative energy/technology teaching and research opportunities. The GCMP will take a more comprehensive and holistic look at RDP using six sustainability pillars that form the dominant strategies of this plan.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Emissions Reductions** | **Energy Generation** | **Energy Storage** | **Waste Reduction** | **Energy Efficiency** | **Educational Opportunities** |

The first pillar is **"Emissions Reductions"** which entails reducing greenhouse gas emissions from campus facilities and operations. **"Energy Generation"** extends the work of the GEMP by identifying additional opportunities for RDP to further expand infrastructure and systems that can create electricity or heat energy. The third pillar of **"Energy Storage"** encompasses technologies that store electricity or heat energy for future use. Because systems such as photovoltaic (PV) panels cannot collect light energy to produce electricity at night, the daytime energy production can be stored and used later. The fourth pillar is **"Waste Reduction"** which includes minimizing landfill waste, increasing recycling rates, and reducing wastewater on campus through water conservation. **"Energy Efficiency"** entails reducing RDP's consumption of natural gas, electricity, and water. This will be achieved by upgrading building infrastructure and systems to create buildings that are more efficient. The final pillar is **"Educational Opportunities**" which collaboratively allows RDP to learn and research an array of sustainable projects and initiatives as well as incorporate them as part of institutional programming.

## 2.3 Targeting Net Zero

As more and more jurisdictions worldwide work to reduce energy consumption, reduce emissions, and achieve carbon neutrality, RDP has also started to explore the concept of making the entire campus Net Zero.

There are currently two dominant approaches to Net Zero: "Net Zero Energy" and "Net Zero Carbon". The Pembina Institute defines a "**Net Zero Energy"** building as one that creates as much energy as it uses on an annual basis. While a **"Net Zero Carbon"** building must either use zero-carbon fuels or offset any emissions associated with fossil fuel use.

Given RDP's already significant investment in green energy solutions, such as photovoltaic solar panels, RDP will first pursue Net Zero Energy as a mid to long-term goal, with the longer-term goal of becoming the first Net Zero Carbon post secondary institution in Canada.

## 2.4 Applying the Six Sustainability Pillars to Potential Future Projects

Achieving Net Zero Energy and Net Zero Carbon are challenging goals that will require a multitude of approaches and projects to achieve them. The following is a high-level outline of

how potential projects could be applied to the six sustainability pillars, where a brief overview of each project type is included in Chapter 3.

1) **Pillar One - Emissions Reductions**
    - 3.1 LED Lighting Upgrades – LED lights are more energy efficient than traditional fluorescent or halogens, which reduces electricity use and associated emissions.
    - 3.2 Combined Heat and Power (CHP) – CHPs produce electricity on site while providing supplemental heating. This reduces electricity demand from the grid, and produces fewer emissions compared with receiving electricity from the Alberta grid.
    - 3.3 Solar Power – Photovoltaic (PV) solar panels do not produce emissions during operation and thus reduce both emissions and grid electricity demands and costs.
    - 3.4 Wind Power – Wind turbines do not produce emissions during operation and thus reduce both emissions and grid electricity demands and costs.
    - 3.5 Water Conservation – Water and wastewater treatment and distribution requires energy which creates emissions. By reducing water usage through conservation and rainwater re-use, both greenhouse gas emissions and water utility demands and costs are reduced.
    - 3.6 Recycling, Composting, and Biomass Energy – Landfill waste contributes to emissions from the transport and decomposition of organic materials. By recycling, composting, and turning waste into biomass energy, RDP can reduce greenhouse gas emissions, tipping fees, and offset some natural gas heating demands with biomass energy produced and used on campus.
    - 3.7 Alternative Transportation and Equipment – By encouraging and utilizing alternative transportation and equipment, RDP can reduce fuel demands and costs, and concurrently reduce the greenhouse gas emissions of the campus.
    - 3.8 Enhancing Existing Building Envelope and Building Systems – Many areas of the campus have older and less efficient building envelopes (i.e. exterior walls, windows, and roofs), as well as older and less efficient building systems (i.e. mechanical ventilation systems, boilers, hot water tanks). As such, utility consumption and associated emissions can be decreased with improvements or replacements of these systems.
    - 3.9 Geothermal Energy – The earth produces a consistent sub-surface source of heat. By tapping into this potential, the campus could reduce both utility consumption and associated emissions.
    - 3.10 Battery Storage – Some sources of alternative energy are intermittent, and so by having batteries on-site energy can be stored for when the campus demands are greater than production. This creates a buffer to help reduce utility demands, and further reduce emissions by maximizing the use of alternative energy.

- 3.11 Campus Planning and Project Delivery – Construction is a major contributor to greenhouse gas emissions, so by planning and delivering projects with this in mind, RDP can reduce emission quantity and density from buildings.
- 3.12 Operational Opportunities – Considering the whole lifecycle impact of purchases and procedures can help reduce greenhouse gas emissions.

2) **Pillar Two - Energy Generation**
   - 3.2 Combined Heat and Power Unit – A CHP unit provides a consistent method of generating electricity which helps hedge the potential variability of some alternative energy systems.
   - 3.3 Solar Power – PV panels produce electricity during daylight hours.
   - 3.4 Wind Power – Wind turbines convert wind energy into electricity.
   - 3.6 Biomass Energy – Organic waste is converted directly to heat energy or electrical energy when burned to turn an electrical turbine/generator, or to biogas if fermented and the gas is captured and purified for use.
   - 3.9 Geothermal Energy – Using the free heat of the earth can help preheat or precool mechanical systems, which helps generate energy and reduce utility demands.

3) **Pillar Three - Energy Storage**
   - 3.10 Battery Storage – Creates a buffer to augment utility demands when alternative energy systems are not producing, or to capture excess energy produced by systems, so it can be used to reduce energy demands.

4) **Pillar Four - Waste Reduction**
   - 3.5 Water Conservation – Low-flow fixtures (ex. showerheads, aerators, and low flow toilers/urinals) reduce water use. Additionally, rainwater collection and re-use systems reduce the amount of city water consumed on campus.
   - 3.6 Recycling, Composting, and Biomass Energy – These initiatives reduce the amount of waste that is directed to landfills.
   - 3.11 Campus Planning and Project Delivery – Planning and project delivery that considers waste production and management can help RDP reduce the quantity of waste produced on campus.
   - 14.0 Operational Opportunities – Considering the whole lifecycle impact of purchases and procedures can help reduce waste if products that have longer lifespans and better serviceability are considered. Proper maintenance also reduces the need for replacement parts and new materials.

5) **Pillar Five - Energy Efficiency**

- 3.1 LED Lighting Upgrades – Older lighting systems use more electricity and require more frequent replacements than LEDs which increases operational costs. They also produce more heat, which increases cooling costs in the summer. Therefore, the replacement of older fixtures with new LEDs will improve efficiency.
- 3.5 Water Conservation – Water reduction and conservation can be achieved through rainwater collection and re-use systems, as well as the low-flow fixtures previously noted. The campus can also take steps to install landscaping that requires minimal watering.
- 3.8 Enhancing Existing Building Envelope and Building Systems – This can include replacing or improving building envelopes with materials with higher efficiency (as previously noted), recommissioning/retrofitting existing equipment and systems to operate more efficiently, and basing the purchase/replacement of systems on lifecycle costs as opposed to just capital costs.
- 3.11 Campus Planning and Project Delivery – Planning and project delivery can help improve energy efficiency through the use of more efficient configurations and systems.
- 3.12 Operational Opportunities – Considering the energy consumption of products and procedures can help reduce utility consumption.

6) **Pillar Six – Educational Opportunities**
   - 3.1 LED Lighting Upgrades – Explore new LED technology that could be incorporated into the electrical labs on campus to create real-life examples for students to review. Students could analyse data on LED consumption and costs as part of electrical, business and science programs.
   - 3.2 Combined Heat and Power – Incorporate programming from Trades and Technology and Science departments to examine CHP units by exploring how they work and how to optimize heat recovery. Students could review data on natural gas consumption, electricity production, and associated costs as part of this educational training.
   - 3.3 Solar Power – Examine existing solar arrays to explore how they work, as well as opportunities to improve efficiency through panel orientation, angle, and type. Students could review data on electricity production and costs as part of trades and technology, business, and science programs.
   - 3.4 Wind Power – Explore how wind turbines work, as well as opportunities to improve efficiency through type, blade angle, height, orientation, etc. as part of trades and technology and science programs. Students could review data on electricity production and costs as part of this educational training.
   - 3.5 Water Conservation – Examine water conservation devices and systems across campus including low-flow fixtures and rainwater recycling systems to explore how they work, as well as opportunities to improve efficiency. Students could review data

on water use/reuse and costs as part of trades and technology (plumbing), Business, and science programs.

- 3.6 Recycling, Composting, and Biomass Energy – Explore new and existing recycling opportunities to create real-life examples for students to review. Students could review data on waste volumes and greenhouse gas emissions as part of business and science programs.
- 3.7 Alternative Transportation and Equipment – Explore alternative transportation and equipment technologies to compare energy use and emissions relative to conventional methods. This could be incorporated into the electrical labs and science labs on campus, as well as business programs, to create real-life examples for students to review.
- 3.8 Enhancing Existing Building Envelope and Building Systems – Explore building materials that improve performance. Students could review data on thermal conductivity and resistance, as well as cost savings associated with improved building envelopes as part of business and science programs.
- 3.9 Geothermal Energy – Explore how geothermal technology improves energy utilization in a building by reviewing the model system in the GWHCGC. Students could review data on production and consumption, as well as cost benefit analysis as part of electrical, business, and science programs.
- 3.10 Battery Storage – Explore battery storage technology that could be incorporated into the electrical/AEL labs on campus to create real-life examples for students to review. Students could review data on storage capacity, efficiency, and cost benefit analysis as part of electrical, business, and science programs.

## 2.5 Timelines for Goals

The following is an overview of the timelines to implement the GCMP goals.

**1) Short-Term Goals**

In the next five years (2021-2026), RDP will undertake steps to reduce consumption and emissions compared to 2019 levels as follows:

- Reduce greenhouse gas emissions by 10%
- Reduce electricity consumption by 10%
- Reduce natural gas consumption by 5%
- Reduce water consumption by 5%
- Reduce waste that is taken to the landfill by 10%
- Explore opportunities to become an energy exporter as a means of revenue generation
- Reduce single use plastics in our cafeteria and food services areas by 10%
- Increase recycling by 15%

- Increase alternative transportation (ex. carpooling, biking, electric/low emissions vehicles, and/or public bus) use by 5%

**2) Mid-Range Goals (5-10 Years)**

The mid-range goals for 2027-2031 are compared to 2026 levels as follows:

- Become a Net Zero Energy campus
- Reduce greenhouse gas emissions by an additional 40%
- Reduce electricity consumption by an additional 90%
- Reduce natural gas consumption by an additional 10%
- Reduce water consumption by an additional 5%
- Reduce waste that is taken to the landfill by an additional 40%
- Establish RDP as a net electricity exporter as a means of revenue generation
- Increase recycling by an additional 15%
- Increase alternative transportation (ex. carpooling, bike, electric/low emissions vehicles, and/or public bus) use by an additional 5%

**3) Long-Range Goals (11-20 Years)**

The long-range goals for 2032-2041 are compared to 2031 levels as follows:

- Become a Net Zero Carbon campus
- Reduce greenhouse gas emissions by an additional 50%
- Further increase RDP's electricity production by 50%
- Reduce natural gas consumption by an additional 10%
- Reduce water consumption by an additional 5%
- Reduce waste that is taken to the landfill by an additional 30%
- Increase recycling by an additional 15%
- Increase alternative transportation (ex. carpooling, bike, electric/low emissions vehicles, and/or public bus) use by an additional 5%

## 2.6 Additional Benefits and Outcomes

By addressing the six sustainability pillars, RDP will be able to achieve a number of other related outcomes and opportunities including:

- Reduced environmental impact
- Reduced utility costs
- Reduced reliance on purchased power
- Increased usage of sustainable/alternative transportation and service equipment
- Increased recycling and reduction or diversion of waste
- Ongoing proactive infrastructure renewal of mechanical and electrical systems
- Advancement in sustainable energy technology

- Advancement in sustainable technology education and career opportunities
- Establish RDP as the first Net Zero Energy, and Net Zero Carbon, post-secondary institution in Canada

## 2.7 Current Utility Utilization and Waste Production

A brief summary of 2022 budgets are contained below in Table 1. This information provides financial context for some of the goals noted above.

*Table 1: RDP Main Campus Utility and Waste Annual Budget 2022*

| | |
|---|---|
| **Electricity Usage (Grid)** | $925,000 |
| ***Natural Gas Usage*** | *$665,000* |
| **Water/Sewer Usage** | $270,000 |
| **Waste (Landfill/recycling)** | $120,000 |

# 3.0 Understanding the Project Options

## 3.1 LED Lighting Upgrades

Light emitting diodes (LEDs) use significantly less energy to produce light compared to older lighting types. Relative to incandescent bulbs, LEDs are approximately 80% more efficient, and even slightly more efficient than fluorescent lighting. Additionally, LEDs have a lifespan that can be up to twice as long as fluorescents, and as a result, operational replacement costs are reduced when facilities transition to LEDs.

As of June 2021, RDP has replaced about 70% of interior lights with high efficiency LEDs. Plans are being developed to outline a multi-year strategy to replace the remaining lighting across campus.

3.1.1 Replace RDP Arts Centre Mainstage incandescent lighting with LED lighting system
3.1.2 Replace remaining 30 percent of interior lighting with LED lighting
3.1.3 Replace Library lighting with LED lighting
3.1.4 Replace older residences lighting with LED lighting

## 3.2 Combined Heat and Power

Combined Heat and Power (CHP) units produce electricity while simultaneously recovering and utilizing waste heat. Using natural gas or biogas engines can achieve a primary energy savings of approximately 40% compared with the separate purchase of electricity from the grid and gas boilers for on site heating. CHPs are typically located close to the end user and therefore help reduce electricity transportation and distribution losses, resulting in fewer associated emissions per unit of electricity.

3.2.1 Optimize CHP heat exchange (completed May 2021)
3.2.2 Reduce CHP exhaust emissions

## 3.3 Solar Power

RDP has nearly 4,200 solar panels on campus, which have an installed capacity of 1.6 MW, and may be the largest institutional solar array in Canada. These panels are located on the rooftops of the GWHCGC, the solar pedway linking this facility to the main campus, three roofs on the south side of the School of Trades and Technologies, and three sides of the new student residence building.

Solar Photovoltaic (PV) panels generate electricity directly from sunlight via an electronic process in a semiconductor matrix. Electrons in these materials are freed by solar energy and can be induced to travel through electrical circuits, providing useable electrical energy.

To achieve a Net Zero campus in the future, sustainable technologies such as solar will need to be expanded. Fortunately, by benefit of a large land base, RDP may consider ground-based solar arrays on the vacant south lands, solar arrays over the decommissioned landfill on the northeast corner of the main campus, and additional building cladding and rooftop arrays.

3.3.1 Optimization of existing solar arrays through improved maintenance, review of installation configuration/angles, and/or improved monitoring
3.3.2 Install a 1-3 MW ground mounted photovoltaic array on the north-east corner of the campus above the decommissioned landfill
3.3.3 Install a solar thermal system to augment/preheat water on campus
3.3.4 Install a 5-10 MW ground mounted photovoltaic array on the south side of the campus adjacent to the QEII highway (south lands)

## 3.4 Wind Power

Of the alternative energy sources considered in this report, wind power is the most uncertain. Wind power takes the natural kinetic power of wind and converts it into electricity using a generator turned by rotors. The amount of power that can be harnessed from the wind is dependent on a number of factors, including, but not limited to; average annual wind speed and location (topography and obstacles etc.).

3.4.1 Install a small-scale wind turbine array for teaching purposes atop or adjacent to the AEL

## 3.5 Water Conservation

RDP uses an average of 80 million litres of water per year, which equates to about 7 million litres per month. The impacts of this usage are also reflected in wastewater costs and associated emissions.

Both the Four Centres building and the GWHCGC have rainwater capture systems that collect and treat greywater for use in toilets and urinals. These buildings also have low-flow fixtures, which further reduces water consumption.

The new residence facility has also undertaken some water conservation strategies that have reduced its water consumption by approximately 25.8% compared to a conventional facility. These strategies include low-flush toilets aerators, and showerheads. Cumulatively, these measures could save RDP approximately 2.5 million litres of potable water every year.

3.5.1 Complete recommissioning of the greywater recycling systems in the Four Centres (completed October 2020)
3.5.2 Replace existing toilets and shower fixtures on main campus with low-flow fixtures as renovations occur
3.5.3 Install additional greywater recycling systems on main campus as renovations occur
3.5.4 Install additional parking lot/roof water processing/storage systems on main campus as renovations and redevelopments occur

## 3.6 Recycling, Composting, and Biomass/Biogas Energy

RDP has extensive recycling for common items like cans, bottles, cardboard, and paper. The can and bottle program is used by RDP Campus Management to help fund scholarships for students. As a result, that money is being put back into improving education opportunities for our students.

Unfortunately, other consumables such as plastics are not part of the program and this waste is sent to landfill. Some organic waste is collected and composted on site, however, the existing composters' capacity is so little that they are often filled within a day, which ultimately means that the majority of organics are being sent to landfill.

To put this into perspective, RDP currently produces approximately 320 tonnes of waste per year. This equates to an estimated 2,000 tonnes of greenhouse emissions when this waste is taken to landfill. The cost of tipping fees and cardboard disposal is approximately $220,000 per year.

Biomass energy presents an opportunity for RDP by reducing tipping fees, cardboard disposal costs, and concurrently divert waste from the landfill. This technology uses organic material as a fuel source that can be fed into a gasification boiler system. These systems generate heat energy to help offset the natural gas heating demands of the campus. It could also be tied into the current domestic hot water systems to augment heat-energy needs there.

3.6.1 Create additional recycling opportunities across campus
3.6.2 Install various waste stream bins across campus to allow waste sorting at the source
3.6.3 Reduce and potentially eliminate single use plastics on campus
3.6.4 Install additional composting facilities on main campus
3.6.5 Expand recycling programs related to used and leftover chemicals, oils, solvents, and paints
3.6.6 Expand recycling or reuse programs related to unwanted equipment and tools, and consider recycling with other institutions
3.6.7 Install a biomass processing and gasification boiler system on main campus
3.6.8 Install a biogas system that produces renewable natural gas for consumption on main campus

## 3.7 Alternative Transportation and Equipment

As the Government of Canada notes, transportation is one of the most significant sources of air pollution in Canada. Subsequently, RDP needs to reduce air pollution from both vehicles and equipment on campus to help combat this challenge. Fortunately, the campus has already taken steps to start to reduce emissions from our equipment by purchasing a battery powered electric ice re-surfacer and electric edger. To further reduce emissions, RDP will need to consider alternative equipment with lower emissions and/or that utilize alternative energy sources such as battery-powered machinery and vehicles as replacements are needed.

With regard to transportation, RDP can continue to support the municipal bus services, campus carpool programs, and encourage biking as an alternative means of accessing the campus. As RDP grows, the draw for students and staff will likely be greater in range, and so supporting and promoting a regional service would be beneficial to enrollment and staff recruitment. Additionally, as autonomous vehicles and ride sharing programs continue to grow, the campus will need to ensure the parking and drop zone areas are designed to accommodate these new initiatives. RDP can also consider alternative work and study strategies to reduce the number of students and staff that need to travel to the campus.

3.7.1 Purchase or lease fleet vehicles that utilize more energy efficient/sustainable fuel sources
3.7.2 Encourage cycling to campus through improved secure bicycle storage and incentive programs

3.7.3 Encourage carpooling and/or public transportation use through improved incentive programs
3.7.4 Purchase or lease campus service equipment (ex. mower, tractor, loader etc.) that utilize more energy efficiency/sustainable fuel sources
3.7.5 Install electric vehicle charging stations

## 3.8 Enhancing Existing Building Envelope and Building Systems

The RDP campus is a blend of older, less efficient buildings, and newer, higher efficiency buildings. Given approximately 75% facilities fall into the former category, there is plenty of opportunities to review the building envelopes (i.e. the exterior walls, windows, and roofs), and building systems (i.e. mechanical ventilation systems, boilers, hot water tanks). By retrofitting and replacing these older systems with new and more efficient systems, there are opportunities to reduce utility consumption and associated emissions. The Government of Canada has found that buildings contribute about 11% of the country's greenhouse gas emissions, and so addressing building envelope and building system efficiency can help reduce these emissions.

One approach will be to recommission or re-certify existing equipment to optimize energy utilization. Another strategy is to retrofit existing equipment with better sensors or controls to improve efficiency. Finally, full or partial replacement of building envelopes or systems may be considered. These will need to be done with consideration to both the initial investment cost as well as the overall lifecycle benefits/savings of the replacement.

3.8.1 Improve insulation in walls, roofs, and windows
3.8.2 Improve air filter systems on mechanical units/systems to reduce static pressure demands
3.8.3 Install energy sub-metering to improve monitoring
3.8.4 Upgrade controls and recommission existing building systems
3.8.5 Install fault detection and ongoing optimization
3.8.6 Install hydronic heat pumps to improve the energy efficiency of systems with a potential ground source bore field loop (this applies or links to geotechnical opportunities as well)
3.8.7 Evaluate the feasibility of a centralized district energy system for campus

## 3.9 Geothermal Energy

The premise of harnessing the earth's natural heat is what forms the foundation of geothermal energy. Loops can be placed into the ground using either a vertical (deep in the ground) or horizontal configuration (depending on the needs and more specifically the subsurface geotechnical conditions) to supplement heating demands in a building. Given the consistency of the subsurface ground temperature, the system can also be used to dissipate excessive heat energy from buildings. In instances when the heat energy of the building is greater than the temperature of the ground, the heat from the building system can be passed into the geothermal

loop. If the ground temperature is colder than that of the building or external ambient air, the geothermal loop can become a source of cooling.

The campus has one small demonstration geothermal loop in the GWHCGC. This loop, located just off the great hall, is a small system that is designed to condition the air for a single room of the facility, and so it is modest in size.

There are also ground batteries that are being developed that use geothermal principles to pump heat (or cooling) into the ground or water bodies to store it for future use. Given the large landmass of the RDP campus and the pond adjacent to the GWHCGC, this is another opportunity to consider.

3.9.1 Install hydronic heat pumps to improve the energy efficiency of systems with a potential ground source bore field loop (this applies to or links enhancements to existing building systems as well)
3.9.2 Examine the feasibility of a ground battery to store heat or cooling energy for the campus

## 3.10 Battery Storage

RDP already experiences instances where on-site electricity generation exceeds the power demands of the campus. This results in RDP being a net exporter to the City of Red Deer. With the low price of electricity sales back to the grid, the cost recovery of electricity production is not likely a revenue source for RDP. Therefore, methodologies to store excess power may be more beneficial to consider. As additional energy production systems are implemented on campus, the potential for excess power production will be greater. Given many alternative energy production systems like solar and wind do not produce energy consistently all of the time, there is further rationale to consider a battery storage system.

3.10.1 Install a battery storage system to store excess electricity produced on campus (also potentially assists with the current CHP production and potential wind energy projects)
3.10.2 Install a battery storage system within the AEL to store excess electricity produced within the lab and help create additional research and education opportunities for RDP

## 3.11 Campus Planning and Capital Project Delivery

As Architecture 2030 notes, the building sector contributes approximately 40% of global greenhouse gas emissions. This contribution is made through the consumption of construction materials, the construction process itself, and the subsequent operation of buildings. Though it is often appealing to build new and/or build more, RDP needs to consider the environmental impacts of construction as part of its GCMP and campus planning. It is also more environmentally efficient to retrofit than to build new.

RDP is fortunate to have a large land endowment so there is more than ample room to build additional facilities. Because of this large land mass the density of the campus is relatively low, which results in the campus being quite spread out. This has led to the vast majority of the campus being no more than two storeys in height.

There are a couple of challenges with this type of morphology. First, the distance to travel between classes, move goods across campus, and distribute energy/utilities is significant. As distances between teaching and learning areas become greater it makes it more challenging to schedule classes on opposite sides of the campus. This could contribute to lower utilization of classrooms, and potentially result in the need to construct additional/duplicate spaces across the campus. Second, given the majority of heat loss occurs through the roof, having larger horizontal configurations of buildings has a greater roof to wall ratio and thus, greater utility consumption. Third, the high quantity of roof area means that there is a larger volume of roofing to maintain which has ongoing operational cost impacts.

As RDP considers future capital projects, it will need to consider how these projects are delivered. Different construction methods lend themselves to more inclusive discussions between stakeholders and builders. Given RDP's commitment to both its learners and sustainability, it needs to carefully select construction methodology for each project that allows the institution to respect both the needs of stakeholders and the GCMP.

3.11.1 Consider both operational and environmental sustainability as the campus master plan is revised and updated
3.11.2 Develop standard specifications for contractors to summarize the intentions of the GCMP
3.11.3 Develop a review process to help select a construction delivery methodology for each capital project that best aligns with both the needs of stakeholders and the parameters of the GCMP

## 3.12 Operational Opportunities

There are numerous operational projects and undertakings both administratively and academically that RDP can undertake to improve sustainability.

3.12.1 Consider the energy efficiency, recyclability/serviceability, as well as the amount of packaging waste associated with products before purchasing them (i.e. develop a Purchasing Policy)
3.12.2 Improve reporting about sustainability progress through dashboards and annual reports
3.12.3 Improve communication about green opportunities and initiatives by expanding the Green Campus web presence and by developing a Green Campus social media feed
3.12.4 Encourage digital as opposed to print solutions
3.12.5 Consider environmental impacts when purchasing chemicals for courses

3.12.6 Promote sustainability through contests, promotions, and partnerships with staff and students (ex. greenest department contest)
3.12.7 Develop a student sustainability club

# 4.0 Summary

As Red Deer Polytechnic transitions to Net Zero Energy and evolves into a Net Zero Carbon campus, further reductions of utilities and emissions will be required. This document provides an overview of nearly forty potential projects that RDP can undertake in the next twenty years to assist with these goals.

With Executive and Board of Governors approval towards the goal of becoming a Net Zero Carbon campus, the GCMP will act as the guidepost to provide direction for RDP to move towards a greener and more sustainable future. With the approved goals and the list of potential projects noted within this document, RDP Campus Management will move toward more detailed evaluation and prioritization of these projects. This next stage will essentially establish a short-form business case and feasibility studies, which will assist RDP in attaining funding support to move various projects forward.

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# 6.0 Appendix

## 6.1 RDP Campus History

**1964:** Red Deer Junior College opened in temporary quarters in Lindsay Thurber Composite High School.

**1968:** The College moved into its own building. Original campus buildings included the main entrance and administrative building, 1300 academic wing, forum, and library, 1400 academic wing and Team Teaching Theatre and a separate main gym building.

**1969:** College expanded to include new classroom wings on each side of the library and third floor of the administrative wing.

College renamed to Red Deer College.

**1971:** Official ground breaking for new residences and new academic complexes.

**1972:** College completed a major expansion which included: Bookstore, Cafeteria, Kevin Sirois Memorial Gym, weight room, dance studio, racquetball courts, painting, and sculpture studios, enlarged Learning Resources Centre (Library), connected student residences, married and single parent townhouse residences. Resident Towers complex opens accommodating 160 single students and 18 families student residences, a new library, gymnasium and cafeteria.

**1979:** RDP Students' Association became the province's first and only college or technical institute student body to erect their own building.

Opening of 1500, 2500, 1600 and 2600 academic wings.

**1982:** 40 of 250 beds in newly completed Residence condominiums became available.

**1983:** Officially Opened the Apprenticeship and Technology wings and new Residence Administration building making RDP the third largest trades and technology school in Alberta and most comprehensive community college in Canada.

19 Self-contained Row houses complex completed student residences.

Students' Association Lounge officially opened.

College doubled in size.

**1984:** Health Centre opened serving 1,396 students and staff.

Team Teaching Theatre dedicated as the Margaret Parsons Theatre.

Children's Services Centre was opened.

Day Care Lab School created.

**1985:** Management Development Centre Opened.

Residence Playground built.

**1986:** Arts Centre opened.

**1995:** The Net Effect, a ten-station internet gallery house, developed in the Library.

Extension Services moves off campus (downtown).

**1996:** The Train Station, the new fitness facility, opened.

**1998:** IKON Lite Centre opened in partnership with IKON to integrate technology into learning.

Adult Development Wing opened in 1800 wing.

**First major renovations project: Biology and Chemistry Labs**

**2000:** Teaching and Learning Technology Centre opened for staff and external resources.

**2001:** Ground broken for Library Information Common, Students' Association, Bookstore and Kinesiology expansion.

**2002:** Grand Opening of the Library Information Common. Renovations and expansions to Students' Association link, expanded FarSide Lounge, a new convenience store (The Lift), Bookstore and Kinesiology department completed.

First phase of Block Rowhouses completed (to accommodate 96 single students).

**2003:** Grand Opening of newly renovated Forum.

**2005:** Grand opening of Confluence Campus in Rocky Mountain House.

**2007:** Automotive Service Technician building opened.

**2009:** RDP opened Four Centres building that includes a new Centre for Trades and Technology, Innovation in Manufacturing, Corporate Training and Visual Art spaces.

**2010:** Renovated space openings: Hospitality and Tourism, Advising, Centre for Teaching and Learning.

**2011:** The RDP Donald School of Business opened its doors in downtown Red Deer to more than 500 students.

**2012:** The Marketplace opened in the centre of campus with new eating and dining facilities along with a completely renovated Campus Store and Tech Store.

**2016:** Started construction of the Gary W. Harris Canada Games Centre/Centre des Jeux du Canada Gary W. Harris.

**2017:** Started construction of the 145 bed residence building.

**2018:** Gary W. Harris Canada Games Centre and the Alternative Energy Lab (AEL) were awarded LEED Gold and LEED Silver, respectively. Additional alternative energy initiatives including a new 1 MW combined heat and power unit, and comprehensive exterior LED lighting upgrades were also completed.

**2019:** New 145 bed residence completed with solar PV panels installed on three sides of the facility.

## 6.2 RDP Energy Management History

Energy conservation is an ongoing strategy at RDP. Reduced energy use and associated emissions will contribute to the overall goal of becoming more economically and environmentally sustainable.

**1979-1980:** Energy Audit

- Energy audit by Nova Consulting recommended the installation of a computer based system to control all fan and heating loads during unoccupied hours. The unit purchased was a Johnson Controls Model JC8510
- Minor lighting adjustments (De-lamping and Cleaning fixtures)

**1985:** Building Automation System

- Upgraded the JC 8510 to a JC 8540 to provide control of additional HVAC equipment and more advanced control strategies

**1992 – 1993:** Lighting Upgrades

- Phase 1 and 2 Lighting Retrofits – reduced electricity use/costs and enhanced existing lighting
- Replaced incandescent lamps with compact fluorescent lamps
- Converted standard fluorescent tubes to T8 lamps and electronic ballasts

**1994:** Energy Management System

- Upgraded the JC 8540 to a Johnson Controls Metasys system
- Incorporated the automated controls into the remaining standalone HVAC systems
- Cycled power to car plugs in winter months
- Increased insulation on roofs when implementing re-roofing
- Replaced mechanical units, boilers, and pumps with high efficiency units

**2003:** Land Use Master Plan identified

- All future buildings would be LEED certified, which is implemented by the Canada Green Building Council
- Established a goal to reduce the amount of on-site parking by reducing the ratio of stalls to student and staff from 0.7 to 0.5
- Pursued enhanced transit service and improved bicycle and pedestrian access
- Preserved the natural area and enhanced green space throughout the campus

**2006 – 2008:** Four Centres Building

- The first building on campus to be LEED certified achieving Silver designation
- 44% reduction in energy use relative to standard building reference through high R value in insulation for roofs and walls, heat recovery, and energy efficient windows and lights
- Reduced water consumption through waterless urinals, capture and storage of rainwater for toilet flushing, and the use of indigenous/ drought tolerant plants
- Sustainable sites achieved through stormwater management (retention pond feature)
- Created a positive learning and work environment through lots of natural light, views to the outdoors, natural ventilation, and low toxic building materials

**2007:** Created the RDP Green Campus Task Group with goals to:

- Reduce overall consumption of natural gas, electricity, and water on campus
  - Continue to support energy conservation measures in renovated and new buildings, implement efficiency programs (Lights Out stickers), phase out high water demand planting with indigenous/ drought tolerant planting
- Increase recycling (paper, cardboard, bottles)
- Implement recycle bins in all classrooms; create scholarship program with funds
- Reduce the impact on the local landfill
- Reduce the number of fossil fuel vehicles driven to campus
- Implement an alternative transportation program (encourage bus ridership, walking, cycling and carpool initiatives)
- Provide regular communication and information
- Host documentary films, guest lecturers and conferences on topics related to the environment and sustainability
- Develop an awareness campaign

**2017-18:** Alternative Energy Initiative

- Installed solar PV panels across various areas of campus to reduce utility demands
- Installed a 1 MW combined heat and power unit, which reduces electricity as well as heating needs
- Replaced all exterior streetlights with more energy efficient LED lamps
- Reduced overall consumption of electricity on campus
- Constructed the Alternative Energy Lab to allow for expanded academic and teaching opportunities at RDP in the areas of alternative and sustainable technology/energy
- The Alternative Energy Lab became the second LEED building on campus with a Silver designation

**2016-18:** Gary W. Harris Canada Games Centre

- Third building on campus to be LEED certified and with a Gold designation
- 25% reduction in energy use relative to standard building reference through high performance mechanical systems, high R value in insulation for roofs and walls, heat recovery, occupancy sensors, and energy efficient windows and lights
- 48% reduction in potable water consumption through low-flow fixtures and capture and storage of rainwater for toilet flushing. Additional water savings achieved through the use of indigenous/ drought tolerant plants
- The stormwater that lands on the landscaped areas of the property is directed to bioswales for infiltration and pollutant reduction purposes. This reduces the potential for pollutants like hydrocarbons, salts, and pesticides/fertilizers that are often picked up in stormwater from entering the adjacent Waskasoo Creek
- Incorporation of alternative energy technology with to the inclusion of solar panels on the roof
- Creation of positive learning and work environments through lots of natural light, views to the outdoors, natural ventilation, low toxic building materials, and lighting and thermal comfort controllability
- Building materials selected for the project were composed of over 21% recycled content, based on cost. Over 27% of the building's construction materials, by cost, were selected based on locality
- 75% of the construction waste generated during the development of the facility was diverted from the landfill by being recycled, composted, or reused

**2016-19:** New Residence Building

- Reduced water consumption through low-flow toilets and shower heads, and use of indigenous/ drought tolerant plants
- Incorporated photovoltaic panels on the exterior of the building to both clad the building as well as capture electrical energy
- Created a positive living environment for up to 145 students/guests through spaces with an abundance of natural light, views to the outdoors, and low toxicity building materials