UNB EST. 1785 UNIVERSITY OF NEW BRUNSWICK | Capital Planning & Operations

Reporting Period: May 2023 to April 2024

UNB Energy Management Program Report

Investing in Energy Savings

Executive Summary

In 1996, the Board of Governors (BOG) approved a formalized Energy Management Program (EMP) for the University of New Brunswick, Fredericton campus (UNBF) to invest in energy projects that will have a return on investment through utility cost avoidances. These avoidances are tracked for 10 years and then archived.

Performance highlights to date for all phases of the UNBF EMP include:

- $14.5 M invested in 188 projects with 10-yr forecasted cost avoidance target of $30 M.
- Actual cost avoidance of $28 M to the end of 2023/24 which is $6.9 M in excess of target.
- Third party funding of $3.5 M has been received and reinvested into the EMP.
- In Fiscal Year (FY) 2023/24, the EMP was responsible for avoidance of $933k of utility costs at UNBF.

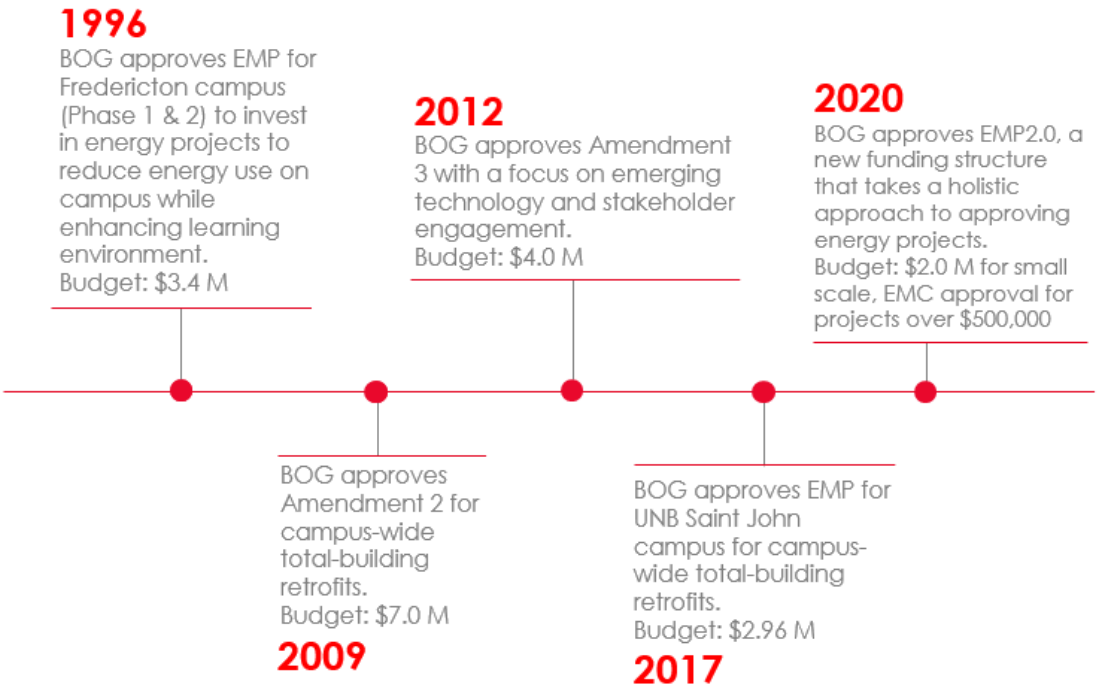
In 2017, BOG approved a formalized EMP for the UNB Saint John (UNBSJ) campus for campus-wide total building retrofits.

Performance highlights to date for the UNBSJ EMP include:

- $2.7 M invested in 39 projects with 10-yr forecasted cost avoidance target of $2.9 M.
- Actual cost avoidance of $951k to the end of 2023/24 which is $112k in excess of target.
- Third party funding of $1.0 M has been received and reinvested into the EMP.
- In FY 2023/24, the EMP was responsible for avoidance of $296k of utility costs at UNBSJ.

The Energy Management Committee (EMC) reports annually on the performance of the EMP on both campuses, which consists of: Fredericton – Phase 1 & 2, Amendment 2, Amendment 3, EMP2.0; and Saint John.

Overview of Energy Management Program



Oversight of the EMP is provided through the EMC. The EMC membership consists of:

AVP Capital Planning & Operations (CP&O) [Chair]
Director of Resource Planning & Budgeting
Director of Administration & Finance (CP&O)
Director of Maintenance & Operations (CP&O)
Director of Energy & Sustainability (CP&O)
Director of Financial & Admin Services (SJ)
Director of Major Capital Projects (CP&O)
Treasurer
AVP Finance & Comptroller
Director of Planning (CP&O)
Energy Coordinator (CP&O)
Director of Facilities Management (SJ)
Project Manager (SJ)

Investment & Cumulative Cost Avoidance Overview of UNBF & UNBSJ EMP

(See Appendix C for details, **black** circled numbers)

Program Phase	Approved Funding	Actual Project Work Completed	Committed or in Progress Projects	Actual & Committed Project Totals	Program Funding Remaining Balance	10-yr Cumulative *Forecasted* Cost Avoidance
Phase 1 & 2	$3,400,000	$3,360,675	$0	$3,360,675	$39,325	$7,420,680
Amendment 2	$7,000,000	$6,986,047	$0	$6,986,047	$13,953	$16,622,423
Amendment 3	$4,000,000	$4,054,920	$0	$4,054,920	-$54,920[1]	$5,604,599
EMP2.0	$2,000,000	$119,752	$6,607	$126,359	$1,873,642	$497,978
UNBF Totals	$16,400,000	$14,521,394	$6,607	**$14,528,001**	$1,871,999	**$30,145,680**
UNBSJ Totals	$2,960,000	$2,731,731	$24,477	**$2,756,208**	$203,792	**$2,862,216**

[1]Automated metering, Keirstead DHW heat pump, and site lighting automation projects were over-budget.

UNBF & UNBSJ 2023/24 Annual Reconciliation of EMP Performance

(See Appendix C for details, **red** circled numbers)

Program Phase	Final Costs of Completed Projects being Tracked	2023/24 Annual Cost Avoidance	Average Weighted Simple Payback	*Actual* Cumulative Cost Avoidance to April 2024 (Measured)	*Target* Cumulative Cost Avoidance to April 2024 (Forecasted)
Phase 1 & 2 Active	$48,036	$12,964	3.7	$104,728	$104,728
Amendment 2 Active	$3,263,394	$489,463	6.7	$4,313,493	$3,464,120
Amendment 3 Active	$4,038,474	$383,728	10.5[1]	$2,289,118	$2,665,383
EMP2.0 UNBF Active	$117,742	$47,775	2.5	$94,684	$82,834
Total (Active Reconciliations)	$7,467,647	$933,930	8.0	$6,802,023	$6,317,065
Phase 1 & 2 Archived	$3,312,639	NA	3.7	$9,044,445	$7,291,040
Amendment 2 Archived	$3,705,032	NA	3.0	$12,305,829	$7,650,190
Amendment 3 Archived	$15,708	NA	2.5	$62,252	$62,252
UNBF Totals	$14,501,026	**$933,930**	NA	**$28,214,549**	$21,320,547
UNBSJ Totals	$2,699,703	**$296,247**	9.1[2]	**$950,637**	$838,993

[1]Greater than 8 years due to AUC Ice plant, HIL Level 3 modifications, Bailey Chiller, and CP&O insulation projects not achieving intended savings.

[2]Greater than 8 years due to Colin Mackay lighting, CRI lab controls, and Ganong lab controls projects not achieving intended savings.

Annual Utility Costs for 2023/24

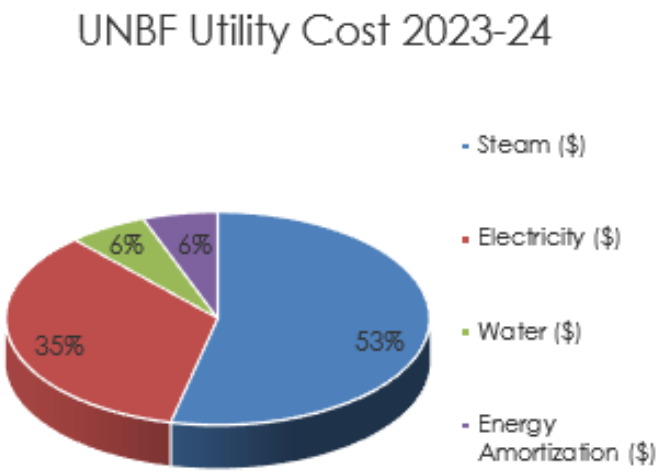
Fredericton Campus

UNBF Utility Consumption and Costs Incurred 2023/24			
Utility	**Fiscal Year Consumption**	**Fiscal Year Change from 2022/23**	**Cost**
Steam (lbs.)	151,269,306	9.4%[1]	$5,544,756
Electricity Consumption (kWh)	23,644,508	-0.8%	$3,591,307
Electricity Demand (kW)	52,704	-10.1%	
Water (m^3)	289,993	40.1%	$626,832
Energy Amortization[2]		13.9%	$591,827
Total Building Area (ft^2)	2,649,511	0.0%	N/A
Actual Total Utility Costs with Energy Project Cost Avoidances			**$10,354,722**
Total Annual Cost Avoidance from Active Energy Projects for 2023/24			**$933,930**

[1]Steam consumption change is normalized to weather.

[2]Energy Amortization is the annual payment associated with the payback period of all active energy projects.

Steam usage increased compared to last FY due to the following issues:



- Aitken House – coming back online after renewal.
- IUC Physics – start up issues with the new system, had trouble keeping the building warm.
- Bailey Hall – new heat recovery system ejecting heat out of the cooling tower.
- McConnell Hall – new instantaneous DHW heat exchanger running continuously.
- LB Residence – check valve was bad, causing condensate to be counted more than once.

These issues will be further investigated in 2024/25 FY.

Electrical Demand decreased compared to last FY, due to changes in load in certain buildings, but worth investigating the trend.

Water usage increased compared to last FY due to the following issues:

- Bailey Hall – fish lab once through water, and chiller construction/issues resulting in more City water use.
- Harriet Irving Library – valve left open for several months, new cooling tower installed that will increase water usage moving forward.
- IUC Physics – chiller issues (more City water use), and MRI lab switched from chilled loop to once through.
- McConnell Hall – new instantaneous DHW heater, dishwasher also runs 14 hours/day.
- Central Heating Plant – make up water, not getting enough condensate return. Thus, the importance of completing steam trap maintenance to reduce the amount of line loss.

These issues will be further investigated in 2024/25 FY.

Energy amortization fluctuates depending on projects that are being repaid each year.

Saint John Campus

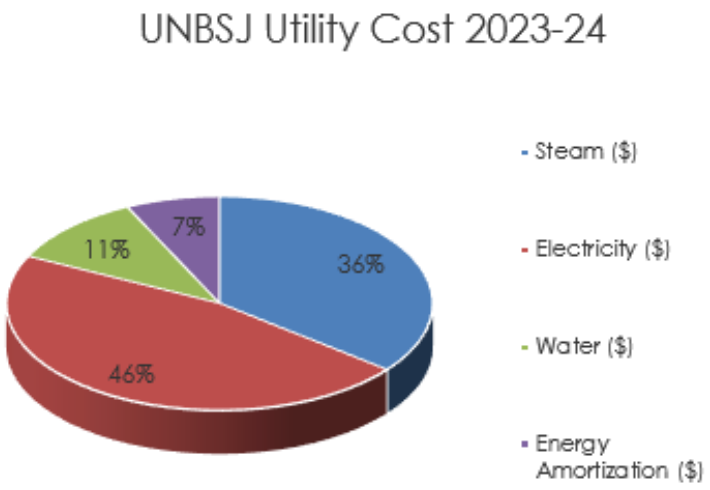
UNBSJ Utility Consumption and Costs Incurred 2023/24			
Utility	**Fiscal Year Consumption**	**Fiscal Year Change from 2022/23**	**Cost**
Steam (lbs.)	18,886,770	-0.8%	$835,151
Electricity Consumption (kWh)	7,550,819	4.7%	$1,092,318
Electricity Demand (kW)	15,776	4.9%	
Water (m^3)	81,667	16.3%	$249,025
Energy Amortization		47.7%	$166,785
Total Building Area (ft^2)	638,825	-8.3%	N/A
Actual Total Utility Costs with Energy Project Cost Avoidances			**$2,343,279**
Total Annual Cost Avoidance from Active Energy Projects for 2023/24			**$296,247**

Steam, Electricity Consumption, and Demand were relatively consistent compared to last FY.

Water usage has increased steadily compared to last FY. Most specifically due to:

- Annex A&B – higher usage of the building.
- DAL Med – more research.
- Thomas Condon Student Centre – higher usage of the building.

It is worth investigating the trends in 2024/25.



Energy amortization fluctuates depending on projects that are being repaid each year.

Total building area change is due to the demolition of Ward Chipman.

Annual Utility Consumption and Avoidance 2023/24

Fredericton Campus

Steam Consumption

Figure 1 below outlines the cumulative steam consumption on the UNBF campus, along with the steam avoidance and cost avoidance because of all EMP projects undertaken to date.

Examples of UNBF projects that reduce steam include heat recovery ventilation, updating mechanical systems, lab exhaust upgrades, insulation upgrades, and earth tube technology.

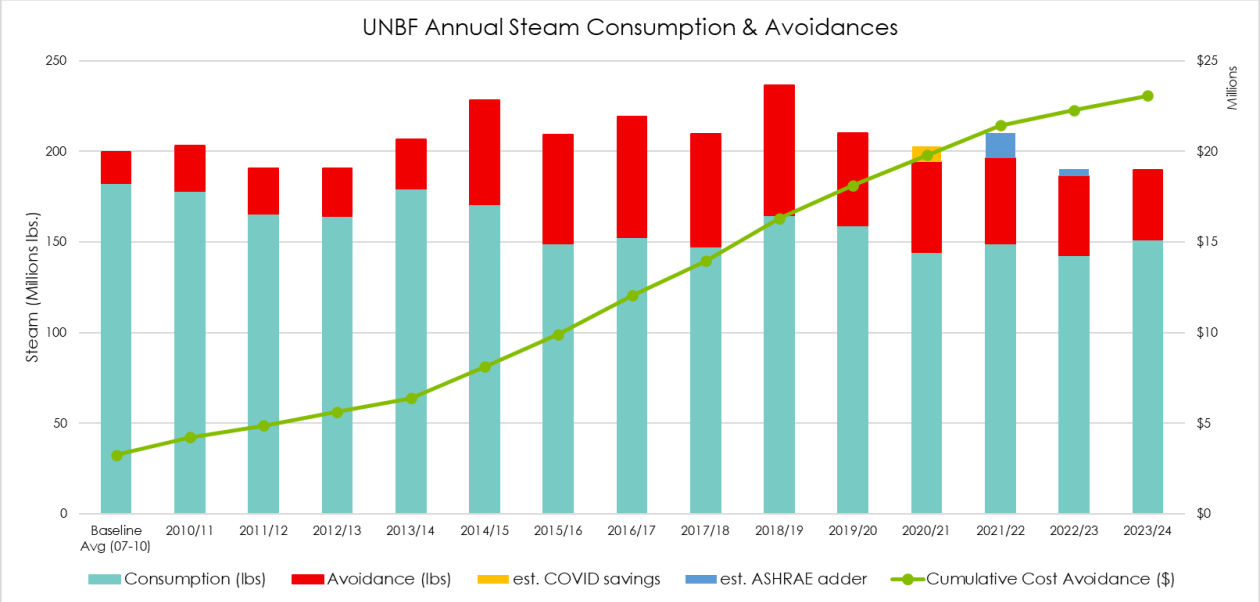


Figure 1

Since 1996, **855,938,820 lbs** of steam and **$23,059,251** of steam cost have been avoided due to energy projects approved under the EMP.

The total steam reduction achieved through the EMP projects is equivalent to:

3.8

years' worth of required steam supply to UNBF, Dr. Everett Chalmers Regional Hospital, and St. Thomas University.

Electricity Consumption

Figure 2 outlines the cumulative electricity consumption on the UNBF campus, along with the electricity avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Examples of UNBF projects that reduce electricity include lighting upgrades, control systems upgrades, natural light harvesting, and renewable energy installation.

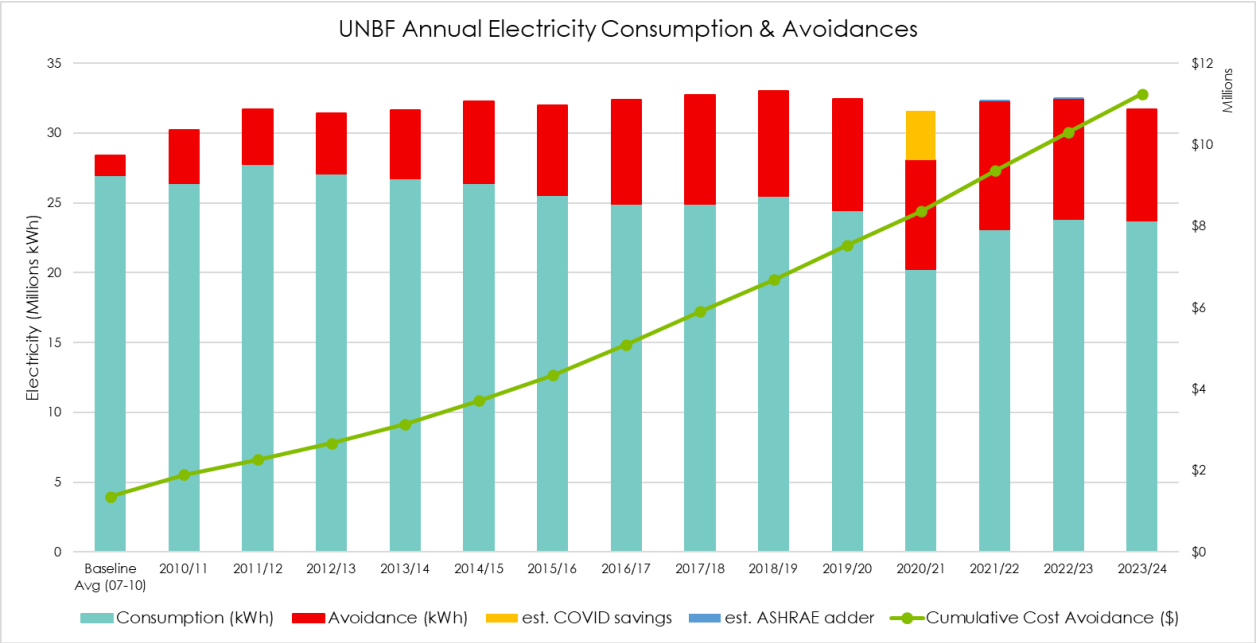


Figure 2

Since 1996, **114,607,429 kWh** of electricity and **$11,243,113** of electricity costs have been avoided due to energy projects approved under the EMP.

The total electricity reduction achieved through the EMP projects is equivalent to:

9,430

homes' energy use for one year.

Demand Consumption

Figure 3 outlines the cumulative demand consumption on the UNBF campus, along with the demand avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Electrical demand charges apply to commercial customers (i.e. most campus buildings) as a cost for the peak monthly "demand" amount of energy consumed (kW), in addition to the electricity use charge (kWh).

Examples of UNBF projects that reduce demand include lighting upgrades, control systems upgrades, installing variable frequency drives (VFDs) on pumps and fans, and shifting/limiting equipment loads.

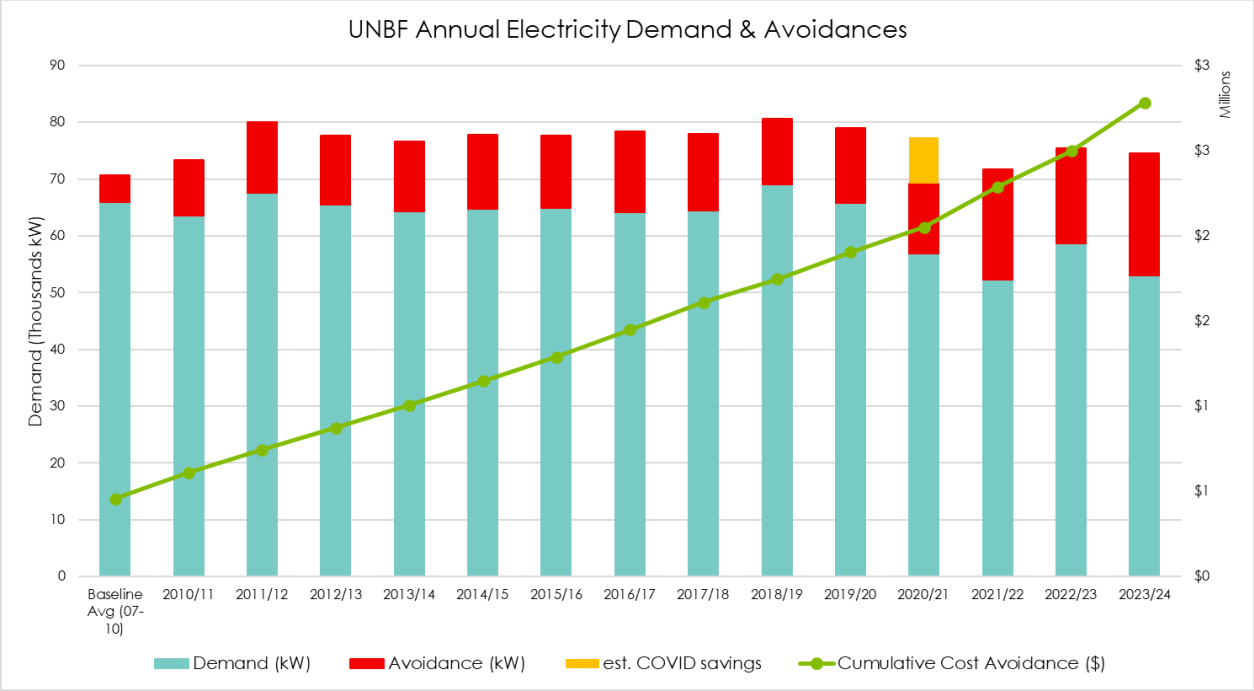


Figure 3

Since 1996, **245,992 kW** of demand and **$2,781,489** of demand costs have been avoided due to energy projects approved under the EMP.

The total demand reduction achieved through the EMP projects is equivalent to generation capacity of:

983,967

18-sqft solar panels.

Water Consumption

Figure 4 outlines the cumulative water consumption on the UNBF campus, along with the water avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Examples of UNBF projects that reduce water include chilled water upgrades, low flow fixtures, recirculation systems, automated water fixtures, and low flow aerators.

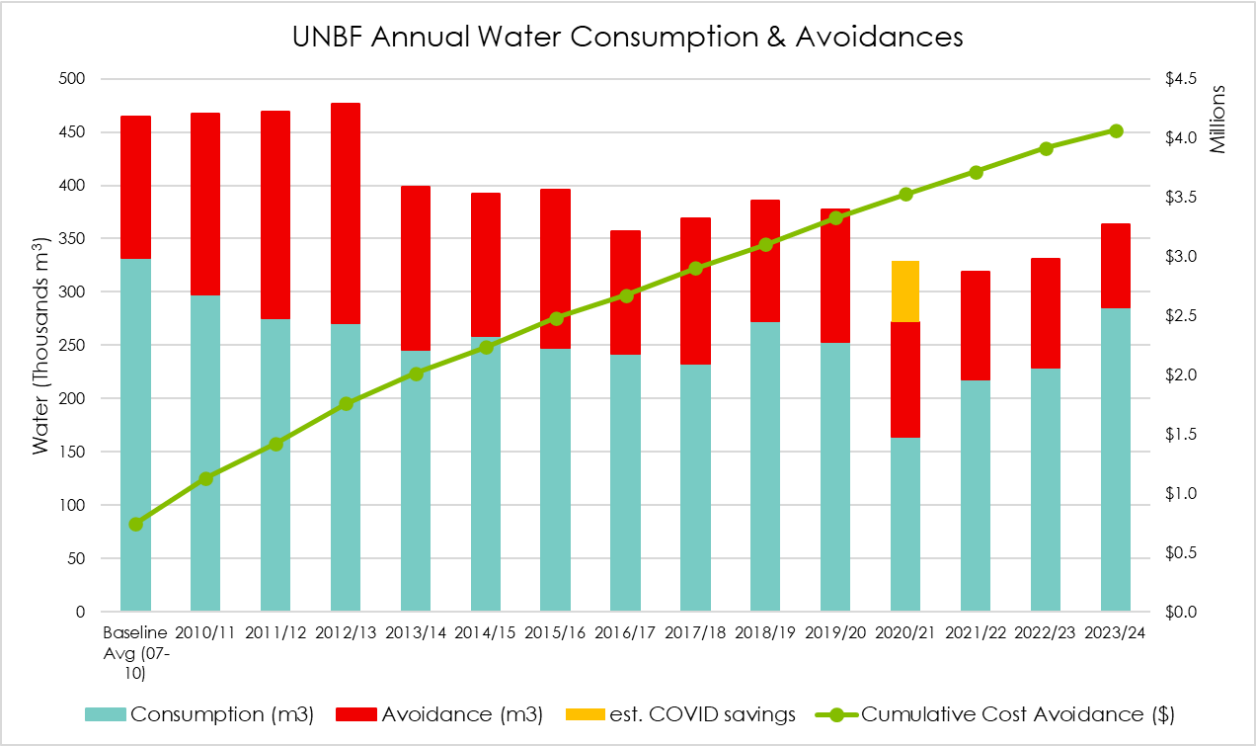


Figure 4

Since 1996, **2,739,785 m³** of water and **$4,065,529** of water costs have been avoided due to energy projects approved under the EMP.

The total water reduction achieved through the EMP projects is equivalent to:

1,448

City of Fredericton water towers.

UNBF EMP Emissions and Cost Avoidance Summary

Figure 5 below illustrates the cumulative CO_{2e} (carbon dioxide equivalent) emission avoidance and the cumulative cost avoidance as a result of all EMP projects undertaken (1996-2023). The red line represents a CO_{2e} reduction based on the yearly changes in emission factor due to the evolution of heating plant efficiency and the fuel mix used to generate steam. The black line represents the cumulative cost avoidance of all projects since the beginning of the EMP, showing continuous savings beyond the required 10-year reporting requirement. The total cumulative cost avoidance is **$41,149,382**.

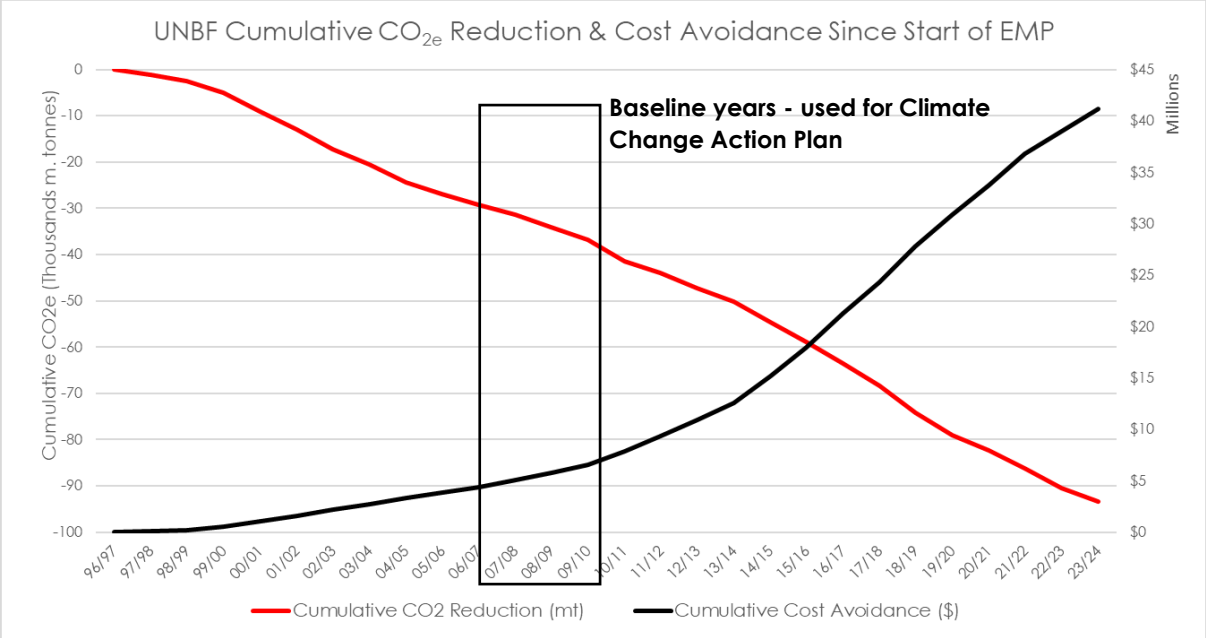


Figure 5

Over the years, UNBF has evolved to lower CO_{2e} generating fuels (i.e., Natural Gas and Bunker oil) and continues to burn more biomass (a renewable resource) each year (45-60% of fuel burned), which affects the slope of the graph. The CO_{2e} emissions reduction is also impacted annually by NB Power's fuel emissions since UNB purchases electricity from them.

In FY 2023/24, the EMP energy projects have resulted in a CO_{2e} emissions reduction of **3,594 metric tonnes**.

Since 1996, UNBF buildings where energy projects have been completed have avoided CO_{2e} emissions by…

93,354 metric tonnes

(based on realistic year-to-year emission factors)

This is equivalent to planting 7,468,324 trees

OR

Taking 22,227 passenger vehicles off the road for one year

Saint John Campus

Steam Consumption

Figure 6 below outlines the cumulative steam consumption on the UNBSJ campus, along with the steam avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Examples of UNBSJ projects that reduce steam include building automation system upgrades and kitchen ventilation upgrades.

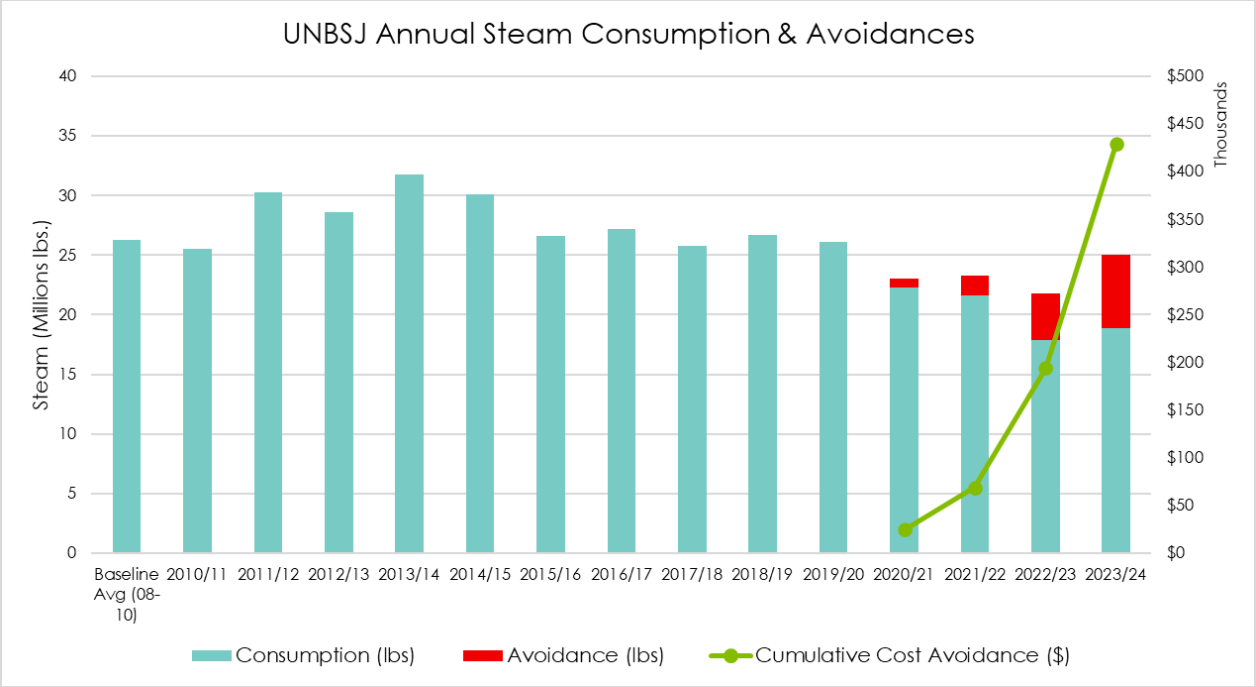


Figure 6

Since 2019, **15,591,776 lbs** of steam and **$537,495** have been avoided due to energy projects approved under the EMP.

The total steam reduction achieved through the EMP projects is equivalent to:

9.9

months' worth of required steam supply to UNBSJ.

Electricity Consumption

Figure 7 outlines the cumulative electricity consumption on the UNBSJ campus, along with the electricity avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Examples of UNBSJ projects that reduce electricity include lighting upgrades and building automation system upgrades.

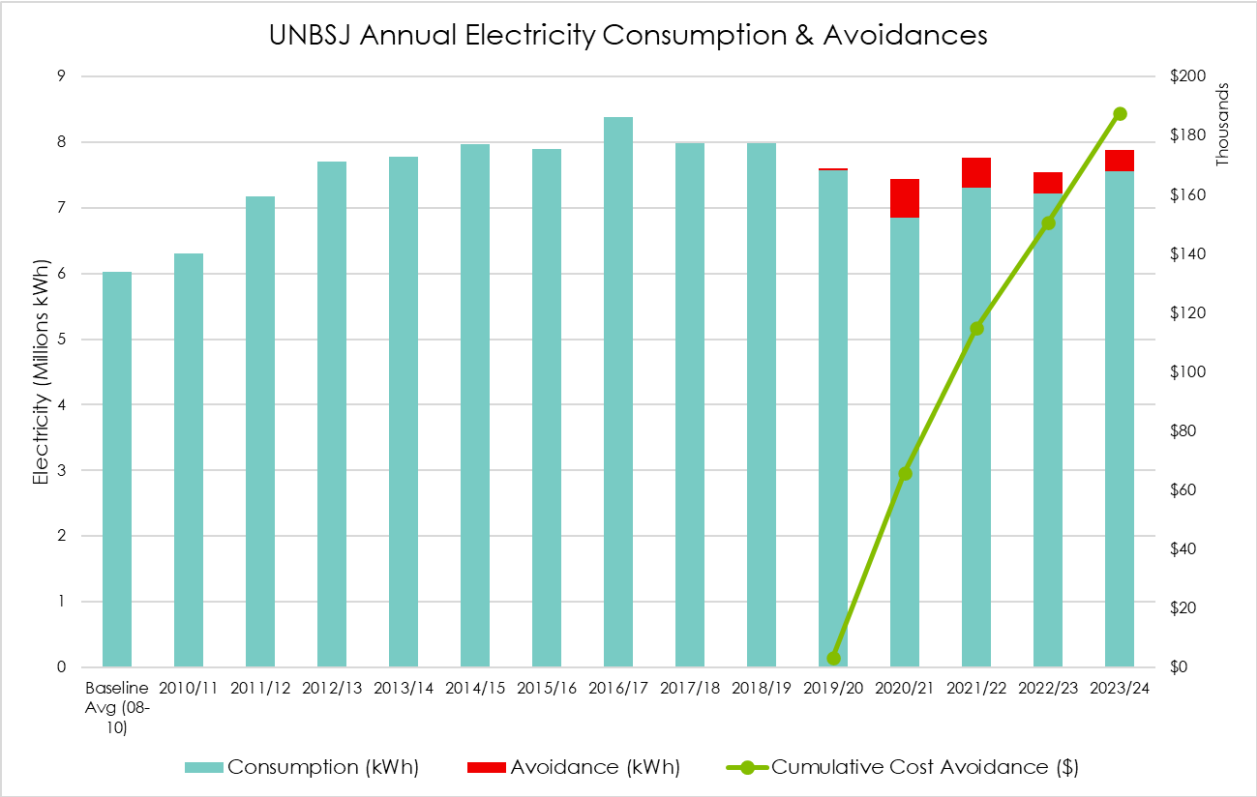


Figure 7

Since 2019, **1,756,319 kWh** of electricity and **$190,567** have been avoided due to energy projects approved under the EMP.

The total electricity reduction achieved through the EMP projects is equivalent to:

149

homes' energy use for one year.

Demand Consumption

Figure 8 outlines the cumulative demand consumption on the UNBSJ campus, along with the demand avoidance and cost avoidance as a result of all EMP projects undertaken to date.

Electrical demand charges apply to commercial customers (i.e. most campus buildings) as a cost for the peak monthly "demand" amount of energy consumed (kW), in addition to the electricity use charge (kWh).

Examples of UNBSJ projects that reduce demand include lighting upgrades and building automation system upgrades.

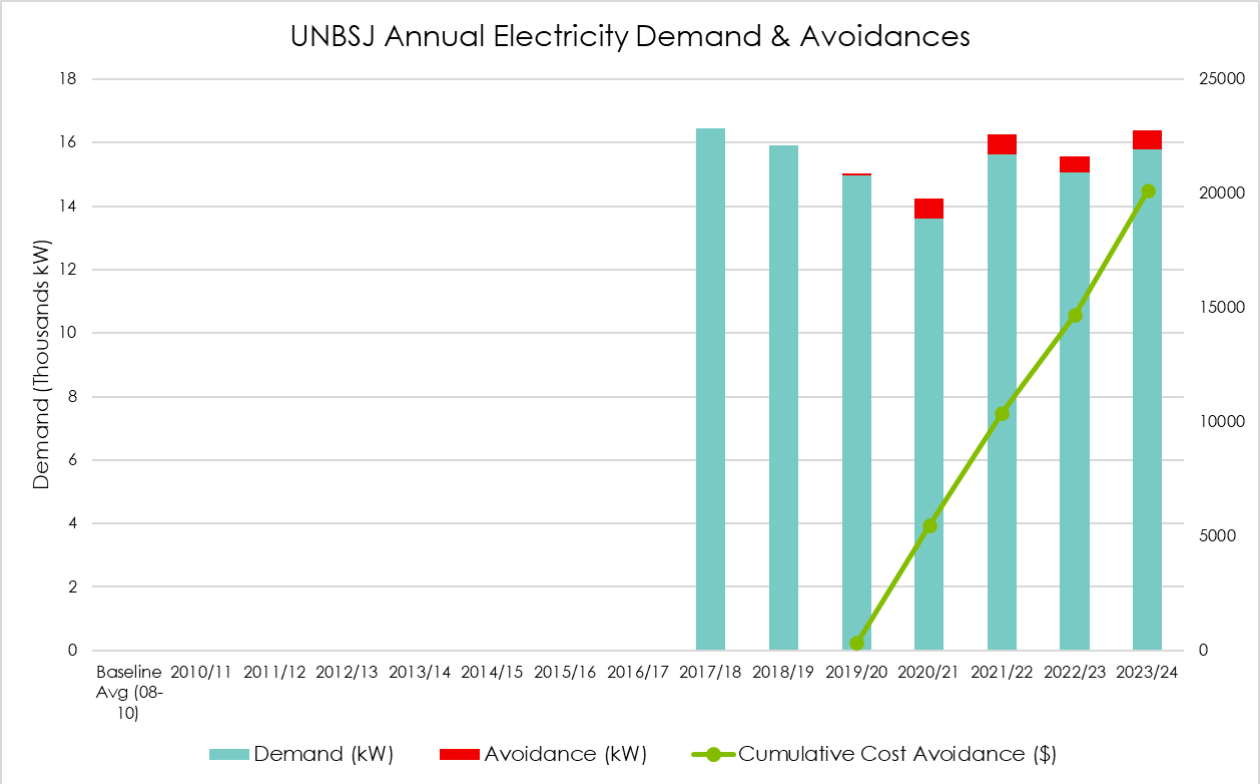


Figure 8

Since 2019, **2,449 kW** of demand and **$20,116** have been avoided due to energy projects approved under the EMP.

The total demand reduction achieved through the EMP projects is equivalent to generation capacity of:

9,798

18-sqft solar panels.

Water Consumption

Figure 9 outlines the cumulative water consumption on the UNBSJ campus, from baseline to date. Water reduction projects started tracking in 2022/23 FY.

Examples of UNBSJ projects that will reduce water include domestic water retrofits, low flow fixtures, and automated water fixtures.

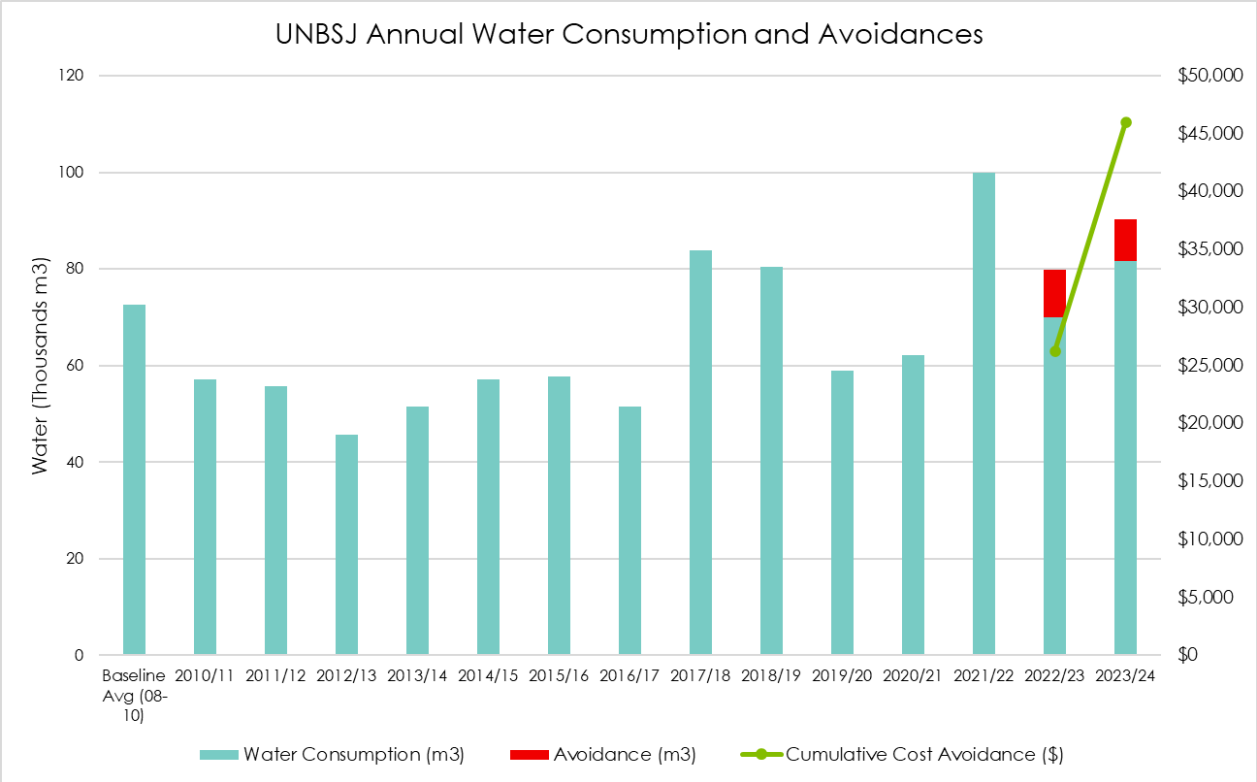


Figure 9

Since 2022, **18,536 cubic meters** of water and **$46,015** have been avoided due to energy projects approved under the EMP.

The total water reduction achieved through the EMP projects is equivalent to:

5.4

City of Saint John water towers.

UNBSJ EMP Emissions and Cost Avoidance Summary

Figure 10 below illustrates the cumulative CO_{2e} emission avoidance and the cumulative cost avoidance as a result of all EMP projects undertaken (2019-2023). The red line represents a CO_{2e} reduction based on the yearly changes in emission factor direct from the Saint John Regional Hospital. The black line represents the cumulative cost avoidance of all projects since the beginning of the EMP, to eventually show the continuous savings even after the 10-year mark. The total cumulative cost avoidance is **$794,194**.

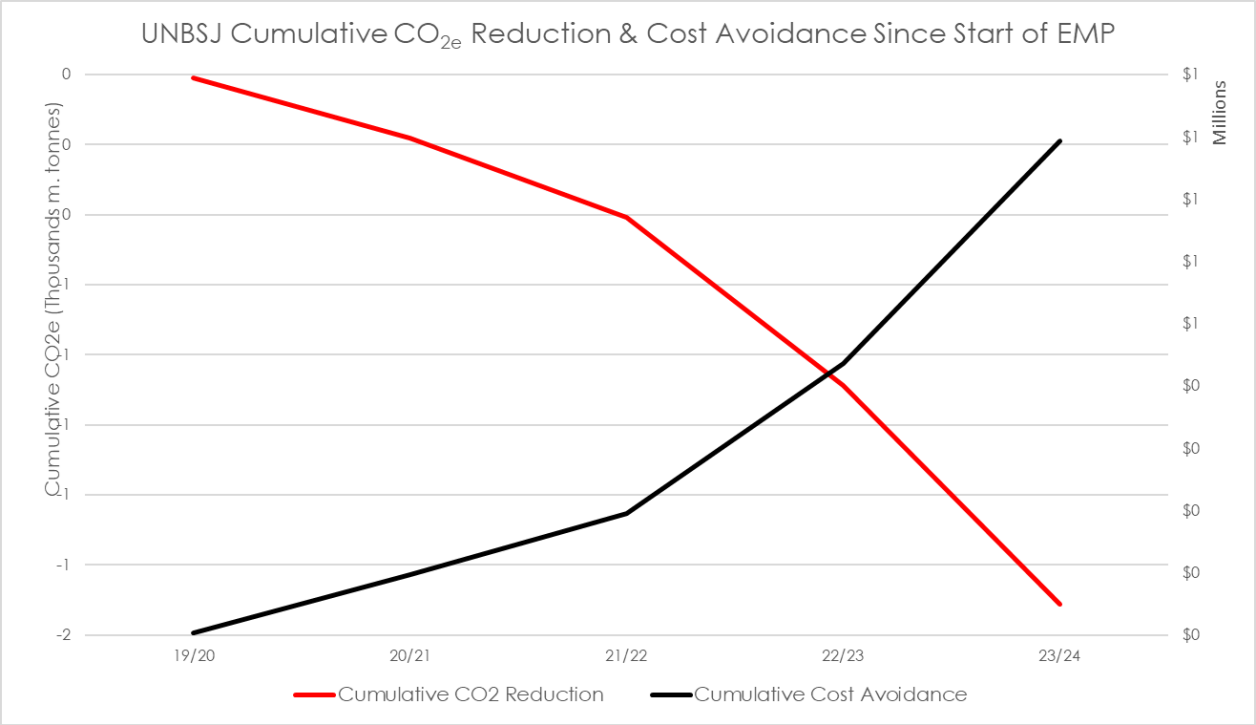


Figure 10

In FY 2023/24, the EMP energy projects have resulted in a CO_{2e} emissions reduction of **549 metric tonnes**.

Since 2019, UNBSJ buildings where energy projects have been completed have avoided CO_{2e} emissions by…

1,513 metric tonnes

(based on realistic year-to-year emission factors)

This is equivalent to planting 121,038 trees

OR

Taking 360 passenger vehicles off the road for one year

Solar Production

During the October 2021 EMC meeting it was decided to use additional (beyond original scope) energy project incentive funds received to invest in future PV installations on both campuses. Solar PV plays a significant role in energy and carbon reduction, but still struggles to achieve paybacks typically supported by EMP funding.

With this fund, EMC has supported the following solar projects:

- **CP&O solar PV – 17kW system**, in operation since November 2022
- **UNBSJ ground mount solar PV – 10kW system**, in operation since February 2024
- **Kinesiology solar PV – 39kW system**, in design phase

Solar PV Project	Allocated Funding (from solar fund)	Actual Funding	EMP contribution	Est. Annual savings	Est. Annual GHG emissions reduction ($mtCO_2e$)
CP&O	$83,500	$75,740	$0	$2,498	6.5
UNBSJ	$40,266	$40,266	$0	$1,344	3.5
Kinesiology	$181,120	In progress	$0	$6,399	12.9
Totals	$304,886	$116,006	$0	**$10,241**	22.9

As the solar projects come online, Figure 11 below will show the annual production (electricity avoidance) and cost avoidance as a result of these projects. Also shown is the target cumulative cost avoidance for all 3 projects over a 25-year lifespan.

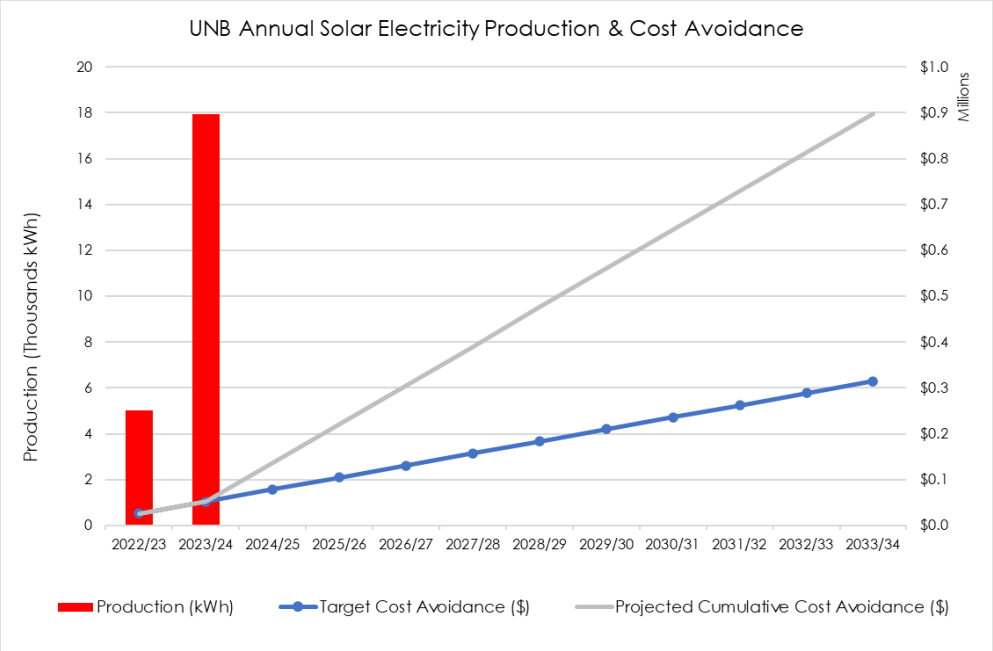


Figure 11

Since 2022, **17,947 kWh** of electricity (equivalent to powering 2 homes) and **$2,651** have been avoided due to the solar PV energy projects approved under the EMP.

Key Annual Developments

Throughout the 2023/24 fiscal year, Energy Management has been working on the following:

Fredericton Campus

Solar PV installations

During the 2022/23 FY, rooftop solar PV was installed at Capital Planning & Operations and the IUC Central Core green roof. In 2023/24, here are the energy savings:

Solar PV Project	Annual Production (kWh)	Annual Savings ($)	Annual GHG emissions reduction ($mtCO_2e$)	Projected Production (kWh)	Projected Annual Savings ($)	Proj. Annual GHG emissions reduction ($mtCO_2e$)
CP&O (17kW)	17,947	$2,096	2.5	22,363	$2,498	6.5
IUC Core (60kW)[1]	45,770	$5,345	14.5	30,059	$3,204	8.7
Totals	63,717	**$7,441**	17.0	52,422	**$5,702**	15.2

[1]Not an EMP project.

Kinesiology building has also been designed for solar, to be installed in the 2024/25 FY. The installation is projected to be 39 kW, with an annual energy savings of 44,369 kWh, 120 kW, and $6,399. This solar project will have an annual GHG emissions offset of 12.9 $mtCO_2e$.

A unique vertical mounted PV option was being designed for the AUC building. The installation was projected to be 100 kW, with an annual energy savings of 94,997 kWh, 600 kW and $16,497. This solar project would have an annual GHG emissions offset of 23.5 $mtCO_2e$. However, this project was determined to be not feasible due to the cost of the structural piece to mount it to the exterior wall.

Instead, Marshall D'Avray is being designed for solar on both the West and East roof, in conjunction with necessary roof replacement. Design and installation are targeted for 2024/25 FY.

Continuing to improve reliability and accuracy of meters

Continued work on mapping and verifying meter and piping layouts across campus. The verification of pump trap capacities for all units that are measured on campus was also completed. Determining the maximum steam load of each building is also being completed, in order to locate loss and ensure buildings are not being overcharged.

Establishing a steam trap maintenance program

Working with CHP staff to develop a steam trap maintenance program to ensure regular testing and monitoring of all ~2,000 steam traps on campus.

Saint John Campus

Upcoming solar PV installation

During the 2022/23 FY, a ground-mount solar PV system was approved to move forward for the UNBSJ campus.

This ground-mount system is 10 kW with a projected annual energy savings of 13,980 kWh and $1,344. The project will have an annual GHG emissions offset of 3.5 $mtCO_2e$. The project started producing energy in February 2024.

Additionally, UNBSJ has reached out to a local company to conduct rooftop solar energy audits for the Mackay Residence, Barry & Flora Beckett Residence, and the G. Forbes Athletic Centre.

Next round of energy audits

Since the first round of EMP projects is nearing completion, UNBSJ has engaged a consultant to conduct energy audits for the 5 remaining campus buildings that were not included in the first round: Hans Klohn Commons, K.C. Irving Hall, DAL Med, 40 Charlotte St., and Beaverbrook House.

These energy audits will focus on HVAC and controls upgrades, geothermal conversion/connection to current wells or a central geothermal plant, and solar.

A study was also conducted to connect K.C. Irving, Ganong Hall, and CRI buildings via a geoexchange network.

New Health & Social Innovation Centre

Construction on the new Health & Social Innovation Centre is well underway. The 65,000 square-foot, three and a half storey building features a hybrid structure, utilizing a concrete core; a steel frame for the education and research program spaces, to allow for flexibility of use in the future; and mass timber to create a warmer and more comfortable environment for informal learning and gathering spaces.

The project, which features a modern and transparent design, is targeting LEED Gold certification and will incorporate a geothermal system to support sustainable heating and cooling. There will be 60 wells in order to accommodate the load required for such a building. The building was also designed and built with a focus on promoting human and environmental health via the following factors:

- Location and Transportation
- Sustainable Site Development
- Water Savings
- High Energy Building Efficiency
- Materials

- Indoor Environmental Quality

The building is also designed in accordance with preparing UNB and its surrounding infrastructure to be resilient to climate change via underground infrastructure renewal around the facility.

Goals for 2024/25 Fiscal Year

In 2024/25, Energy Management aspires to continue these above efforts while also focusing on:

- Continuing to improve building meter reliability and sub-metering (F, SJ)
- Implementing more solar PV projects on campus (F, SJ)
- Upgrading remaining campus buildings to LED, hopefully with in-house resources to save money and make use of UNB's excellent trades people (F)
- Identifying more opportunities for energy projects (F, SJ)
- Starting work on the next phase of energy audits (SJ)
- Focus on projects not reaching intended savings (F, SJ)
- Focus on buildings that increased steam & water usage compared to the previous year (F, SJ)
- Look into demand management opportunities (F)

Appendices

Appendix A

Definitions and Terminology

Archived project is a project which has had cost avoidances tracked for the 10-year annual reconciliation period, which is the EMC's mandated monitoring period. After 10 years, the cumulative cost avoidance is recorded and then "archived". No further cost avoidance is attributed to the project.

ASHRAE is the American Society of Heating, Refrigerating and Air-Conditioning Engineers to which UNB is a member. ASHRAE 62.1 is outlined in the National Building Code as the standard to follow for minimum fresh air requirements in a building. Since COVID, the standard is now 10 CFM/person or 0.6 CFM/sqft.

CO_{2e} or carbon dioxide equivalent is a term which allows us to describe the environmental impact from different greenhouse gases from steam and electricity in a common unit.

Consumption (kWh) is the total amount of energy (electricity) used over a specific period.

Completed and reconciled project is a project where construction has finished, construction costs are finalized, and a fiscal year of performance as an energy project has passed. The project is then monitored for 10 years where the annual cost avoidance is measured and tracked for the project.

Cumulative cost avoidance of active projects is the total sum to date of the annual cost avoidance of the current projects being tracked within their 10-year reconciliation period.

Cumulative cost avoidance of archived projects is the sum of all cost avoidance generated by archived projects at the completion of their 10-year reconciliation period.

Cumulative cost avoidance forecast is the total sum of forecasted cost avoidances anticipated over the 10-year reconciliation period. This is an estimated figure based on the anticipated annual cost avoidance as predicted from the energy audit.

Cumulative cost avoidance target is the sum of the annual projected cost avoidances of energy projects over a 10-year reconciliation period. This provides an estimated project life cycle cost avoidance to compare with actual cost avoidances over a 10-year period.

Demand (kW) is the maximum amount of power (electricity) required by a building, that NB Power must have the capacity to supply to that meter, at any given time.

Emission Factor is a value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.

Energy Amortization is the annual calculated cost allocation of an energy project charged to the respective building where the energy project occurred, and utility cost avoidance will occur.

Heating degree day is a measurement designed to quantify the energy needed to heat a building. It is the number of degrees that a day's average temperature is below 18 degrees Celsius.

Appendix B

EMP Third-Party Leveraging for UNB

Funding Program	Received in FY 2023/24	Cumulative Funding Received
UNB Fredericton		
NRCan Eco-Energy (2011)	-	$101,830
Climate Action Fund (2012)	-	$380,880
Efficiency NB (2011-2014)	-	$1,135,808
NRCan Energy Manager (2020)	-	$12,000
NB Power $30/GJ Commercial Building Retrofit (2014-2022)	-	$111,982
NB Power Energy Audit Incentive (2014-present)	$0	$37,095
NB Power $60/GJ Commercial Building Retrofit (Dec 2022-present)	$13,284	$30,547
NB Power Low Carbon Economy Funding (2019-present)	$580,725	$1,595,051
NB Power Peak Demand Rebate (2017-present)	$4,020	$20,970
NB Power Business Rebate (2020-present)	$0	$40,459
UNBF TOTALS:	**$598,029**	**$3,466,622**
UNB Saint John		
NB Power $30/GJ Commercial Building Retrofit (2014-2022)	-	$35,417
NB Power Low Carbon Economy Funding (2019-present)	-	$965,642
UNBSJ TOTALS:	**$0**	**$1,001,059**

Appendix C

UNBF Detailed Project Reconciliation and Financials

Phase 1 & 2

Phase 1 & 2 Energy Improvement Projects Annual Reconciliation (Measurement & Verification) - Updating Period Ending April 2024

Project No.	Phase 1 & 2 Energy Projects	Estimates at Proposal Stage		Projections at Project Completion			Actual Cost Avoidance			
		Estimated Project Cost ($)	Estimated Annual Cost Avoidance ($)	Actual Project Cost ($)	M&V Start Date	Forecasted Cost Avoidance ($) Over 10 years	Annual Cost Avoidance ($)	Cumulative Cost Avoidance ($)	Reconciliation Completion Date	Simple Payback (Years)
137	SUB Variable Speed Range Hoods (Steam Table (Acc. 14343 Removed From Scope Acc# 14294) Approved	$27,727	$4,660	$32,112	M&V May 2014	$46,600	$4,660	$46,600	2024	6.9
166	SUB Steam Table (acc. 14343) – Deemed	$16,448	$8,304	$15,924	M&V May 2017	$83,040	$8,304	$58,128	2027	2.0
	Phase 1 and 2 Program Budget Proposal	$3,400,000								
	Active Reconciliation Totals	$44,175	$12,964	$48,036		$129,640	$12,964	$104,728		3.7
	Target – Cumulative Cost Avoidance Forecasted		$104,728							
	Archived Reconciliation (64 Projects) Totals			$3,312,639		$7,291,040		$9,044,445		
	Phase 1 and 2 Energy Program Totals			$3,360,675		$7,420,680		$9,149,173		
	Program Balance	$39,325								

Amendment 2

Amendment 2 Energy Improvement Projects Annual Reconciliation - Updating Period Ending April 2024													
Project No.	Amendment 2 Projects	Estimates at Proposal Stage					Projections at Project Completion *Includes Incentive $$ & Net Tax*			Actual Annual Cost Avoidances			
		Estimated Project Cost ($)	Estimated Project Cost to EMC ($) With Incentives	Annual Cost Avoidance ($) Estimated	Simple Payback (Years)	Simple Payback (Years) With Incentive	Actual Project Cost (INCLUDES Actuals where Possible & Incentives if Recieved)	Measurement and Verfication (M&V) Start Date	Forecasted Cost Avoidance ($) Over 10 years	Annual Cost Avoidance ($)	Cumulative Cost Avoidance ($)	Reconciliation Completion / 10 Yr. Archived Date	Simple Payback (Years)
95	Toole Hall (EMC Appr. Changes)	$946,661	$872,301	$105,806	8.9	8.2	$856,056	M&V 2014	$1,058,055	**$107,153**	**$1,071,526**	**2024**	**8.0**
97	Smart Metering	$61,560	$61,560				$61,560	N/A					
	Group C Total: Science Buildings	**$1,008,221**	**$933,861**	**$105,806**	**9.5**	**8.8**	**$917,616**		**$1,058,055**				
	Group Audit Cost (incentive = $36,000)	$96,500	$60,500				$60,500	N/A					
102	Memorial Hall	$79,572	$82,572	$10,854	7.3	7.6	$74,375	M&V 2016	$108,540	**$29,287**	**$234,300**	**2026**	**2.5**
103	Marshall d'Avray Hall	$398,983	$323,983	$47,644	8.4	6.8	$335,170	M&V 2014	$476,440	**$82,076**	**$820,764**	**2024**	**4.1**
104	MacLaggan Hall	$135,620	$112,640	$11,755	11.5	9.6	$73,387	M&V 2015	$117,550	**$20,044**	**$180,395**	**2025**	**3.7**
107	Keirstead Hall	$1,312	$1,267	$183	7.2	6.9	$2,504	M&V* 2015	$1,830	**$183**	**$1,647**	**2025**	**13.7**
108	IUC Forestry	$434,301	$359,301	$60,648	7.2	5.9	$423,540	M&V 2016	$606,480	**$49,112**	**$392,896**	**2026**	**8.6**
109	HIL - A2 Project Excluding Lighting	$120,976	$99,163	$15,657	7.7	6.3	$114,516	M&V 2014	$156,570	**$65,176**	**$651,761**	**2024**	**1.8**
148	HIL - LED Lighting	$164,718	$164,718	$19,026	8.7	8.7	$136,247	M&V 2016	$190,260	**$19,026**	**$152,208**	**2026**	**7.2**
110	Incutech #1	$68,413	$67,463	$10,291	6.6	6.6	$73,132	M&V 2014	$102,910	**$19,267**	**$192,669**	**2024**	**3.8**
112	Alumni Memorial	$59,474	$39,434	$7,434	8.0	5.3	$41,893	M&V 2015	$74,340	**$7,434**	**$66,906**	**2025**	**5.6**
114	Submetering (South Gym Only)	$12,563	$12,563				$12,563	N/A					
	Group D Total: Academic Buildings	**$1,572,432**	**$1,323,604**	**$183,492**	**8.6**	**7.2**	**$1,347,827**		**$1,834,920**				
	Group F Audit Cost (incentive = $4,000)	$9,000	$5,000				$5,000	N/A					
115	Annex C	$7,831	$7,687	$601	13.02	12.78	$5,782	M&V 2014	$6,013	**$876**	**$8,760**	**2024**	**6.6**
117	Daycare	$4,641	$3,955	$1,060	4.38	3.73	$5,744	M&V* 2015	$10,600	**$1,060**	**$9,540**	**2025**	**5.4**
118	Enterprise #3 - Header House	$21,785	$20,396	$1,077	20.23	18.94	$17,621	M&V 2014	$10,770	**$3,036**	**$24,288**	**2021**	**5.8**
119	Grad House	$6,328	$5,867	$803	7.88	7.31	$2,411	M&V 2014	$8,030	**$1,021**	**$10,205**	**2024**	**2.4**
120	Incutech#2	$42,501	$37,377	$3,998	10.63	9.35	$41,259	M&V 2014	$39,976	**$4,099**	**$40,993**	**2024**	**10.1**
121	Muriel McQueen	$5,507	$4,809	$966	5.70	4.98	$4,585	M&V 2014	$9,660	**$3,145**	**$31,777**	**2024**	**1.5**
122	Neville Homestead	$2,460	$2,208	$412	5.97	5.36	$3,409	M&V* 2015	$4,120	**$412**	**$3,708**	**2025**	**8.3**
123	Sommerville House	$7,323	$7,323	$1,202	6.09	6.09	$1,780	M&V 2016	$12,020	**$351**	**$2,808**	**2026**	**5.1**
	Group F Total: Ancillary Buildings	**$107,376**	**$94,622**	**$10,119**	**10.6**	**9.4**	**$87,591**		**$101,189**				

125	Tunnel Insulation Upgrade	$90,131	$90,131	$34,294	2.6	2.6	$101,997	M&V* 2015	$342,940	$34,294	$308,646	2025	3.0
169	Bailey Hall Fish Lab Water Recirculation - R1	$695,563	$695,563	$83,781	8.3	8.3	$696,757	M&V 2020	$837,810	$11,437	$45,748	2030	60.9
195	Bailey Hall LED Lighting	$125,926	$113,926	$15,245	8.3	8.3	$129,227	M&V 2022	$152,450	$30,974	$61,948	2032	4.2
	A2 Program Budget Proposal	$7,000,000											
	Actual Project Progress Totals To Date	N/A	N/A	N/A	N/A	N/A	$3,281,015		$4,316,594	$489,463	$4,313,493	Non-Appl.	6.7
	Estimated/Projected Project Totals	$0			Active M&V Totals		$3,263,394						
	Target - Cumulative Cost Avoidance Forecasted			$3,464,120									
	Archived 10 Yr. Reconciliations						$3,705,032		$7,650,190		$12,305,829		
	Amendment 2 Program Totals (Estimated+Actual)						$6,986,047						
	Program Balance	$13,953						10 Yr. Forecasted =	$16,622,423				

Notes on projects outside their estimated SPB:

Keirstead – over-budget by $1,200, increasing SPB by 6.5 years.

IUC Forestry – a second report was submitted in 2013 with a major adjustment regarding the Controls and Ventilation upgrade, which increased the project cost while lowering the annual savings.

Neville Homestead – over-budget by $1,000, increasing SPB by 2 years.

Bailey Fish Lab – readjusted the target reduction with consultation from MCW. However, the Bailey Chiller renewal project was still underway in 2021/22 which required the use of City of Fredericton water periodically, thus increasing the water usage in the building. The user group still has yet to keep the system in recirculation because they were dissatisfied with the equipment and the continued malfunctions/failures.

Amendment 3

Amendment 3 Energy Improvement Projects Annual Reconciliation - Updating Period Ending April 2024

Project No.	Amendment 3 Projects	Estimates at Proposal Stage			Projections at Project Completion			Actual Cost Avoidances			
		Estimated Project Cost to EMC ($) *Include Incentives*	Annual Cost Avoidance ($) Estimated	Simple Payback (Years)	Actual Project Cost (INCLUDES Actuals & Incentives if Received)	Measurement & Verification Start Date	Forecasted Cost Avoidance ($) Over 10 years	Annual Cost Avoidance ($)	Cumulative Cost Avoidance ($)	Reconciliation Completion Date	Simple Payback (Years)
126	**Automated Metering**	$400,000	$60,000	6.7	$482,403	M&V 2016	$600,000	$60,000	$480,000	2026	8.0
	Totals Project Cost	$400,000			$482,403						
	Energy Manager Discretionary Fund										
138	Singer AHU#6 CO2 Control	$1,000	$216	4.6	$455	M&V 2014	$2,160	$216	$2,160	2024	2.1
139	Bailey Hall Rm 38 Growth Chambers (2) Lighting	$2,127	$634	3.4	$2,127	M&V 2016	$6,340	$634	$5,072	2026	3.4
140	SUB Lighting Fixure Upgrade	$736	$147	5.0	$736	M&V 2014	$1,470	$147	$1,470	2024	5.0
143	Path Lighting: 2 NW entrance to SUB	$475	$95	5.0	$475	M&V 2015	$950	$95	$855	2025	5.0
144	Path Lighting: 2 at entrance to Bankbookstore	$475	$95	5.0	$475	M&V 2015	$950	$95	$855	2025	5.0
145	Path Lighting: 6 at Headhall exterior steps (LBR pa	$1,425	$285	5.0	$1,425	M&V 2016	$2,849	$285	$2,279	2026	5.0
156	For/Geo Summer Condensate Recovery	$1,750	$420	4.2	$1,204	M&V 2015	$4,200	$420	$3,780	2025	2.9
157	Presidents Residence Garage LED	$303	$61	5.0	$267	M&V 2016	$610	$61	$488	2026	4.4
158	Maclaggan Hall Exterior LED & Control Retrofit	$800	$239	3.3	$295	M&V 2016	$2,390	$239	$1,912	2026	1.2
159	IUC Phsyics Entry Heater	$1,800	$384	4.7	$464	M&V 2016	$3,840	$384	$3,072	2026	1.2
162	HIL 3 Way Valve - Simultaneous Heat/Cool	$9,480	$2,732	3.5	$3,160	M&V 2016	$27,320	$2,732	$21,856	2026	1.2
161	South Gym Lighting (EMC Vote/Approved Project)	$20,071	$4,545	4.4	$13,164	M&V 2016	$45,450	$6,958	$34,790	2021	1.9
163	Forestry/Geology Main Steam Valve Control	$5,000	$4,734	1.1	$5,216	M&V 2016	$47,340	$4,734	$37,872	2026	1.1
167	Campus House Exterior LED	$554	$111	5.0	$554	M&V 2017	$1,110	$111	$777	2027	5.0
172	Kierstead DHW Heat Pump	$4,233	$847	5.0	$6,889	M&V 2020	$8,470	$847	$3,388	2030	8.1
173	FM LED Lighting	$9,333	$3,378	2.8	$7,908	M&V 2017	$33,780	$3,378	$23,646	2027	2.3
174	College Hill Daycare LED Lighting	$2,285	$469	4.9	$1,847	M&V 2018	$4,690	$469	$2,814	2028	3.9
175	Alumni Memorial LED Lighting	$4,935	$1,531	3.2	$4,894	M&V 2018	$15,310	$1,531	$9,186	2028	3.2
176	Carleton Hall LED Lighting	$9,433	$2,695	3.5	$7,324	M&V 2018	$26,950	$2,695	$16,170	2028	2.7
177	Neville Homestead LED Lighting	$1,022	$206	5.0	$779	M&V 2018	$2,060	$206	$1,236	2028	3.8
178	Residence Administration LED Lighting	$1,564	$444	3.5	$1,628	M&V 2018	$4,440	$444	$2,664	2028	3.7
179	BankBookstore LED Lighting	$9,967	$3,315	3.0	$5,315	M&V 2019	$33,150	$3,315	$16,575	2029	1.6
180	SUB Cafeteria LED Lighting Leverage	$6,213	$1,243	5.0	$6,213	M&V 2019	$12,430	$1,243	$6,215	2029	5.0

181	Annex C LED Lighting	$2,473	$514	4.8	$1,367	M&V 2018	$5,140	$514	$3,084	2028	2.7
182	RN Scott LED Lighting	$8,655	$1,849	4.7	$6,853	M&V 2018	$18,490	$1,849	$11,094	2028	3.7
183	Dome MH Fixture #1 LED Leverage	$4,753	$951	5.0	$4,753	M&V 2018	$9,510	$951	$5,706	2028	5.0
185	Dome MH Fixture #2 LED Leverage	$4,753	$951	5.0	$4,753	M&V 2019	$9,510	$951	$4,755	2029	5.0
189	AUC basement LED Lighting (5 rooms)	$757	$413	1.8	$435	M&V 2020	$4,130	$413	$1,652	2030	1.1
190	Aitken House LED Lighting	$3,073	$1,413	2.2	$3,282	M&V 2021	$14,130	$1,413	$1,413	2022	2.3
	Totals Project Cost	$119,445			$94,256						
	Heat Recovery Projects										
165	AUC Ice Plant Waste Heat Utilization	$380,979	$47,622	8.0	$363,221	M&V 2018	$476,220	$20,555	$123,331	2028	17.7
188	Bailey Hall Chiller Plant Replacement	$232,375	$43,200	5.4	$232,376	M&V 2023	$432,000	$25,680	$25,680	2033	9.0
	Totals Project Cost	$613,354			$595,597						
	Capital Renewal Leveraging										
135	SUB Windows Leveraging (Summer 2012)	$30,000	$4,000	7.5	$30,000	M&V 2014	$40,000	$4,000	$40,000	2024	7.5
186	HeadHall S. PH Leverage (Priority 1-Option B)	$349,280	$43,660	8.0	$359,378	M&V 2021*	$436,600	$39,915	$119,745	2031	9.0
187	HIL Level 3 Mechanical Modifications	$201,560	$25,151	8.0	$201,560	M&V 2021	$251,510	$1,419	$2,838	2031	142.0
191	Toole Hall LED & Lab Controls Upgrade	$717,816	$113,657	6.3	$717,816	M&V 2024	$1,136,570				
	Totals Project Cost	$1,298,656			$1,308,754						
	Stakeholder Projects										
136	Site Lighting Automation	$18,346	$3,049	6.0	$27,204	M&V 2015	$30,490	$3,049	$27,441	2025	8.9
	Totals Project Cost	$18,346			$27,204						
	Emergent Technologies										
141	HIL Domestic Hot Water & Summer Shutdown	$33,672	$6,037	5.6	$32,431	M&V 2017	$60,370	$6,037	$42,259	2027	5.4
142	Currie Center Optimization - Rev 1 (M&V 12 yrs)	$1,210,721	$132,447	9.1	$1,181,172	M&V 2016	$1,324,470	$116,802	$934,419	2026	10.1
160	AUC LED Rink Lighting	$150,738	$18,638	8.1	$129,245	M&V 2017	$186,380	$18,638	$130,466	2027	6.9
168	FM Attic Spray Foam Insulation	$82,800	$12,280	6.7	$76,930	M&V 2017	$122,800	$7,100	$49,698	2027	10.8
170	MacLaggan Hall LED (Updated)	$80,204	$9,887	8.1	$72,840	M&V 2022	$98,870	$9,887	$19,774	2032	7.4
171	Central Heating Plant LED Lighting	$84,557	$11,873	7.1	$54,089	M&V 2022	$118,730	$33,316	$66,631	2032	1.6
	Totals Project Cost	$1,642,692			$1,546,707						

A3 Program Budget Proposal	$4,000,000									
Actual Project Progress Totals To Date		N/A	N/A	$4,054,920	10 Yr. Forecasted	$5,604,599	$383,728	$2,289,118	Non-Appl.	10.5
Estimated/Projected Project Totals	$0	Active M&V Totals		$4,038,474						
Target - Cumulative Cost Avoidance Forecasted		$2,665,383								
Archived 10 Yr. Reconciliations				$15,708		$62,252		$62,252		
Program Investment Total	$4,054,920									
Program Balance	-$54,920									

Notes on projects outside their estimated SPB:

AUC Ice Plant – issues with the system for all of 2021/22 including leaks and maintenance on different equipment. Ice Plant was started up in March 2022, and savings were almost reached in 2022/23 with the system in operation. However, in 2023/24 the chiller system tripped consistently, and the system was not in operation. In 2024/25, we are engaging MCW to investigate the chiller system to ensure it works properly moving forward.

HIL Level 3 Modifications – issues with the system during 2021/22 (not in operation). System only became operational in December 2022, should see better savings in 2023/24. In 2023/24, not reaching savings, but after discussions with MCW it was determined that we are not capturing all the savings resulting from the project. We were missing the heat wheel portion. Savings should be better for 2024/25.

Site Lighting Automation – over-budget by $12,144, increasing SPB by 2.9 years.

Currie Center Optimization – not reaching intended savings only by a slight amount, causing the SPB to increase minimally.

Facilities Management – baseline adjusted in 2018/19 to reflect the change in usage (Security moving into the building) not accounted for when the project was designed. SPB is over by 3.2 years.

EMP2.0 Energy Improvement Projects Annual Reconciliation - Updating Period Ending April 2024

Project No.	EMP2.0 Projects	Estimates at Proposal Stage			Projections at Project Completion			Actual Cost Avoidances			
		Estimated Project Cost to EMC ($) *Excludes Incentives*	Annual Cost Avoidance ($) Estimated	Simple Payback (Years)	Actual Project Cost (INCLUDES Actuals & Incentives if Recieved)	Measurement & Verification Start Date	Forecasted Cost Avoidance ($) Over 10 years	Annual Cost Avoidance ($)	Cumulative Cost Avoidance ($)	Reconciliation Completion Date	Simple Payback (Years)
FREDERICTON CAMPUS											
	Energy Manager Discretionary										
198	LB Residence LED Lighting	$17,182	$3,598	4.8	$17,617	M&V 2022	$35,980	$6,322	$12,645	2032	2.8
201	Keirstead LED Lighting	$11,784	$2,605	4.5	$19,105	M&V 2023	$26,054	$3,604	$3,604	2033	5.3
203	LB Gym LED Lighting for Gym	$2,793	$1,738	1.6	$3,574	M&V 2023	$17,380	$3,634	$3,634	2033	1.0
204	McConnell LED Lighting	$11,347	$4,135	2.7	$11,972	M&V 2023	$41,350	$3,391	$3,391	2033	3.5
206	Campus House LED Lighting	$225	$137	1.6	$112	M&V 2024	$1,371				
207	BMO Clubhouse LED Lighting	$749	$264	2.8	$1,386	M&V 2024	$2,636				
208	Grad House LED Lighting	$191	$488	0.4	$511	M&V 2024	$4,876				
209	Neill House LED Lighting	$2,914	$2,494	1.2			$24,940				
210	Mackenzie House LED Lighting	$3,693	$3,279	1.1			$32,790				
	Totals Project Cost	$50,878			$54,277						
	Quick Wins										
192	Sir Howard Douglas Hall LED Lighting	$15,509	$1,596	9.7	$6,291	M&V 2021	$15,960	$1,596	$4,788	2031	3.9
193	Carleton Hall LED Lighting	$25,931	$2,029	12.8	$5,743	M&V 2021	$20,290	$568	$1,704	2031	10.1
194	Tilley/Singer LED Lighting	$188,957	$15,194	12.4	$32,903	M&V 2021	$151,940	$15,194	$37,985	2031	2.2
197	EPJ LED Lighting	$43,485	$12,241	3.6	$20,537	M&V 2022	$122,410	$13,466	$26,933	2032	1.5
	Totals Project Cost	$273,882			$65,474						
	Other Funding Sources										
196	CP&O Solar PV	$83,500	$2,498	33.4	$75,740	M&V 2022	$24,980	$1,326	$2,651	2032	57.1
200	Kinesiology Solar PV	$181,120	$6,399	28.3							
205	Aitken Centre Solar PV	$36,119	$16,497	2.2		No longer feasible					
	Totals Project Cost	$300,739			$75,740						
SAINT JOHN CAMPUS											
	Other Funding Sources										
199	Ground Mount Solar PV	$40,266	$1,344	30.0	$40,266	M&V 2024	$13,439				
	Totals Project Cost	$40,266			$40,266						
	EMP2.0 Program Budget Proposal	$2,000,000									
	Actual Project Progress Totals To Date		N/A	N/A	$119,752	10 Yr. Forecasted	$497,978	$47,775	$94,684	Non-Appl.	2.5
	Estimated/Projected Project Totals	$6,607	Active M&V Totals		$117,742						
	Target - Cumulative Cost Avoidance Forecasted		$82,834								
	Program Investment Total	$126,359									
	Program Balance	$1,873,642									
	Shading Represents Earmarked Funds for Solar Projects, not EMP money.					$640,487	Earmarked Funds used for Solar Projects				

Notes on projects outside their estimated SPB:

Keirstead LED – project over-budget due to needing to replace the T12 hallway fixtures instead of re-lamping.

McConnell LED – project slightly over-budget.

UNBSJ Detailed Project Reconciliation and Financials

UNBSJ Energy Improvement Projects Annual Reconciliation - Updating Period Ending April 2024

Project No.		Estimates at Proposal Stage				Projections at Project Completion			Actual Cost Avoidances			
		Estimated Project Cost to EMC ($) Includes Incentives	Annual Cost Avoidance ($) Estimated	Simple Payback (Years)	Simple Payback (Years) With Incentive	Actual Project Cost (minus Incentives Received)	Measurement & Verification Start Date	Forecasted Cost Avoidance ($) Over 10 years	Annual Cost Avoidance ($)	Cumulative Cost Avoidance ($)	Reconciliation Completion Date	Simple Payback (Years)
1	KC Irving Hall Lighting Retrofits	$49,371	$6,413	7.7	6.9	$46,470	M&V 2020	$64,130	$9,879	$39,515	2030	4.8
2	KC Irving Hall Exterior LED Lighting	$1,389	$481	2.9	1.7	$1,063		$4,810				
3	Thomas J Condon Student Centre Lighting Retrofits	$36,878	$5,153	7.2	6.2	$20,141	M&V 2020	$51,530	$39,917	$98,834	2030	3.9
4	Thomas J Condon Student Centre Ventilation-Kitchen Hood Variable Air Flow Control	$64,112	$6,628	9.7	8.6	$38,736	M&V 2022	$66,280				
5	Thomas J Condon Student Centre Building Automation System Upgrade	$166,115	$22,237	7.5	6.4	$96,884	M&V 2022	$222,370				
6	Thomas J Condon Student Centre Domestic Water Retrofits	$984	$1,867	0.5	0.5	$89	M&V 2022	$6,915				
7	G Forbes Elliot Athletics Centre Lighting Retrofits	$22,467	$2,630	8.5	7.6	$39,727	M&V 2020	$9,741	$47,408	$166,290	2032	4.6
8	G Forbes Elliot Athletics Centre Exterior LED Lighting	$46,067	$3,721	12.4	11.2	$23,249		$37,210				
9	G Forbes Elliot Athletics Centre Building Automation System Upgrade	$244,427	$28,970	8.4	7.3	$152,718		$289,700				
10	G Forbes Elliot Athletics Centre Domestic Water Retrofits	$492	$1,030	5.0		$44	M&V 2022	$10,300				
11	Beaverbrook House Exterior LED Lighting	$3,470	$488	7.1	6.3	$219	M&V 2019	$4,880	$488	$2,440	2029	0.4
12	Ward Chipman Building Exterior LED Lighting	$2,524	$291	8.7	7.5	$2,689	M&V 2019	$2,910	$291	$1,164	2022	9.2
13	Ward Chipman Building Unoccupied Space Isolation & Controls Upgrades	$126,603	$24,426	5.2	4.1	$28,403		$244,260	Bldg being decommissioned.			
14	Ward Chipman Building Domestic Water Retrofits	$10,404	$2,147	4.8	4.8	$936	M&V 2022	$21,470	No data.			
15	William Ganong Hall Exterior LED Lighting	$7,302	$752	9.7	8.6	$1,050	M&V 2019	$7,520	$752	$3,760	2029	1.4
16	William Ganong Hall Air Compressor Replacement	$26,081	$15,900	1.6	1.4	$17,080	M&V 2022	$159,000	$29,668	$59,336	2032	45.7
17	William Ganong Hall VAV Lab Control & Building Optimization	$1,268,954	$73,049	17.4	16.4	$1,338,069	M&V 2023	$730,490				
18	Colin B. Mackay Residence Lighting Retrofits	$48,781	$5,528	8.8	7.9	$51,205	M&V 2020	$55,280	$976	$3,905	2030	56.6
19	Colin B. Mackay Residence Exterior LED Lighting	$2,994	$187	16.0	14.8	$4,034		$1,870				
20	Canadian Rivers Institute Lighting Retrofits	$238	$37	6.4	5.5	$21	M&V 2019	$370	$291	$1,455	2029	3.9
21	Canadian Rivers Institute Exterior LED Lighting	$1,764	$254	6.9	5.8	$1,118		$2,540				
22	Canadian Rivers Institute VAV Lab Control & Building Optimization	$143,585	$9,248	15.5	14.5	$197,657	M&V 2023	$92,480	$0	$0	2033	
23	Philip W. Oland Hall Exterior LED Lighting	$2,497	$240	10.4	9.2	$385	M&V 2019	$2,400	$240	$1,200	2029	1.6
24	Philip W. Oland Hall Building Automation System Upgrade	$96,309	$18,713	5.1	4.1	$77,152	M&V 2020	$187,130	$11,989	$47,957	2030	6.4
25	Sir James Dunn Residence Exterior LED Lighting	$2,441	$168	14.5	13.4	$260	M&V 2019	$1,680	$168	$840	2029	1.5
26	Sir James Dunn Residence Heat Recovery	$23,518	$2,651	8.9	7.7			$26,510				
27	Sir James Dunn Residence Domestic Water Retrofits	$1,898	$241	7.9	7.3	$171	M&V 2022	$2,410	$6,520	$13,040	2032	0.0
28	Sir Douglas Hazen Hall Exterior LED Lighting	$4,868	$502	9.7	8.5	$1,409	M&V 2019	$5,020	$502	$2,510	2029	2.8
29	Sir Douglas Hazen Hall Building Automation System Upgrade	$152,828	$14,232	10.7	9.7	$94,981	M&V 2021	$142,320	$36,836	$110,507	2031	2.6
30	Physical Plant (Facilities Management) Domestic Water Retrofits	$70	$75	0.9	0.3	$6	M&V 2022	$750	$75	$150	2032	0.1
31	Canada Games Stadium Exterior LED Lighting	$4,678	$172	27.2	26.0	$4,228	M&V 2019	$1,720	$172	$860	2029	24.6
32	Canada Games Stadium Domestic Water Retrofits	$7,733	$1,982	3.9	3.2	$696	M&V 2022	$19,820	$4,106	$8,213	2032	0.2
33	Annex A & B (Saint John College) Lighting Retrofits	$33,226	$2,414	13.8	13.0	$17,850	M&V 2020	$24,140	$3,545	$14,181	2030	5.7
34	Annex A & B (Saint John College) Exterior LED Lighting	$3,955	$395	10.0	8.8	$2,530		$3,950				
35	Annex C (Engineering Building) Lighting Retrofit	$10,232	$926	11.0	10.3	$5,895	M&V 2019	$9,260	$1,035	$5,175	2029	7.0
36	Annex C (Engineering Building) Exterior LED Lighting	$1,023	$109	9.4	8.2	$1,400		$1,090				

37	Annex C (Engineering Building) Programmable Thermostats	$703	$103	6.8	5.7							
38	Annex N (Student Health Centre) Lighting Retrofits	$1,002	$114	8.8	8.2	$1,055	M&V 2019	$1,140	$244	$1,220	2029	5.6
39	Annex N (Student Health Centre) Exterior LED Lighting	$681	$130	5.2	4.1	$308		$1,300				
40	Annex N Programmable Thermostats	$256	$51	5.0	3.8							
41	UNBSJ Campus Stream Trap Replacement	$15,000	$45,880	0.3	0.3	$13,306	M&V 2022	$458,800	$45,880	$91,760	2032	0.3
42	UNBSJ Campus Metering Program	$310,728	$55,265	20.0	20.0	$448,499	M&V 2019	$155,360	$55,265	$276,325	2029	8.1
	Totals Project Cost	$2,948,648	$355,800	8.3	7.5	$2,731,731		$3,130,856				
	Program Budget Proposal	$2,960,000										
	Actual Project Progress Totals To Date		N/A	N/A		$2,731,731	10 Yr. Forecasted	$2,862,216	$296,247	$950,637	Non-Appl.	9.1
	Estimated/Projected Project Totals	$24,477	Active M&V Totals			$2,699,703						
	Target - Cumulative Cost Avoidance Forecasted	$838,993										
	Program Investment Total	$2,756,208										
	Program Balance	$203,792										

<u>Notes on projects outside their estimated SPB:</u>

Colin Mackay – Over-budget by $3,464. Not reaching intended lighting savings.

William Ganong – Lab control portion was over-budget and is not reaching intended savings.