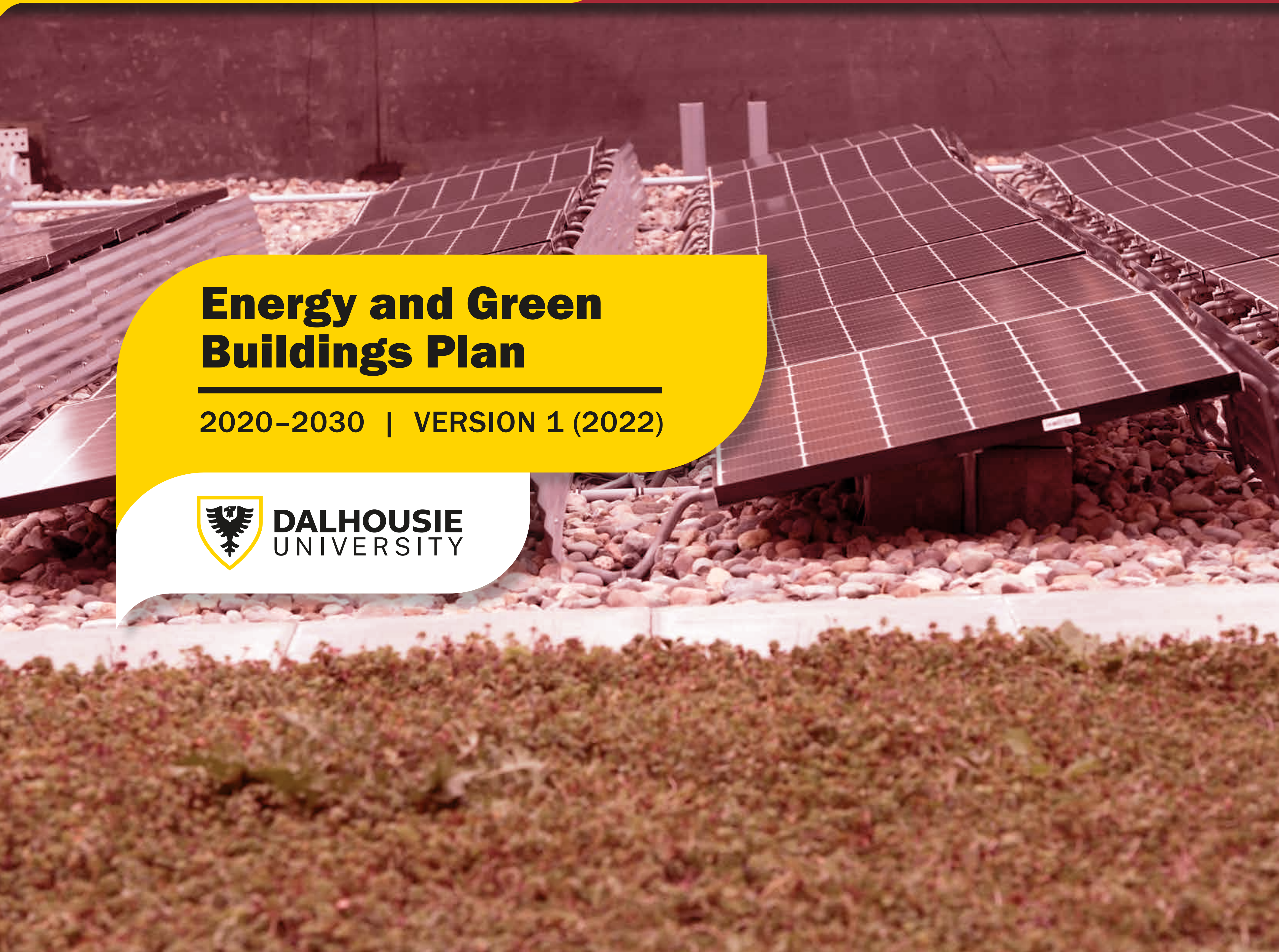
Energy and Green Buildings Plan

2020–2030 | VERSION 1 (2022)

DALHOUSIE
UNIVERSITY



Acknowledgements

Prepared by the Office of Sustainability with engagement and information from Facilities Management, from building and energy professionals, campus, and community members. Between 2019 and 2022, additional focus groups, surveys, reporting frameworks, literature and plan reviews, and a new University Strategic Plan provided revised content for the plan.

Land Acknowledgment

Dalhousie sits on the unceded territory of the Mi'kmaq people and recognizes the interconnectedness of all our relationships—to the environment and to each other—for generations to come.

We recognize that African Nova Scotians are a distinct people whose histories, legacies and contributions have enriched that part of Mi'kma'ki known as Nova Scotia for over 400 years.

Rainwater cistern in the Design Building.

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This plan focuses on the built environment that Dalhousie owns and operates from existing buildings to new construction. It includes goals related to sustainable building with particular focus on energy and water, air quality, climate change, sustainable materials and sites, transportation demand management, and social health objectives. It references energy and green building literature, standards, programs, and experience from ISO 50001 to programs of the World and Canada Green Building Council.

Dalhousie recognizes and reports on the UN Sustainable Development Goals through reporting frameworks. This plan addresses Goal 3 Good Health and Well-Being, Goal 6 Clean Water and Sanitation, Goal 7 Affordable and Clean Energy, Goal 11 Sustainable Cities and Communities, Goal 12 Responsible Consumption and Production, Goal 13 Climate Action, Goal 14 Life Below Water, Goal 15 Life on Land, and connects to each of the other 9 goals.

1.0 **Current Context**

1.1 **Energy and Building Landscape**

Societies' use of energy sources has globally increased exponentially from 1900 (over 12,000TWh) to 2020 (over 176,000 TWh) and is tracking to continue growing at the same exponential rate. The diversity of sources has changed from primarily biomass, to coal and biomass, to now include oil and gas, hydro, nuclear, and renewable energy such as wind and solar.[1]

Driven by technology, consumption, and population, the built environment is also expanding at a significant pace. At universities, our buildings, information technology, and district energy networks drive operational and embodied energy use. Other energy consumption is largely connected to transportation usage for field research, commuting, business travel, and procurement of goods.

The creation, operation, and disposal of buildings account for significant use of energy sources globally. High carbon energy sources can drive up the carbon footprint of this work.[2] Producing and transporting energy sources is under a major transition as society grapples with the impacts of rapid climatic changes spurred by greenhouse gas pollution from fossil fuel energy use. The production and distribution of energy sources is linked to prosperity, pollution, violence, and inequity.[3] Countries are moving to reduce energy use, decarbonize, and decentralize energy sources to slow down the negative impacts of climatic change and increase energy security and equity, though the pace of progress needs to increase dramatically.[4]

In Canada, the built environment represents the third largest greenhouse gas source.[5] Nova Scotia imports fossil fuel (oil, coal, natural gas, gasoline, and diesel) from other countries and from western and central Canada for heating, cooling, and power.[6] The region is vulnerable to geo-political changes, commodity and distribution toll pricing, and severe weather. Energy efficiency has been a key focus in the province with supportive organizations like Efficiency NS aiming to reduce energy (primarily electricity) source consumption.[7] More wind, small amounts of solar, and hydro from Newfoundland and Labrador (NL) have been

Low Flow toilet in the Arts Centre.

added to the electricity grid though the bulk amount of fuel use for electricity still tends to be coal, gas, oil, and small amounts of biomass. Integrated resources planning from Nova Scotia Power outlines the introduction of more hydro (from NL), more wind, and a potential for major regional power sharing projects. Green hydrogen and tidal electricity are in the development stages, along with smaller scale use of storage (battery and thermal).[8,9,10]

The pace and proliferation of green building programs have escalated in recent years to address the impact of the built environment on societal health, the environment, and life cycle costs.[11] Owners use third-party certification to support higher performance for measures such as reducing natural resource consumption and pollution, supporting liveable communities, having clear and tracked sustainability standards, identifying specific quantifiable goals and deliverables for the building team, and for amplifying education and reputation. Time, administrative work, and program-related fees are cited as reasons for not pursuing certifications.[12] More recently, emphasis on zero-carbon and net-zero building has been included in standards and policy statements to advance progress on reducing greenhouse gases. Definitions and programs are continuing to evolve, and some are more comprehensive than others. Some key elements include immediate and comprehensive energy and emissions through reduction (conservation and efficiency), followed by using renewable energy sources and potentially storage.[13] Scientifically sound use of carbon offsets and removals, after reduction and renewables are exhausted, and that are consistent with sustainable development goals, are highlighted.[14]

1.2 Existing Infrastructure

Dalhousie University owns and operates 96 building structures and houses across all three Halifax campuses: Studley, Carleton, and Sexton. Over ninety-five percent of these buildings and some of the houses are on a district energy (DE) system where steam is created from natural gas at the Central Services Building. Steam and hot water are used for heating and some cooling. Steam is directly provided to the Studley and Carleton campus buildings. The district steam is converted to hot water at the Tupper Building (Carleton campus) to serve the Collaborative Health Education Building (CHEB), and the majority of the Sexton Campus, through a direct buried insulated hot water line that runs 1 km to the Sexton Campus. In the last decade, newer buildings use heat pump technology (air or ground source) for heating and cooling with small amounts of energy from the DE system.

The DE system also provides central cooling through a chilled water loop to key buildings on the Studley and Carleton campuses. At the central plant, chilled water is generated through electric and gas chillers. Some newer buildings have individual electric cooling systems. Nine solar air, thermal and photovoltaic (PV) systems are on campus building rooftops to offset load. The Sexton campus has a geoexchange field used for heating and cooling.

All properties are located on the peninsula of Halifax, NS. The total building floor space owned and operated by Dalhousie in Halifax is just over 5,000,000 million square feet. The university also leases a small amount of space in hospitals and retail locations in Halifax.

Computer Science Building solar system

Most campus buildings on the Studley and Carleton campus are fed by a Nova Scotia Power main electrical feed. Campus houses, the Mona Campbell building, and Sexton campus are fed by street feeds from Nova Scotia Power. Water meters, for most properties in Halifax, have a water meter from the Halifax Water Commission.

Natural gas and very small amounts of furnace oil are used for peaking fuel, and water and chemicals are used to create steam at the Central Heating Plant. Sexton campus receives hot water via a steam to hot-water conversion station at the Tupper Building. There are a small number of house properties that have natural gas, heat pumps, or oil-fired boilers, and two properties that have predominately electric heating). Diesel and propane are used for back-up generation, labs, kitchens, and/or warehouse heating. On-campus renewable energy sources offset heat, electricity, and potable water.

The Agricultural Campus (AC) includes 45 buildings and houses totalling 837,400 square feet. Over 95% of all building space at the AC is on a district energy (DE) system fed from a central biomass cogeneration plant. Biomass sources comes from sawmill residue. The thermal oil heat created from the biomass heater moves a 1 MW turbine used to create electricity. This Organic Rankine Cycle (ORC) system is a first installation of its kind at a university campus in North America. Process thermal energy is used for heating the campus through a hot water network. The electricity produced (approximately 70% of what the campus uses) is supplied to the grid.

At the AC, two main Nova Scotia Power feeds (North and South of College Rd) provide electricity to the campus. Some smaller house properties and off campus locations are street fed and use heat pumps and oil as heating sources. Currently there are two main campus water feeds at the AC provided by the Town of Truro. An on-campus well is used to provide water for aquaculture facilities in the Haley building.

All utilities have meters on Dalhousie properties to measure consumption and to bill the university. Dalhousie also has a large network of utility meters used to meter buildings and subsystems as gas and electricity are often fed from one main feed. Depending on the meter type the university or the utility is responsible for purchasing and maintaining the hardware and software. A master meter spreadsheet was developed which includes a list of the Dalhousie meters used on campus, their location and related account information. Meter technical specifications have also been assembled. Different software is used for utility and costing analytics, benchmarking, and reporting.

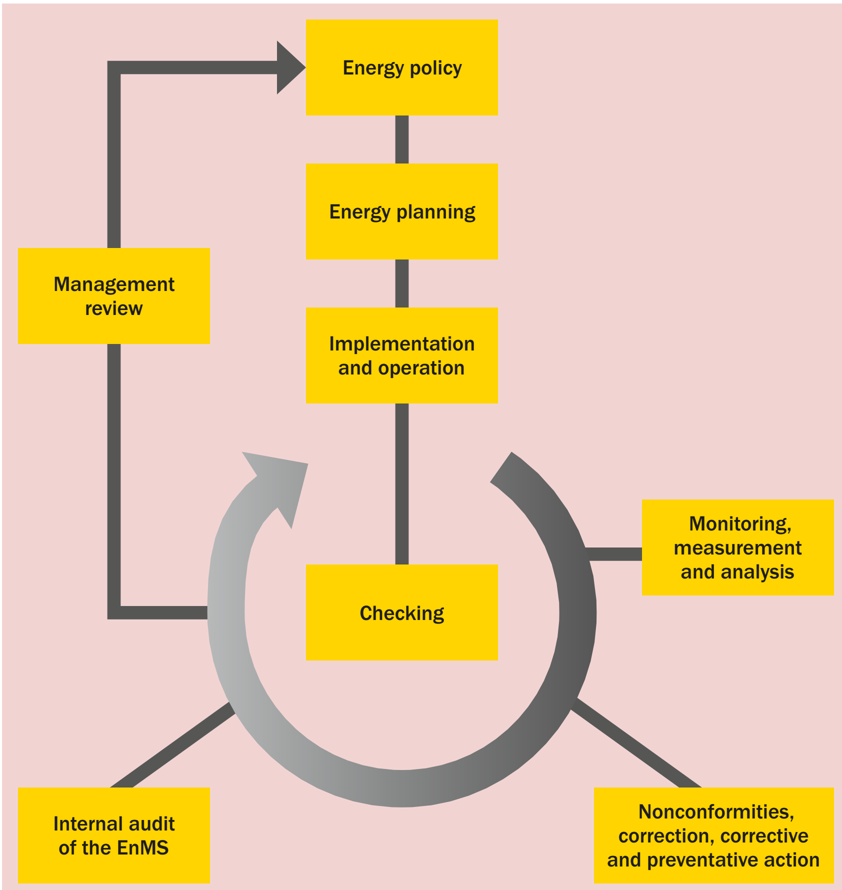
Leased space and facilities that are owned, but not financially operated by Dalhousie (such as Peter Green Hall), are outside the scope of this plan. The University provides steam and hot water to the University of King's College buildings, a National Research Council building (Oxford St and Coburg Road), the Halifax Law Court (Spring Garden Road), and a local apartment building (6101 South Street).

Agricultural Campus biomass cogeneration plant

1.3 **Energy and Green Building Planning and Policy**

For over a decade a concentrated energy planning and program has been in place. It follows a similar process as what is defined in the ISO 50001 standard (Figure 1).

Figure 1. Energy Management Information System Model (ISO 2011)



Energy and green building key performance indicators and energy policy directives are outlined in Section 5 (Energy and Green Building) of the University Sustainability Policy and in the University Design Guidelines.

Energy planning is informed by a number of data sets including Level 1 building audits; Level 2 building audits; site visits; meetings with facilities and other departmental staff; building metering analyses; benchmark comparisons through reporting programs like ENERGY STAR®, Sustainable Tracking Assessment Rating System (STARS), ASHRAE, APPA; and published industry and sector information. Energy performance is defined in building codes, programs, and best practices documents.

Green building planning includes utility planning (energy and water), as well as analysis for issues such as sustainable transportation, site management and landscapes, pollution reduction (indoors and outdoors), sustainable materials, social and artistic initiatives, and innovation and leadership.

First LEED Gold building at Dalhousie, Mona Campbell Building

A variety of factors help inform green building plans and policies including campus wide surveys and meetings, university and international sustainability reporting, funding programs, government, industry, and literature. A recent review of the U15 (15 research-intensive universities in Canada) sustainable building policies and actions showed 14 of 15 universities using the Leadership in Energy and Environmental Design (LEED) program for policy targets and action. Some organizations, including universities, are also moving to Net-Zero and Passive House certification along with LEED. Comprehensive green building programs cover several topics with a level of scope that some other singular focused programs may not have. Funders and rating systems often cite green building programs as proof of performance. Recently cited targets include Net-zero, Net-zero Ready, LEED Platinum, and Passive House. All levels of government have cited Net-zero building codes by 2030.

Building on energy planning efforts, several processes are used to action initiatives including:

- Reviewing annual facilities renewal and client (departmental funded) projects for sustainable building and energy opportunities.
- Developing sustainability projects that are funded through Dalhousie's utility savings business case model. The Office of Sustainability annually submits utility business cases where utility savings/cost avoidance will pay back a project over a set period.
- Incorporation of sustainability and energy features in new construction planning and design, and in design guidelines.
- Incorporation of sustainability and energy features in procurement tenders, request for quotes and proposals, and standing offers.
- Ongoing discussion with the green building and energy professional community.
- Ongoing optimization of building spaces through programs like recommissioning.
- Meeting quarterly with the energy committee. Members from the Office of Sustainability and Facilities Management discuss ideas and projects.
- Developing sustainability projects that are advanced and funded through student and class research, external grants, strategic initiatives, and operating dollars.

A comprehensive energy management information system (EMIS) is in place. Annual reporting of key sustainability performance metrics is provided to senior administration and the Board. Comprehensive international reporting including energy and green building performance indicators is submitted to the Times Higher Education (THE) Impact Rankings program and the Sustainable Tracking Assessment Rating System (STARS) program. Ongoing meetings, analysis measurement and verification are used to identify issues and opportunities for improvement.

1.4 **Benchmarking**

Energy and Green buildings efforts are regularly benchmarked against:

- Our own performance and learnings (published in university sustainability reporting);
- Models and predictions;
- Others in our sector through participation in public reporting programs like STARS, THE, and ENERGY STAR® Building Portfolio manager; and
- Leaders and stretch goals in this space as outlined by professionals, practitioners, and government.

The measurements used varies from program to program with some accounting for variables like weather and functionality and others not. Several variables impact utility consumption such as space type (e.g., lab buildings and food services spaces are far more energy intensive per square foot than academic buildings), weather, occupant density, space changes, square footage, and construction projects. When analyzing energy opportunities spaces are categorized, based on ENERGY STAR® Building Portfolio manager, to understand trends and performance in the areas of Academic, Athletic, Community, Data Centre, Laboratory, Office, Residence, Warehouse, and Central Service.

The baseline year for most sustainability key performance indicators is 2010, established with the publication of the first University Sustainability report. From 2010–2020:

- The average electricity reduction per person for all campuses was 15% compared to the baseline (Figure 2).
- The average fuels reduction per person for all campuses was 27% (Figure 3).

- A total reduction of 64% in absolute consumption of water was achieved (Figure 4).
- Green buildings indicators included striving for LEED gold in new capital construction and applying sustainable building design guidelines in existing projects. After this time buildings achieved LEED Silver or Gold Certification status or are candidate buildings and more sustainable building design guidelines were developed and used.

During fiscal years 2020–2021 and 2021–2022, the COVID-19 pandemic changed university operations as many students and employees worked remotely. Research, facilities management, health professional education, and other functions remained active on campus. Reductions were seen on average of 20% for energy and 34% for water. At the AC, a major science building came online, increasing consumption. In buildings that were still open, heating, ventilation, and air conditioning (HVAC) units (existing and temporary) were ramped up to provide more fresh air exchanges.

Figure 2. Electricity usage kWh per person (Halifax and AC).

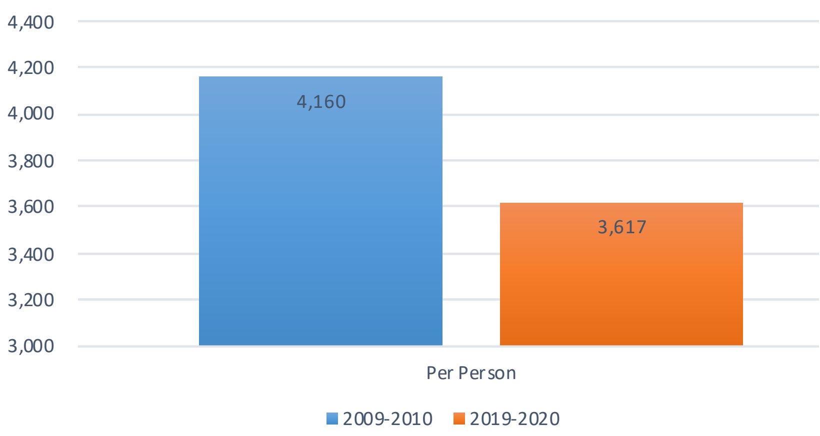


Figure 3. Fuels reduction kWhe per person (Halifax and AC).

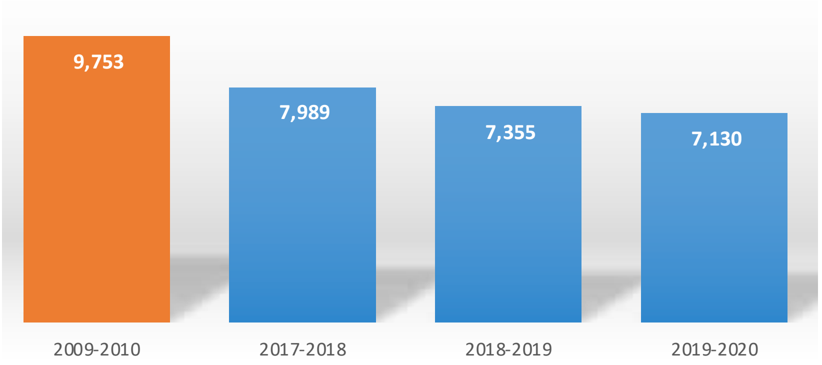
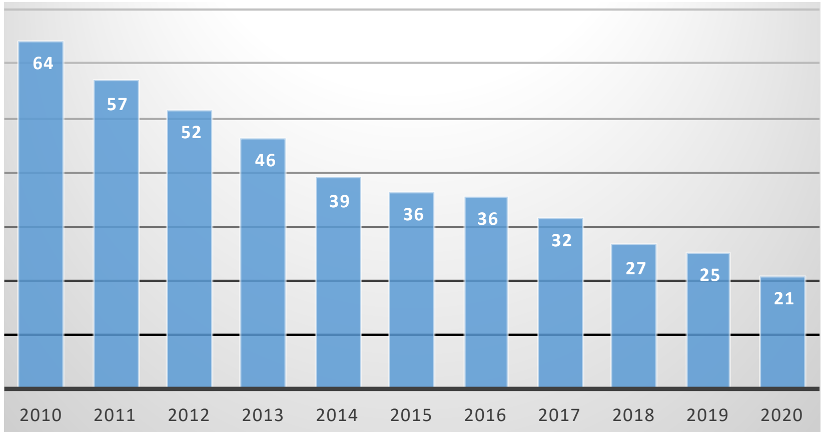


Figure 4. Total water reduction per person/m3 (Halifax and AC).



2.0 Plan Development and Management Timeline

In the last decade: numerous projects, studies, and optimization initiatives have been completed (Figure 5.)

Figure 5. Timeline information.

2008–2009	2010–2011	2012–2013	2014–2015	2016–2017	2018–2019	2020–2021
▸ Creating of Utility Savings business case model to fund utility and sustainability projects in the built infrastructure ▸ Incandescent bulb switch out, hot water tank wrap, server upgrades ▸ Deep Retrofit of the LSC ▸ Energy and water upgrades of campus houses	▸ Campus Lighting upgrade (HFX) ▸ Green Building Policy passed ▸ Mona Campbell, LSRI bldg. opened ▸ Ecoloymics started ▸ Aquatron water recycling	▸ Campus Energy Master Plan and Building Audits ▸ ENS Embedded Energy Manager started ▸ Steele Ocean Science Building opened ▸ Energy efficient Fridge/Freezer replacement and major kitchen equipment upgrades ▸ SUB upgrades (solar, lighting, HVAC)	▸ Energy Committee Started ▸ AC Renewable Energy Master Plan ▸ Deep Retrofit of the Tupper Building ▸ LMP and CHEB buildings opened ▸ Water fixture upgrades	▸ Upgrade of district steam to hot water at AC and Sexton ▸ AC campus lighting upgrades ▸ Server consolidation ▸ Steam pipe and valve insulation (two phases) ▸ WMLC building opened	▸ Energy Management Information Systems Plan ▸ Upgrade of biomass boiler to biomass co-generation at AC ▸ Start of Heating and Cooling Plant renewal ▸ Data centre – cold aisle containment and free cooling ▸ Fitness Centre, IDEA and Design buildings opened	▸ Campus LED tube switch out ▸ Water purification reductions ▸ High efficiency belts ▸ Green Labs Program started ▸ Optimizing DE system flow

ONGOING Metering enhancements, ongoing commissioning including recommissioning, building optimization, and setbacks, high efficiency pumping and variable frequency drive upgrades, multiple renewable energy and rain water systems added as part of new buildings (LEED Silver or Gold)

On average, 10–15 projects are in implementation stages each year as others are being planned. Dalhousie has received two Efficiency NS awards for energy work: (2013) Bright Star Award and the (2019) Bright Business Engagement.

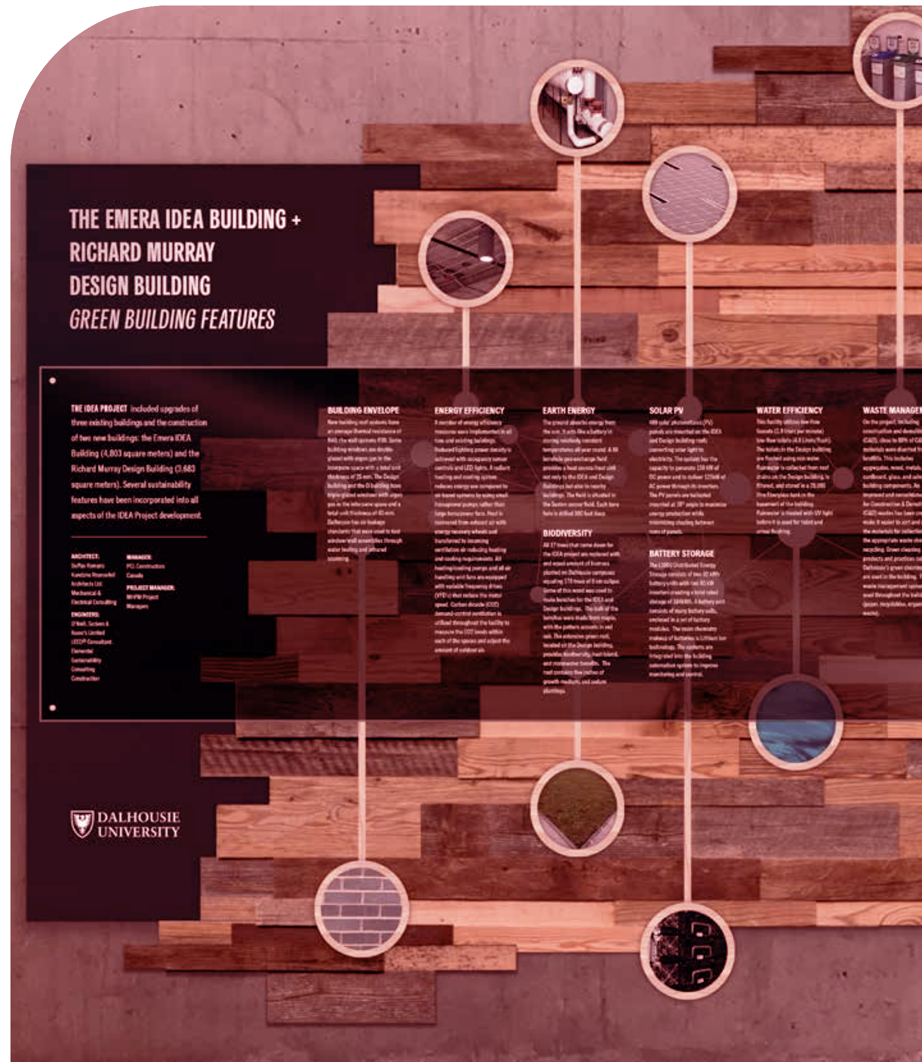
Since 2010, nine buildings have been built (Mona Campbell, Life Science Research Institute, Steele Ocean Science, LeMarchant Place, Wallace McCain Learning Commons, Collaborative Health Education Building, Fitness Centre, Emera IDEA and Richard Murray Design). Buildings achieved LEED Gold or Silver standards or are candidate buildings. Two major existing science buildings (LSC and Tupper) have undergone multi-million-dollar full-building energy performance upgrades. This represents 17% of the building space in Halifax campuses. Third-party certification for the full building energy retrofits and other building retrofits were examined. At the time a path was chosen to upgrade Dal design standards and practice for existing buildings. If LEED buildings and full building retrofits are included, this represents 33% of Halifax buildings and 29% of all building space of all campuses (Halifax and the AC).

Throughout the nine new Dalhousie buildings and full-building retrofits, several new initiatives and features have been implemented. Examples of strategies include:

- Sustainable Sites: electric car charge stations, end-of-trip indoor and outdoor facilities, green roofs, white roof, naturalized vegetative areas, and permeable concrete.
- Water Efficiency: rainwater cisterns, low-flow fixtures, and eliminating once through water cooled equipment.
- Energy and Atmosphere: geo-exchange (ground source heat pumps), solar strategies (air heating-solar wall, hot-water heating – solar thermal, electricity generation – solar photovoltaics and battery storage), variable refrigerant flow (VRF) heat-recovery heat-pump system, high efficiency equipment and systems, triple-pane windows and higher than normal envelope insulation, LED lighting, active chilled beams, assembly water and air testing, measurement and verification, and enhanced commissioning.
- Materials and Resources: Carbon cure concrete block, FSC certified wood, bubble deck construction, deconstruction and salvage, and other local and recycled content products.
- Environmental Quality: Low VOC furniture and products, and air quality sensors and testing.
- Innovation and Design: tree re-use (trees on site were used for furniture in the building and the biomass was replaced), green cleaning, educational tours, videos, signs, dashboards, sessions, and information sheets.

In 2019, Dalhousie received the Green Building Pioneer award from the Atlantic Chapter of the Canada Green Building Council.

Educational signage at the IDEA building



3.0 **Dalhousie Management Structure**

Board level strategic plans and documents provide guidance to operational efforts. Dalhousie's strategic plan places value on social responsibility and sustainability and highlights them in core pillar actions of campus operations and management. The President, the top senior management position, signs university operational plans and policies, such as the Sustainability Policy. Administrative departments such as those reporting the vice president of finance and administration are involved and responsible for development, delivery, evaluation of energy and green building performance as outlined in the board-level plans and presidential policies (Figure 6).

Figure 6. Energy and Green Building Roles and Responsibilities

Vice President of Finance and Administration

Financial Services

- Set final utility budget with FM support
- Provide capital accounts for project work
- Work with OS and FM to incorporate energy and green building standards into tenders, RFPs, standing offers and processes

Office of Environmental Health and Safety

- Work with OS and FM to incorporate pollution prevention and safety measures in building design and projects

Facilities Management

Planning

- Works with OS to develop green building and energy design guidelines
- Plans capital and minor projects to meet energy and green building policies, standards, and client project scope
- Plans meters and related infrastructure
- Uses meter data in planning and billing support
- Develops utility tacking reports

Finance

- Creates and tracks university utility budget
- Input utility bill and Dal meter information into software
- Verification of monthly invoices

Capital Projects

- Manages project implementation to meet policies, guidelines, and project scope
- Use standards set for metering & measurement to ensure this is incorporated & commissioned as part of capital projects

Operations

- Maintains buildings and outdoor landscapes
- Manage building automation system
- Manage and calibrate water, hot water, condensate, steam meters
- Monitor and optimize system efficiencies for significant energy use (DE systems, Air handlers, ...)
- Improve energy performance through day-to-day activities
- Co-chair energy committee and KPI reporting
- Manage energy supply contracts

Ancillary Services/Athletics

- Pays for utility bills in budget. Interested in accurate meter information
- Client for energy and green building projects

Office of Sustainability

- Works to develop green building and energy policies, plans and approaches that meet University sustainability plans and ambitions
- Part of University reporting team to collect sustainability data for university and international reporting including energy and green building targets
- Is an advisor, team member and client to advance green building and energy projects
- Actively pursues funding to support efforts and leads utility business case development
- Uses utility meter data to analyze trends, identify problems, for measurement & verification, university wide reports, education, and competitions
- Co-chair energy committee and KPI reporting
- Provides advice on energy supply procurement

IT Services

- Involved in maintaining servers & supporting integration of meters & software on the Dal network
- Client for energy and green building projects

4.0 **Vision, Principles and Scope**

Vision

Dalhousie's built infrastructure supports our mission to create accessible and equitable spaces, that are functional, resilient, energy efficient, and ecologically and socially centered.

Principles

Principles of simplicity, durability, economic, ecological life cycle thinking, and social equity frame energy and green building actions. They connect to many facets of sustainable development as highlighted by the World Green Building Council (Figure 7).

Figure 7. Contributions of green buildings to sustainable development goals (provided by the WGBC)

Scope

The scope of the program for EnMS and green building approaches includes all buildings and spaces owned and operated by the university in alignment with our Greenhouse Gas reporting as defined by the ISO 14064 standard. It does not include leases or buildings not operated by the university.

5.0 Goals, Actions and Targets

Table 1: Goals, Actions and Targets

GOALS	OBJECTIVES	ACTIONS	TARGETS
Reduce energy and water consumption	▸ Deploy passive design and conservation strategies to avoid natural resource use. ▸ Do more with less with efficiency initiatives. ▸ Ongoing learning, analysis, and education. ▸ Energy and water reuse .	▸ Use natural systems more effectively such as solar orientation – solar gain and reflectiveness, landscape buffering, earth energy, natural ventilation where possible, and better building envelopes (less air and water leaks and more insulation, while not creating air quality issues). ▸ Focus on occupant behaviour, load matching, space utilization, demand management, ensuring right-sized efficient systems and equipment, and optimization. ▸ Ongoing energy and green building audits, benchmarking, research, learning and discussion. ▸ Reuse energy from one system with another and use grey and rainwater to reduce total water and energy consumption.	▸ KWhe (energy) and m3 (water) per year, per person, per building and building type – normalized by weather. ▸ 70% water reduction by 2030; hold energy growth and reduce consumption against baseline with conservation and efficiency from 2010 baseline.
Advance climate action mitigation and adaptation targets	▸ Along with efficiency and reduction programs, significantly reduce fossil fuel usage with a goal of net-zero buildings. ▸ More durable and resilient green and built infrastructure.	▸ Generate energy on and off campuses from renewable sources such as solar, wind, and geoexchange technologies. ▸ Support enhanced building envelopes and efficiency programs. ▸ Building resilient buildings and outdoor spaces to contend with warmer, wetter wilder climates. ▸ Explore meaningful and verifiable carbon sinks.	▸ Increased renewable energy usage for heating, cooling, and power functions. Amount increased. ▸ 100% renewable electricity by 2030 (from on and off campus sources). ▸ Building designs, plans and implementation consider new climate realities (e.g., back up energy needs, enhanced envelope, storm water management ...). ▸ Identify local and global carbon sink projects that support EDIA goals. ▸ Reduction of air quality, ozone depleting, and global warming contaminants.

GOALS	OBJECTIVES	ACTIONS	TARGETS
Improve workplace well-being and productivity	▸ Reduce air quality and chemical pollution. ▸ Improve biodiversity. ▸ Create social, accessible, and equitable spaces.	▸ Continue green cleaning program that includes products and equipment, reducing indoor air contaminants and following best management practices, and considerations for occupant comfort. ▸ Purchase products with low chemical off gassing and VOCs, and that meet high sustainability performance. ▸ Consider product embodied carbon, ecological, social and health footprint, and durability for building material, equipment, appliances, and furniture. ▸ Improve accessibility, biodiversity and social spaces that reflect the diversity of the Dalhousie community.	▸ Sustainable products purchased and used. ▸ Built and outdoor spaces accessibility and diversity improvements.
Support sustainable transport and landscapes	▸ Manage and enhance the health of outdoor spaces connected to the building.	▸ Restoring and enhancing landscapes, reducing light and heat from buildings, and managing the building sites for erosion control, hazards, and tree protection. ▸ Includes support for sustainable transportation modes from vehicle sharing, low-emitting and alternative vehicles, and active transportation.	▸ Healthy outdoor campus spaces increased. ▸ Sustainable transportation infrastructure supports such as cycling and pedestrian end-of-trip facilities, and accessible corridors.
Demonstrate reputational and community leadership	▸ Support teaching and research. ▸ Demonstrated leadership in green building and energy space.	▸ Understanding, testing, and re-evaluating systems and processes to achieve the best performance in green building. ▸ Supporting student internships, classes, and research partnerships to advance mutual goals. ▸ Sharing learnings with community and campus partners. ▸ Achieving high level of performance.	▸ Modifications made based on management process. ▸ Number and type of students, classes, and partnerships. ▸ Number and types of networks, presentations, and workshops. ▸ Meeting high standard for green building for all projects. Comprehensive and focused program certification for new construction such as striving for LEED Gold or higher and Net-Zero/Zero Carbon certification.
Lower the total cost of ownership	▸ Deploy total cost of ownership from an economic, health, social and environmental perspective.	▸ Conduct additional business cases analysis for new construction and major building retrofits. Refine process. ▸ Reflect carbon pricing in financial decision-making criteria.	▸ Management research project to refine process and forms. ▸ Process implemented.

6.0 Implementation and Evaluation

The university has been using a combination of utility savings/cost avoidance, facilities funding, external grants and rebates, and client funding to support energy and green building initiatives. Building costs and capped construction budgets put pressure on solutions that have a higher capital cost but may have a lower total cost of ownership. With these realities, some items are not implemented.

To meet the next set of targets, decision-making and investments need to consider climate and carbon costs, life cycle costing, and longer-term planning horizons in keeping with the university ambitions. Key strategy areas guide planning and implementation as we work towards 2030 targets.

Strategy Areas

Energy and Green Building Management

- Energy and Green building policy as part of the Sustainability Policy
- President's Advisory Council on Sustainability and Energy Committee – quarterly meetings
- Annual reporting
- Ongoing monitoring, measurement, and analysis
- Key goals and KPIs reflected in capital and facilities planning
- Enhancement of procurement strategies for sustainable and energy conscious, products, services, equipment
- Improvements to Energy Management Information System (EMIS) for enhanced analytics and fault detection
- Green Labs, ecolympics, and other programs and sessions
- Energy power purchase agreement for 100% renewable electricity

New Construction

- Strive to meet high performance green building standards through third party-certification such as LEED Gold or higher, zero carbon, and/or Passive House.

Major Building Upgrades (over $5 million)

- Deep energy retrofits: Killam Library, Chemistry/Dunn, Dalplex .... Includes major energy and water upgrades, facilities renewal, and renewable energy measures

Minor Building Upgrades (under $ 5 million)

- Building optimization
- Recommissioning: LSC, Haley, Arts Centre, Cox, ...
- High efficiency pumps and motors, variable frequency drivers
- Greenhouse upgrades
- Green Lab projects – equipment
- Enhanced envelope as part of facilities renewal building upgrades
- Air, compressed air, and water leakage upgrades

District Energy (DE) Systems - Plants, distribution, connection to buildings

- Steam to hot water conversion of Studley and Carleton campus. First phase is to lower temperatures, save energy and prepare for additional renewable energy source integration.
- Geoexchange field optimization – Sexton campus; other installations
- Waste heat recovery from: ORC cooling waters in the summer; seawater lines, boiler stack, DE distribution system

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