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DUISBURG
ESSEN



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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.

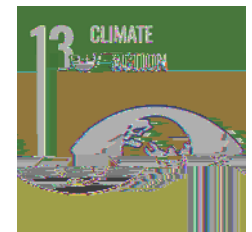
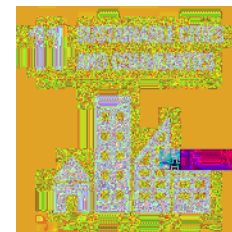


Tab C

Acknowledgements	2
1.0 Current Context	4
1.1 Energy and Building Landscape	4
1.2 Existing Infrastructure	5
1.3 Energy and Green Building Planning and Policy	7
1.4 Benchmarking	8
2.0 Plan Development and Management Timeline	10
3.0 Dalhousie Management Structure	12
4.0 Vision, Principles and Scope	13
5.0 Goals, Actions and Targets	14
6.0 Implementation and Evaluation	16
7.0 References	17

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 C C

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

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}

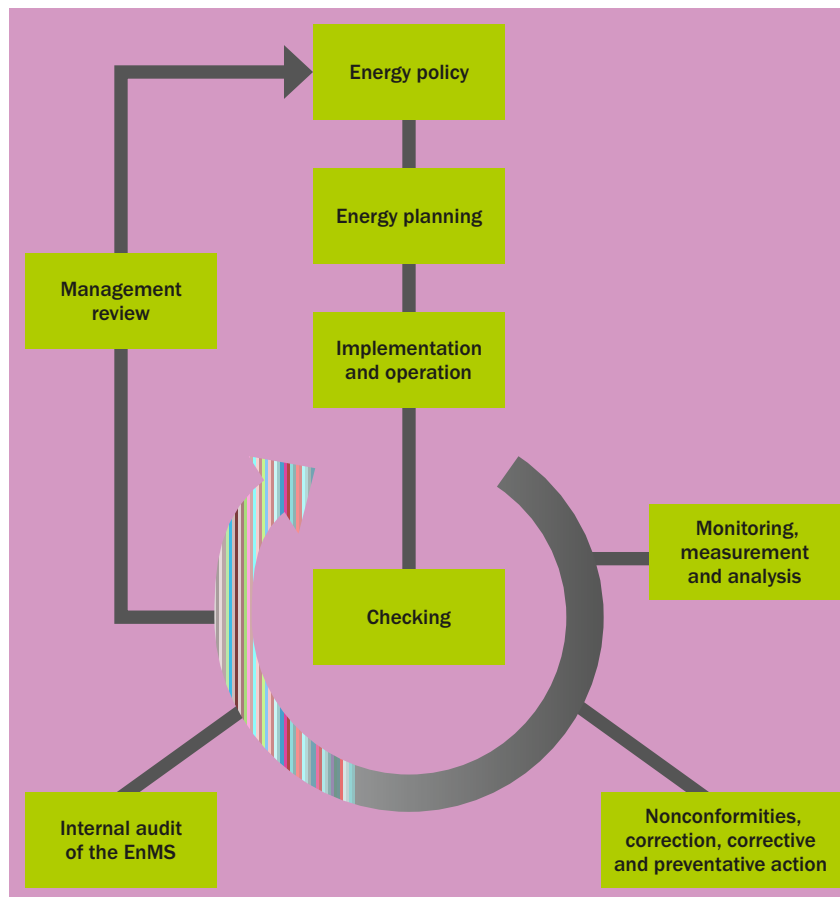
The pace and proliferation of green building programs have escalated in recent years to address the impact of the built environment on societal health, the environment, and life cycle costs.¹¹

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

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.

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2.0 P a D m a d M a a m T m

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
<ul style="list-style-type: none"> ▶ Creating of Utility Savings business 						

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).

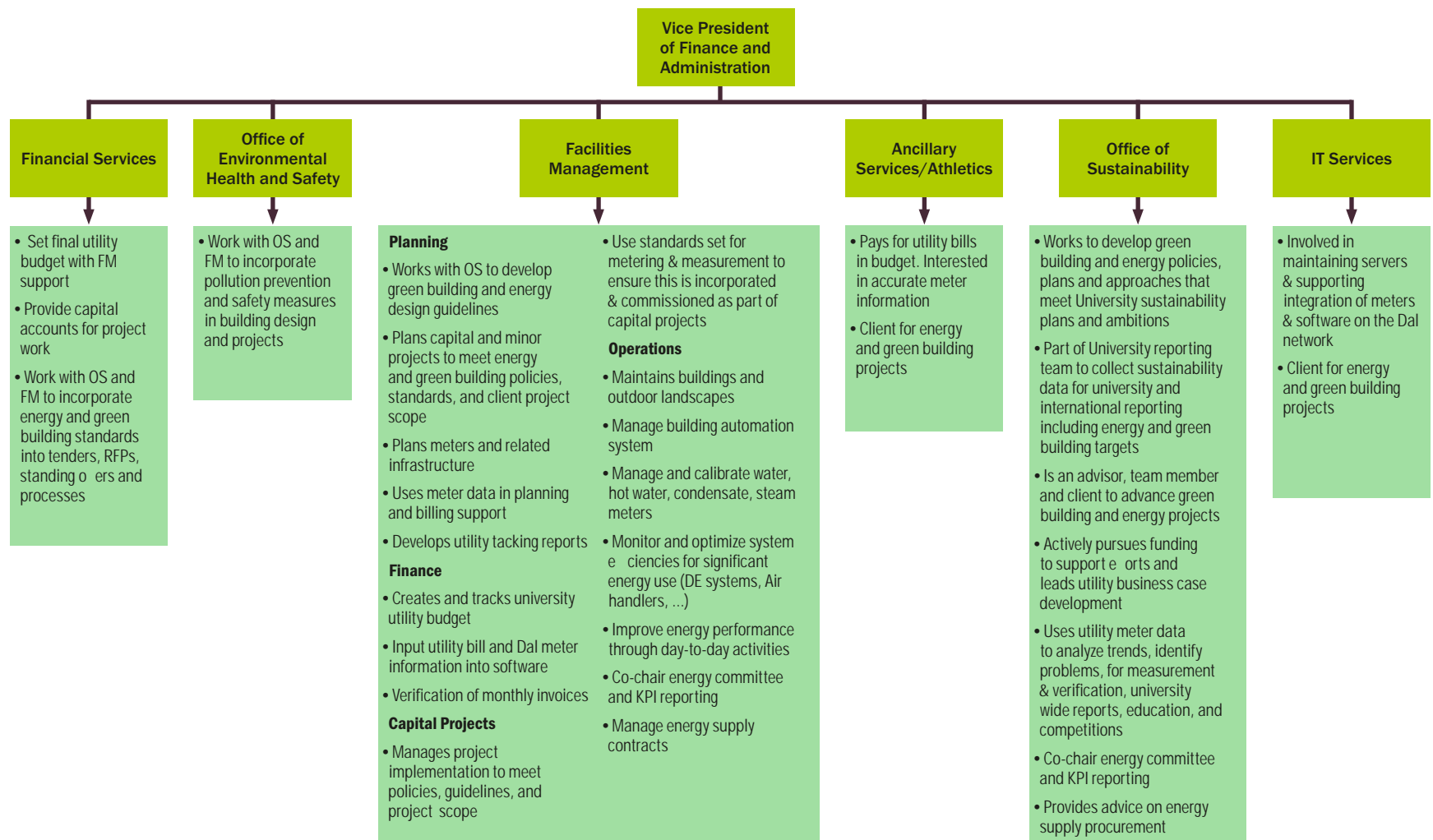
Throughout the nine new Dalhousie buildings and full-building retrofits, several new initiatives and features have been implemented. Examples of strategies include:

- ▶ 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

3.0 Da Ma a m S c

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 to 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



4.0 V, P c a d Sc

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).

Scope

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5.0 Goals, Actions and Targets

Table 1: Goals, Actions and Targets

GOALS	OBJECTIVES	ACTIONS	TARGETS
Reduce energy and water consumption	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ 	

GOALS	OBJECTIVES	ACTIONS	TARGETS
Improve workplace well-being and productivity	<ul style="list-style-type: none"> ▶ Reduce air quality and chemical pollution. ▶ Improve biodiversity. ▶ Create social, accessible, and equitable spaces. 	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ Sustainable products purchased and used. ▶ Built and outdoor spaces accessibility and diversity improvements.
Support sustainable transport and landscapes	<ul style="list-style-type: none"> ▶ Manage and enhance the health of outdoor spaces connected to the building. 	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ Support teaching and research. ▶ Demonstrated leadership in green building and energy space. 	<ul style="list-style-type: none"> ▶ 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. 	<ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ Deploy total cost of ownership from an economic, health, social and environmental perspective. 	<ul style="list-style-type: none"> ▶ Conduct additional business cases analysis for new construction and major building retrofits. Refine process. ▶ Reflect carbon pricing in financial decision-making criteria. 	<ul style="list-style-type: none"> ▶ Management research project to refine process and forms. ▶ Process implemented.

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