



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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UBC Okanagan Campus
Energy Team
Quarterly Report
April 2021 – June 2021

Report Date: 2021-07-27



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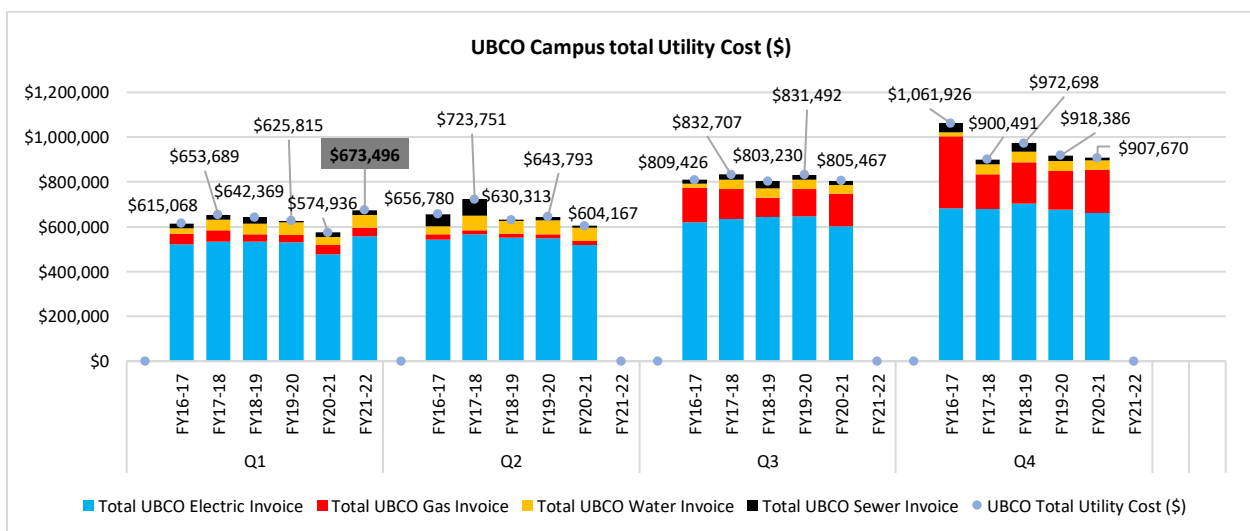
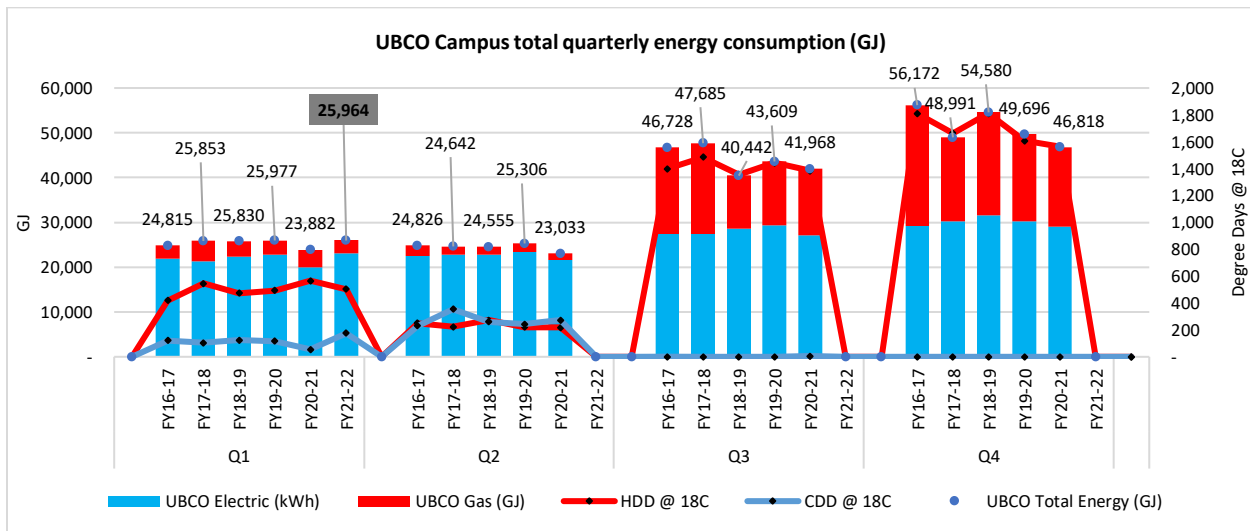
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1. Overview of the First Quarter of FY2021-2022

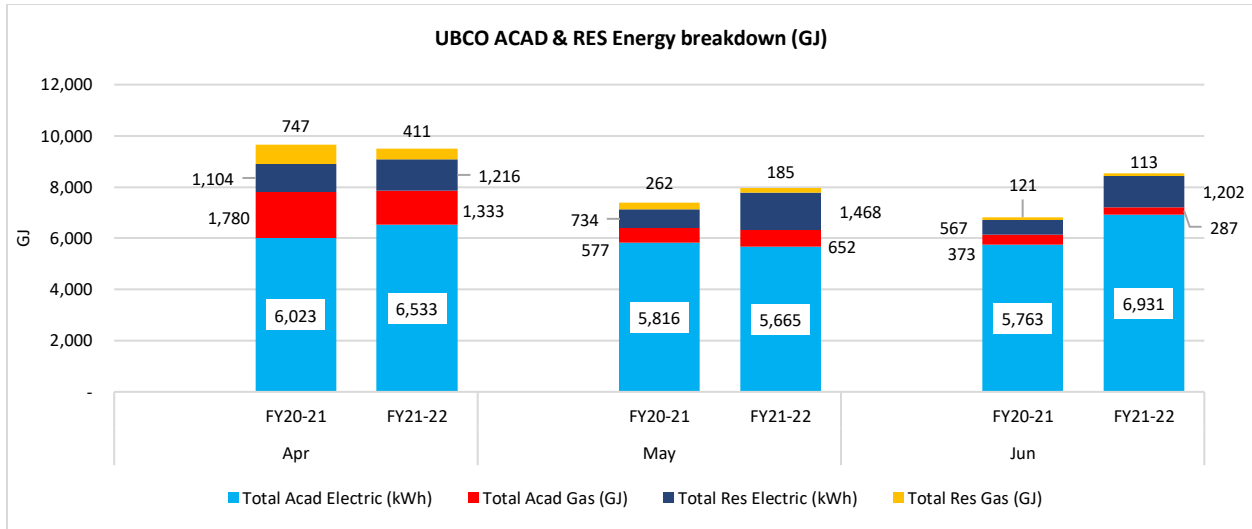
UBCO Campus total energy consumption over the past quarter (Q1 2021) was 25,964 GJ compared to 23,882 GJ for Q1 last fiscal year (Q1 2020), a 9% year over year quarterly increase leading to a 17% increase in total campus energy utility cost. This total energy consumption includes a 13% increase in campus Electricity consumption i.e. from 5,562 MWh in Q1 2020 to 6,397 MWh in Q1 2021 and a reduction of 23% in campus Gas consumption i.e. from 3,860 GJ in Q1 2020 to 2,981 GJ in Q1 2021. This is in direct correlation with the degree days experienced during the period as detailed below.

In Q1 2021, a 225% increase in Cooling Degree-Days (CDD) was observed i.e. from 54 degree-days in Q1 2020 to 175 degree-days in Q1 2021 (i.e. 3.25 times Q1 2021). During the same period, an 11% reduction in Heating Degree-Days (HDD) was observed i.e. from 565 degree-days in Q1 2020 to 503 degree-days in Q1 2021. The 13% increase in electricity consumption from cooling tower, chillers, air conditioning units due to huge cooling demand in the campus is a result of record-shattering heat waves in Western Canada primarily interior BC.





The figure below shows the breakdown between Academic and Residences energy consumption for the first quarter.



2. Policy Development

Appropriate policies and guidelines assist in meeting campus energy goals and as such are championed by the Energy Team. Significant developments in energy-related campus guidelines and policies that occurred in the past quarter are described below.

2.1. Strategic Energy Management Plan (SEMP) 2020

Strategic Energy Master Plan (SEMP) evaluates demand-side measures i.e., options to reduce loads including heating, cooling and electrical loads. A 5-year SEMP was created in 2016 and again in 2018 with the intention of continuing with updates every 2 years. For the 2020 update a longer 10-year horizon was chosen for the SEMP along with a more detailed look at projects recommended for implementation in the first 5 years.

Energy Team is working on implementing the Energy Conservation Measures (ECMs) identified as per the SEMP 2020. Following are the identified measures for the first two years:

- Campus-wide lab demand-controlled ventilation – Occupancy Controlled Ventilation (Underway)
- Recommissioning of existing controls at ARTS building (Underway)
- Demand controlled ventilation for campus AHUs and/ or MUAs
- Night-time precooling
- Recommissioning of existing controls at campus buildings

2.2. High-Level Net-Zero Carbon District Energy (DE) Strategy

The main campus is expected to grow with the addition of the Innovation Precinct. This motivated further analysis and consideration of district energy strategy with a view of modernization, renewal, and growth to serve both existing and new load.

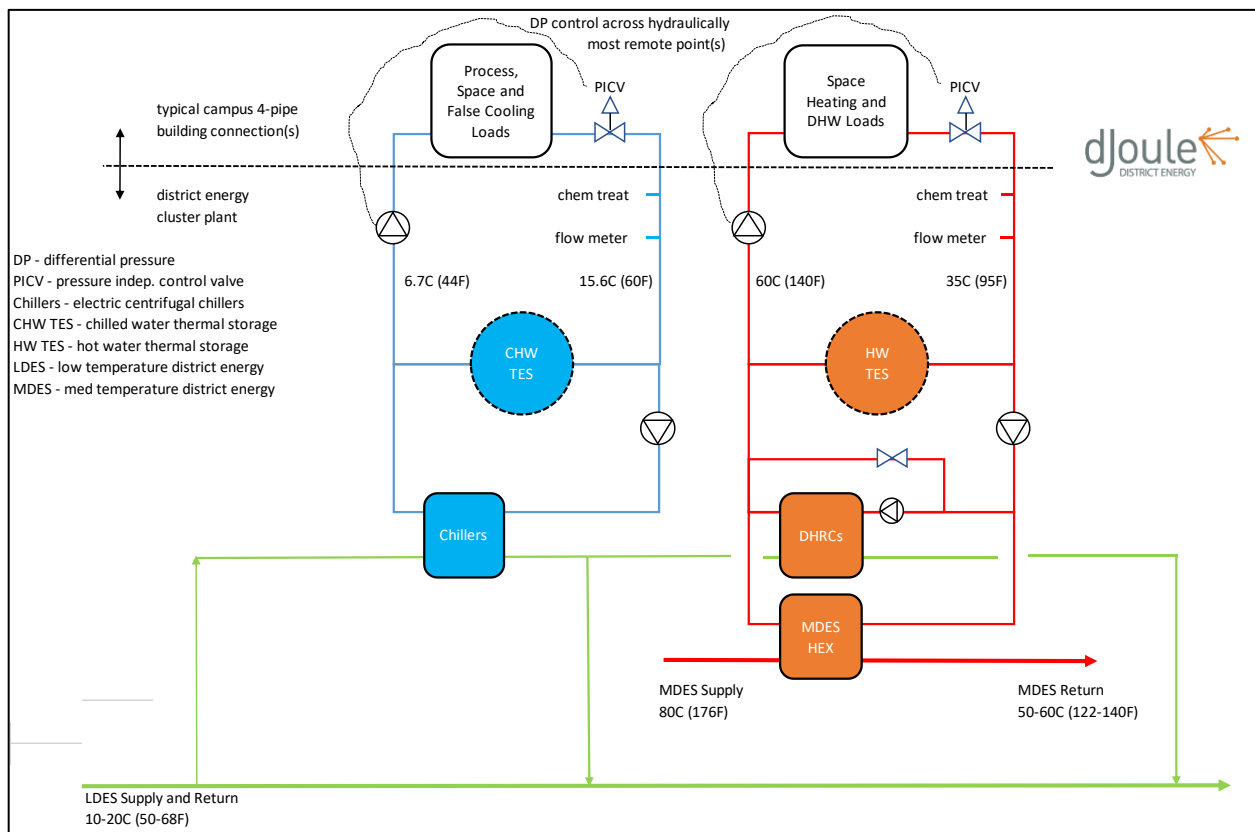


A decision was made by the UBC steering committee to proceed with district energy utility services where district scaled water source heat pumps provide hot and cold water to the buildings. With the distribution and energy transfer station strategy set, the focus turned to DE decarbonization, as well as a strategy for service to the new Interdisciplinary Collaboration and Innovation (ICI) building on the main campus.

The ICI building was determined to be a good location for a zone scale plant (Cluster plant or mini plant) for the following reasons:

- First opportunity
- Avoid cost and land use of standalone plants in individual buildings
- Proximity to MDES/LDES mainlines
- Proximity to future growth and existing buildings

Energy Team worked with DE consultant to advance the schematic design and development of the cluster plant in the ICI building. Figure below shows a proposed high-level design for the cluster plant.



The cluster plant at the ICI building was accepted and approved by UBC executive team. Energy Team will be working diligently to support the implementation of cluster plant at the ICI building and its associated connection with adjacent buildings.

In terms of DE decarbonization, the key strategy for decarbonization features the integration of air source heat pumps (ASHP) in a transition to a future state that is affordable, sustainable, and resilient in service to connected customers. This approach is designed for baseload down to outside air temperatures as low

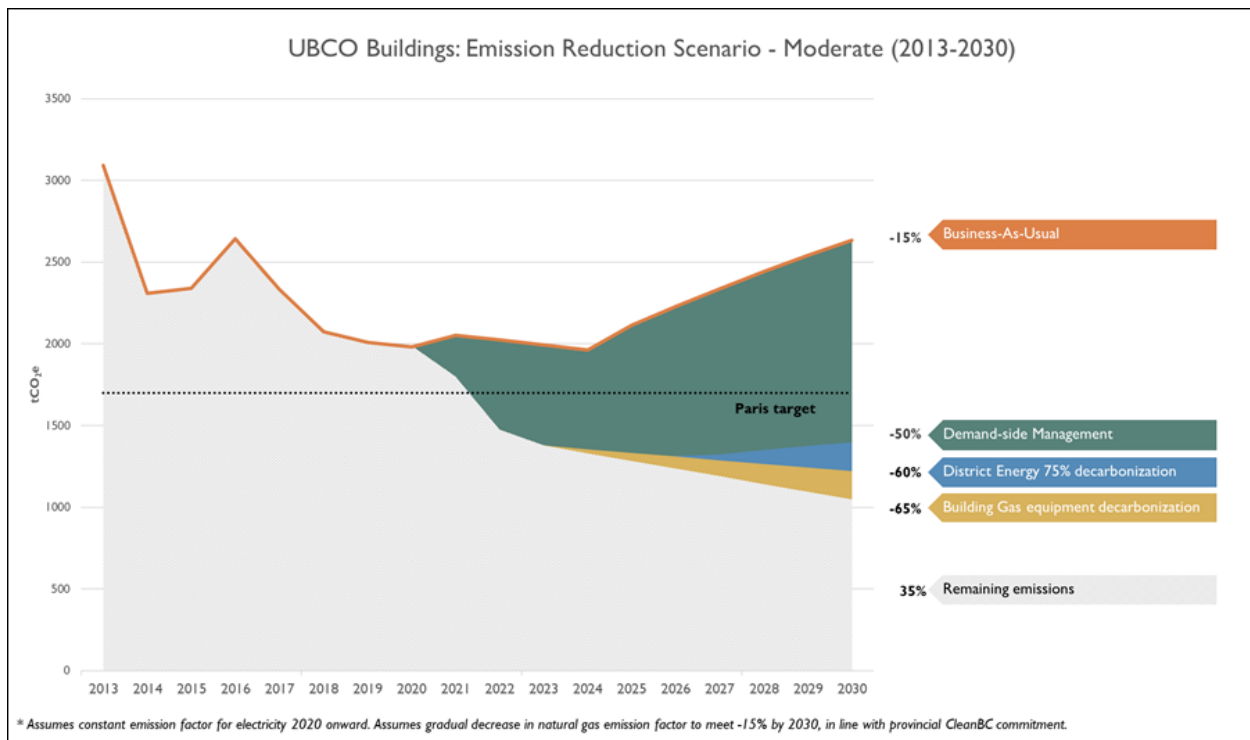


as -5C (23 deg F) before gas boiler heat is required. These hours represent less than 10% of the annual operating hours in a year.

A schematic design and economic assessment of an Air Source Heat Pump (ASHP) and thermal energy storage (TES) plant near the GEO building was conducted in subsequent DE strategy phase. Currently, work is underway to advance this strategy and install air source heat pumps in next three to five years.

2.3. Low Carbon Energy Strategy

Energy Team has been working with campus Sustainability department to help inform realistic carbon emission reduction targets under Low Carbon Energy Strategy based on work being done as part of Strategic Energy Master Plan and High-Level Campus Carbon Energy Strategy.



Based on the strategy, a moderate (realistic) target of 65% emission reduction¹ from 2013 levels by 2030 is recommended. This can be achieved by partial decarbonization of the central plant, implementing projects that will reduce energy demand, and connecting select existing buildings to central energy supply systems (district energy).

2.4. UBCO Net Positive Modelling Study – Archetype update and Analysis

Energy team has been working with RDH Building Science Inc. to update the five archetype models from the previous 2016 UBC Net Positive Modelling Study using Okanagan climate files and building

¹ Note that the electricity emission factor used in 2020 when conducting the scenario analysis was 2.587 tCO₂e/GWh and assumed constant till 2030. However, this factor has been retroactively updated to 35 tCO₂e/GWh for 2013 and 40.1 tCO₂e/GWh for 2020.



archetypes that are representative of UBCO new construction with TEUI, TEDI, GHGI results for each archetype.

This work includes updating the ECM bundles to be specific to UBCO, as well as updating the costing and financial analysis for the new construction archetypes, and will also determine the applicability of each bundle to existing building retrofits. This work is currently underway and expected to be completed by September 2021.

2.5. Energy Monitoring and Data Management Platform

Energy data for the campus is obtained from a number of sources including utility bills, manual meter readings, and building digital control systems. UBCO Energy Team has engaged with the UBCO School of Engineering to develop a custom data management system for the campus. This project aims to develop an intelligent data-driven energy monitoring and management system for micro-communities using statistical and advanced data analysis methods.

In the meantime, Energy Team has developed a utility tracking tool using advanced programming language knowledge python and excel to track overall campus utility consumption (Electricity, Natural Gas, Water, Sewer) as well as building-level consumption at the monthly, quarterly, and annual interval. The tracking is being done for three different parameters i.e. utility consumption, utility cost, and carbon emissions associated.

2.6. UBCO HVAC Infrastructure Asset Management Database

Energy Team has been working with the Facilities Management to advance and update the Infrastructure HVAC Asset Management database and potentially linking this up with the major capital retrofit projects on campus in the near future. This also includes consolidating campus-wide DDC points, physical meters, and manual metering points in one location and further developing a meter tree. This will further be input to the Data Analytics platform which Energy Team has been working on with UBCO School of Engineering.

2.7. Future Campus Construction

In order to ensure that future campus energy goals and targets are met, it is important that new buildings constructed on campus are designed and built to be consistent with the Whole Systems Infrastructure plan as well as other campus plans and goals. As such, the Energy Team has been involved in providing technical reviews and setting goals, targets, and strategies as early as possible for future campus expansions such as new construction ICI building.

2.8. Technical Guidelines

Technical Guidelines are intended to provide minimum standards for campus projects. There are a large number of guidelines that cover both UBC as a whole and some that are specific to the Okanagan campus.

In 2021 with a view to streamline the process, a new Joint Working Group including UBC Vancouver and UBC Okanagan facilities teams has been formed. The Working Group has been set up to provide potential TG updates, collaborate between campuses and between disciplines. The Energy Team has been involved in facilitating regular meetings for the Joint Working Groups and working to update several that are specific to energy performance and monitoring.



3. Energy Conservation Projects

In order to reduce utility costs, energy consumption and GHG emissions, energy conservation measures (ECMs) are regularly implemented on campus. In terms of actual studies/ projects, the following projects have been completed/ in progress over the last quarter.

3.1. UBCO Science Laboratory Rooms Demand Controlled Ventilation (DCV)

SES Consulting identified this measure in their 2020 SEMP report for the FY20-21 implementation. The ventilation rate of non-critical laboratory spaces is not strictly controlled, causing significantly higher air changes per hour than required for occupant health and comfort. The use of upgraded controls equipment and strategies will be considered for reduction and standardization of air changes during both occupied and unoccupied hours. This project is expected to save 66,800 kWh Electricity and 800 GJ Natural Gas per year.

UBCO Energy Team had put forward an incentive application to perform an engineering study for this project to better determine the cost and benefits of this project. However, due to a delay in the application processing from FortisBC, the project went forward without support from FortisBC.

Siemens Controls is the prime contractor working on this project which is being managed by UBCO's Project Services along with the help of the Energy Team. Following labs have been identified for this first phase of the project:

- Priority 1 Labs: 121, 142, 143, 145, 358, 374
- Priority 2 Labs: 119, 127, 141
- Priority 3 Labs: 336, 338, 345, 347, 355, 363 (second phase of the project)

The construction start date is the first week of February 2021 and was expected to be completed by end of March 2021. However, project is running behind schedule due to delays as a result of COVID-19.

3.2. Recommissioning study for the Arts building

UBCO Energy Team has put forward an incentive application to perform a Recommissioning (RCx) study for the ARTS building. SES Consulting has been contracted to provide support in performing this recommissioning for the ARTS building. This study is expected to identify deficiencies in the operation of the buildings that were wasting energy, increasing equipment wear and tear, or decreasing occupant comfort. This is the study and further measure implementation is expected to save 58,900 kWh Electricity and 130 GJ Natural Gas per year.

3.3. UBCO ASC FIPKE Laboratory Rooms Demand Controlled Ventilation (DCV)

SES Consulting identified this measure in their 2020 SEMP report for the FY20-21 implementation. The ventilation rate of non-critical laboratory spaces is not strictly controlled, causing significantly higher air changes per hour than required for occupant health and comfort. The use of upgraded controls equipment and strategies will be considered for reduction and standardization of air changes during both occupied and unoccupied hours.

UBCO Energy Team is currently working on collecting background data for this project. We have also put forward an incentive application to perform an engineering study for this project to better determine the cost and benefits of this project.



3.4. Nechako Commons Kitchen Equipment

Nechako Commons is a new residence building with a large cafeteria and other campus amenities included. Energy Team has been working with the Project Manager UBC Properties Trust and contractors to apply for eligible FortisBC incentives for the kitchen equipment. Energy Team identified additional \$10,000 of eligible rebate for Nechako Commons cafeteria which brings the total to \$24,000 of rebate for the appliances in Nechako Commons.

3.5. Monitoring improvements

A few monitoring improvements were implemented by the UBCO Energy Team which included resolving the WIFI occupancy reporting issue, working with Siemens to fix the Desigo deficiencies list and add missing trends on the key hydronic graphics.

4. New Construction Projects

The Energy Team is involved in the design and construction process for new construction on campus. The Energy Team's goal is to ensure that the design and construction of new buildings on campus are consistent with the campus Whole Systems Plan in terms of energy targets and sources. The Energy Team also co-ordinates the pursuit of energy efficiency incentives from FortisBC.

4.1. Interdisciplinary Collaboration and Innovation (ICI)

The UBC Okanagan Campus (UBCO) is proposing a new building to facilitate world-leading, interdisciplinary/ transdisciplinary research and academic programming, and to advance its mandate as a partner in regional development. Tentatively titled the Interdisciplinary Collaboration and Innovation (ICI) building and is expected to be up to 13,364 gross square meters. Energy Team has been involved in advocating the creation of Owner's Project Requirements (OPR) for the ICI building, reviewing the schematic designs for the building and providing inputs on the energy-related standards/ benchmarks.

4.2. Innovation Precinct 1 (1540 Innovation Drive) Renovations

In 2017, UBC purchased 1540 Innovation Drive – a 1.36-acre land parcel with 24,400 sq. ft. warehouse/office building – at the north end of the university's future Innovation Precinct. This property is of strategic importance as it will be the first example that pairs commercial activity with UBC Okanagan research and learning. It will facilitate innovation and co-location partnerships with local technology companies, support graduate student needs, and help address the shortage of academic space at UBC Okanagan.

The building is being renovated to accommodate research laboratory facilities for Engineering faculty, studio space for Faculty of Creative and Critical Studies Master of Fine Arts students, an industry-UBC partnership research centre, and shared collaborative space.

Energy Team identified \$10,000 of prescriptive rebate that equipment installed in Innovation Precinct # 1 was eligible for. We have been working with the Project Manager UBC Properties Trust and contractors Falcon Engineering to apply for an eligible FortisBC incentive for the renovations.

4.3. University House Renovations

UBCO is currently working on renovating its existing U-House building. The intent is to co-locate CORM departments as much as possible and maximize opportunities for collaboration and productive



collisions. The scope of work is currently being developed and Energy Team will be working to apply for an eligible incentive for the renovations through FortisBC.

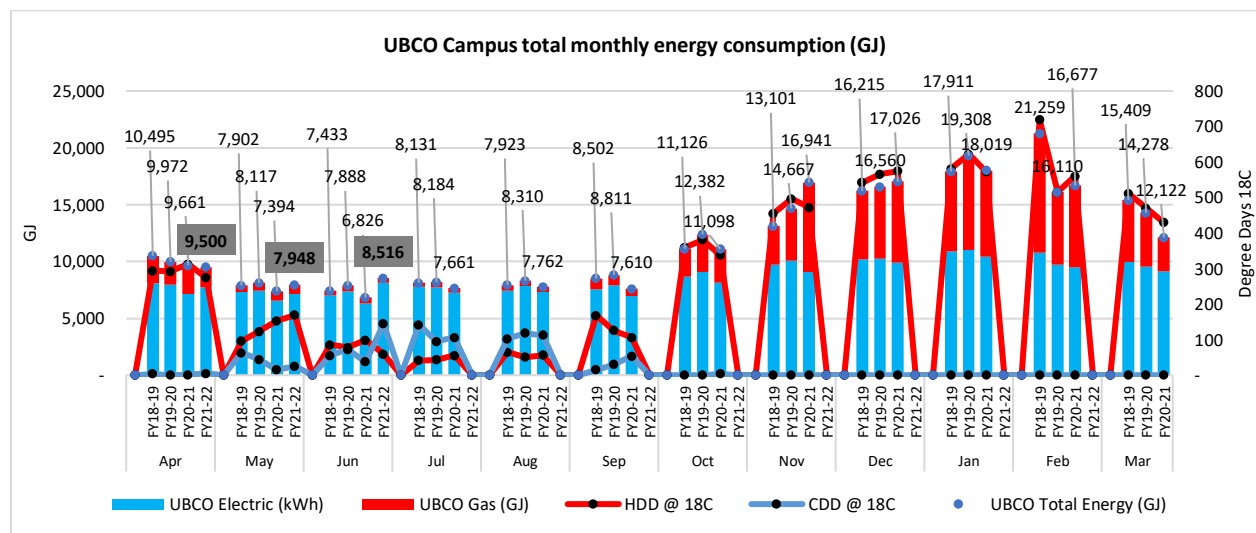
4.4. UBC Okanagan’s Downtown site

Planning is underway for UBC Okanagan’s downtown Kelowna site with a number of community-accessible facilities being considered, including a new public gallery, creative innovation spaces, and a public engagement and learning suite.

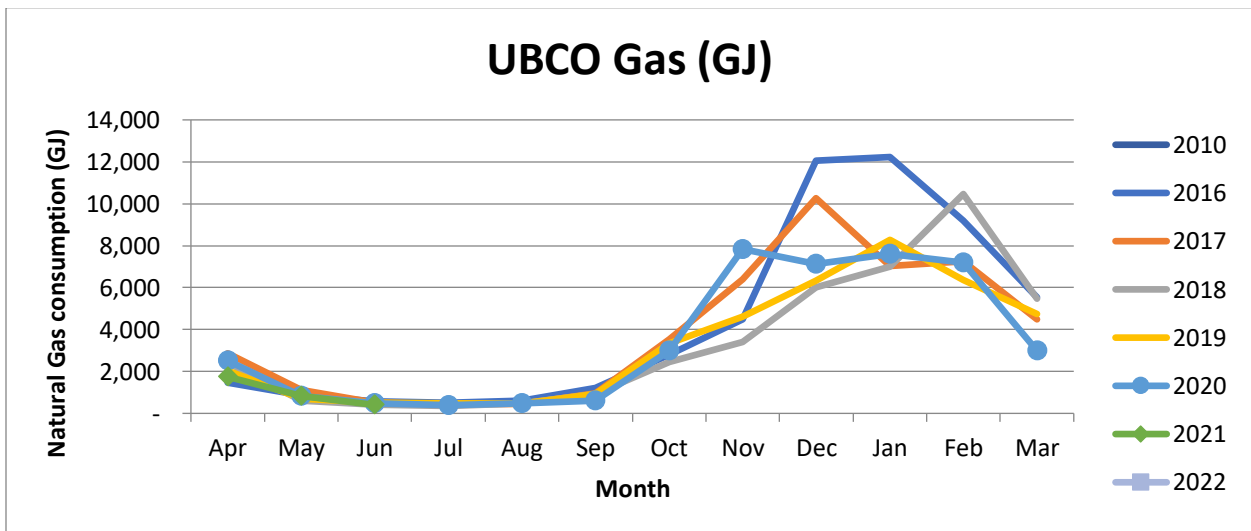
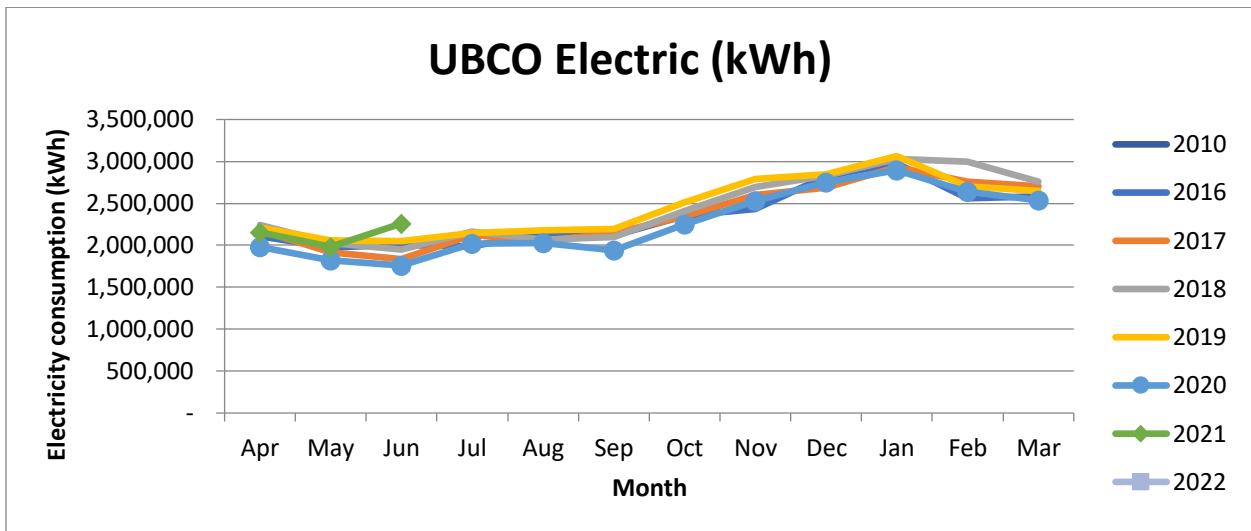
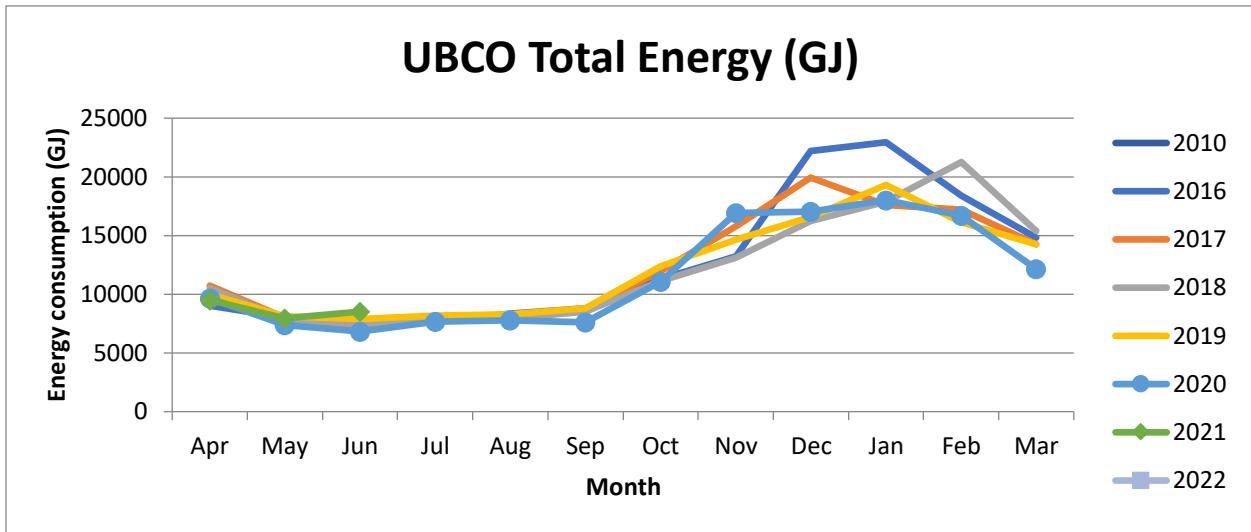
In partnership with UBC Properties Trust, UBC is planning a new building at 550 Doyle Avenue. Once design and approvals are in place, construction is expected to begin in mid-2022.

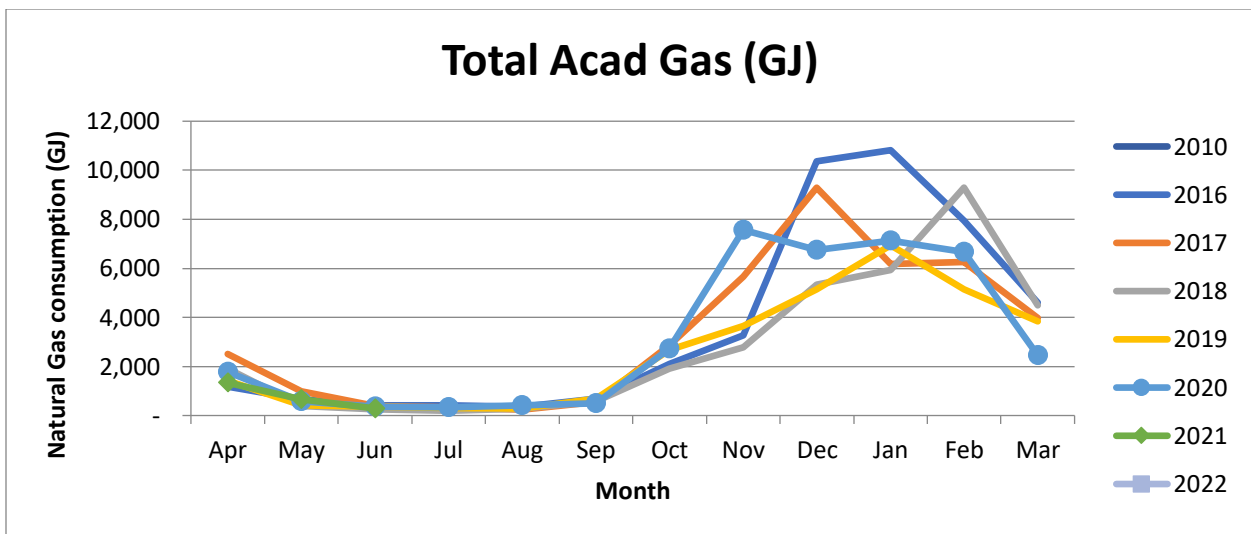
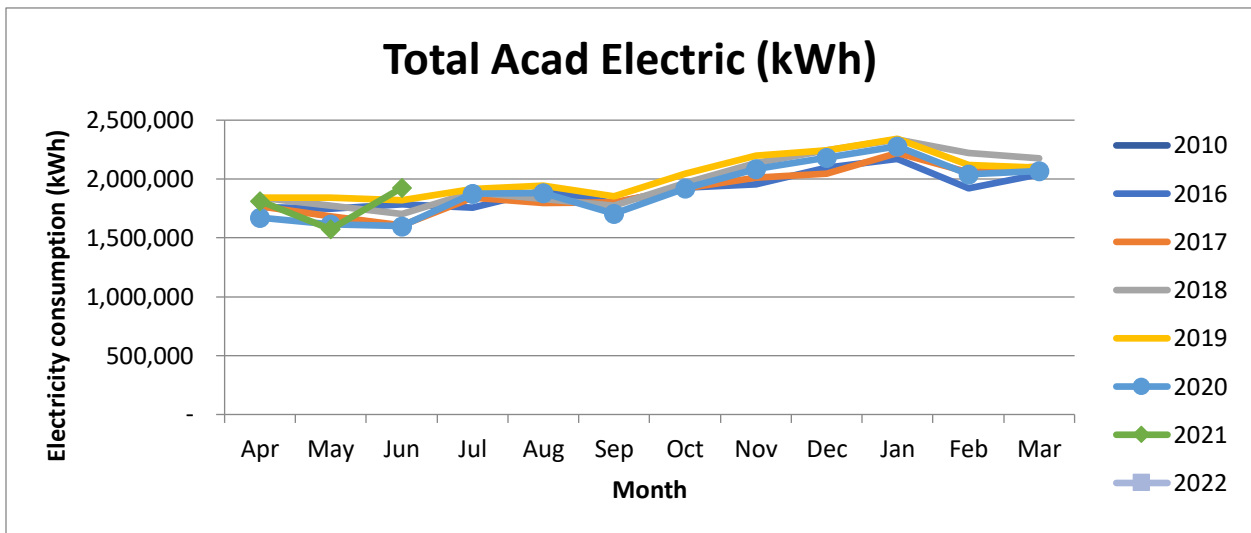
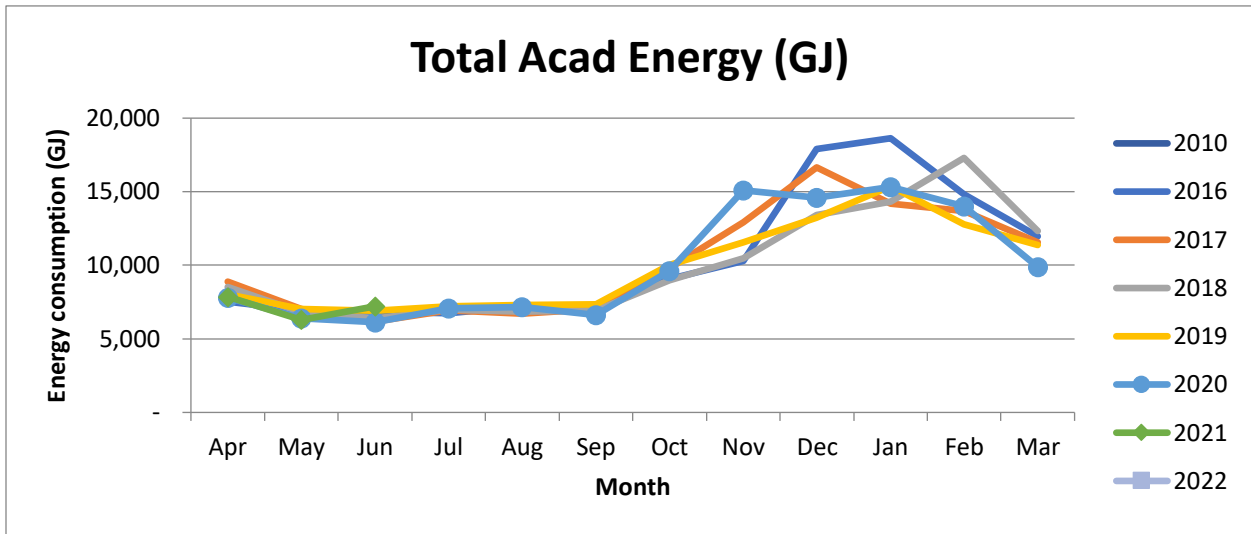
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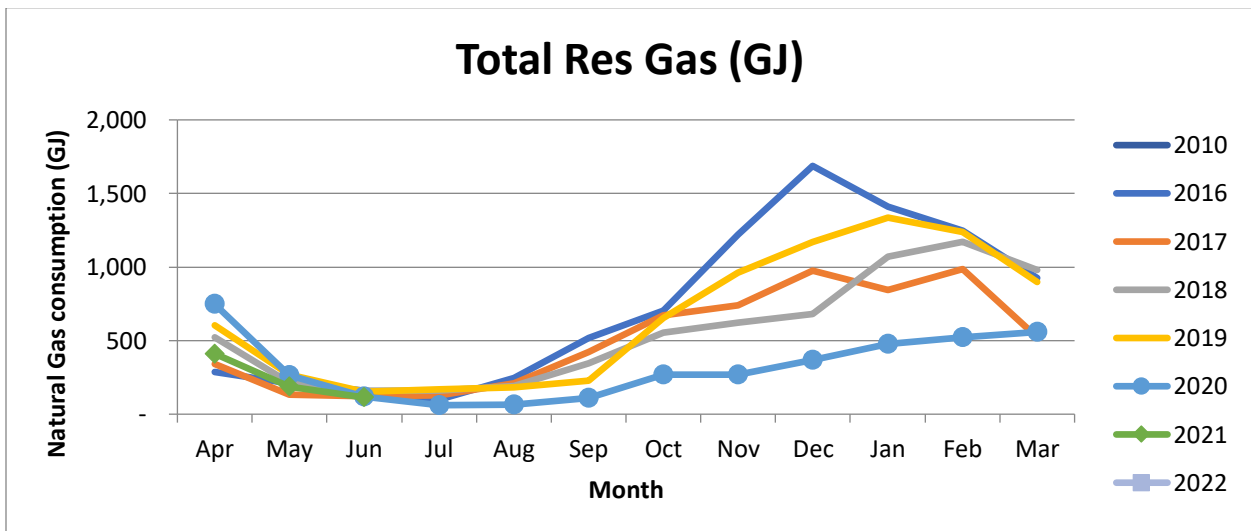
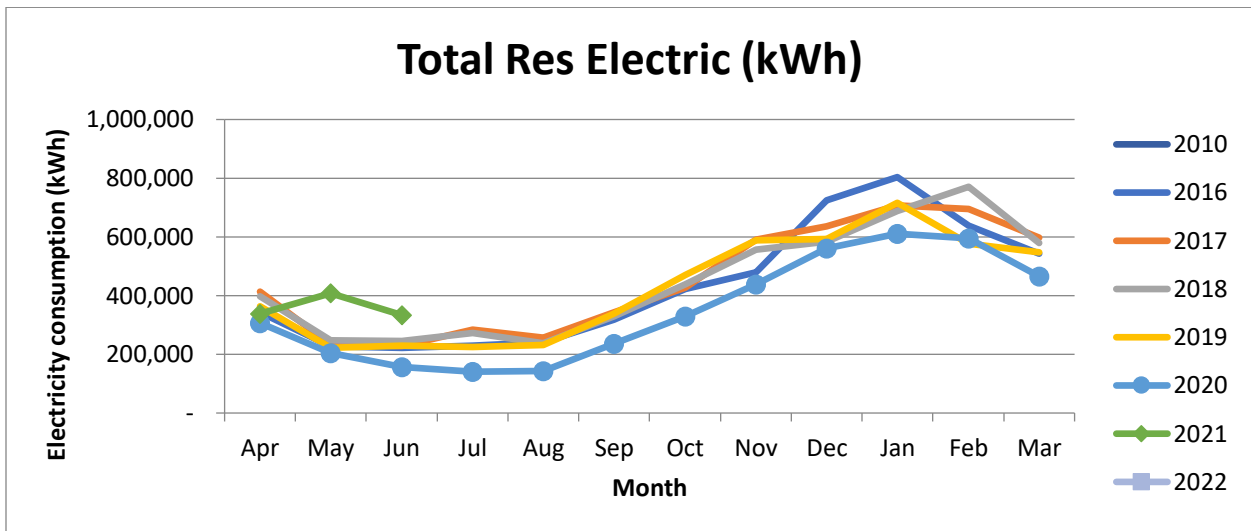
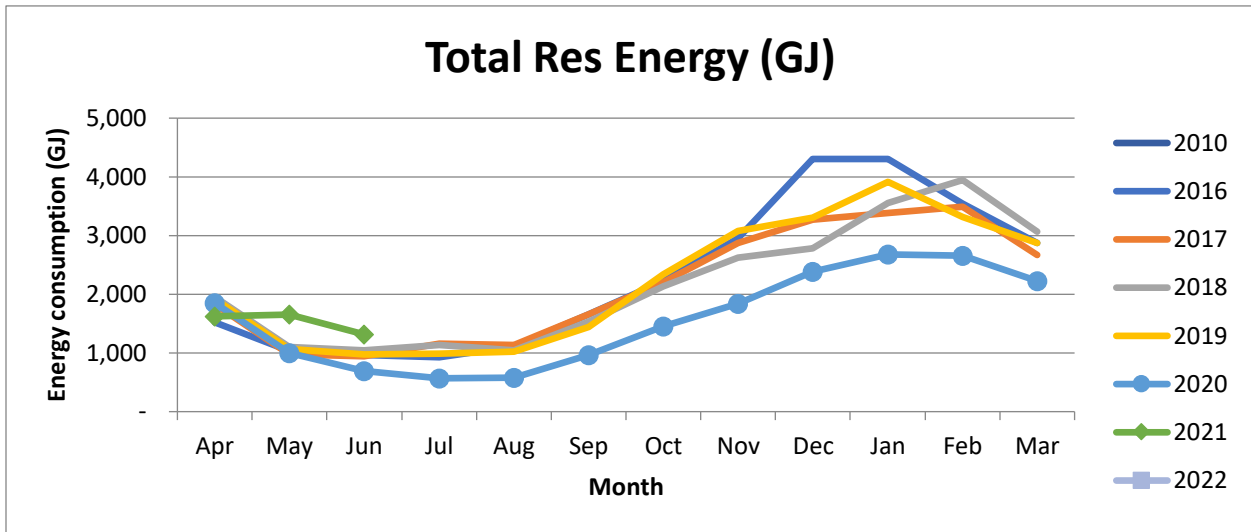
This section presents various figures which show and compares the month over month energy consumption from FY 18-19 to FY 21-22².

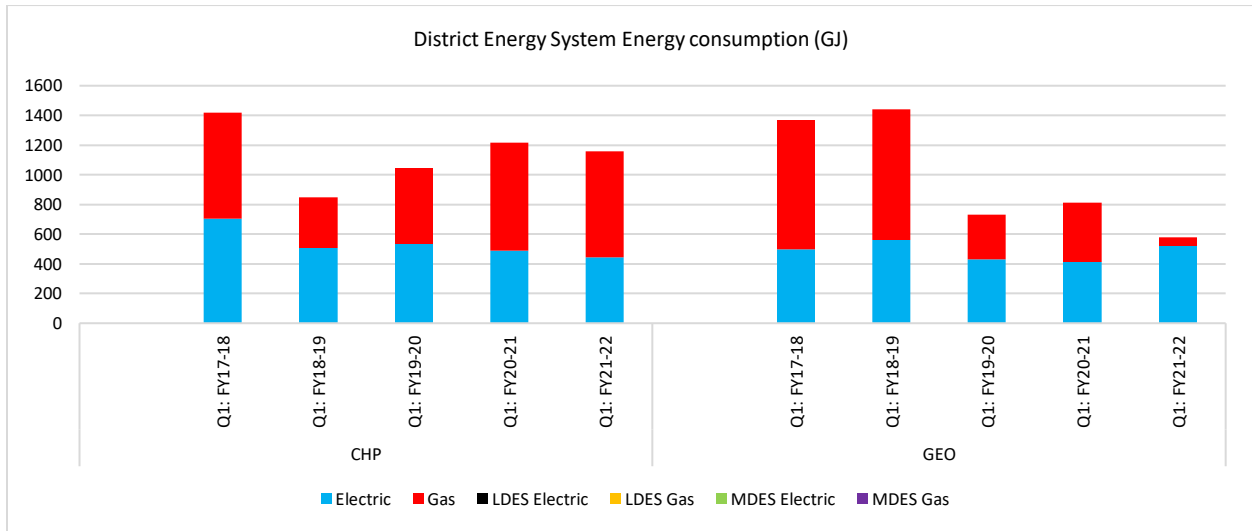


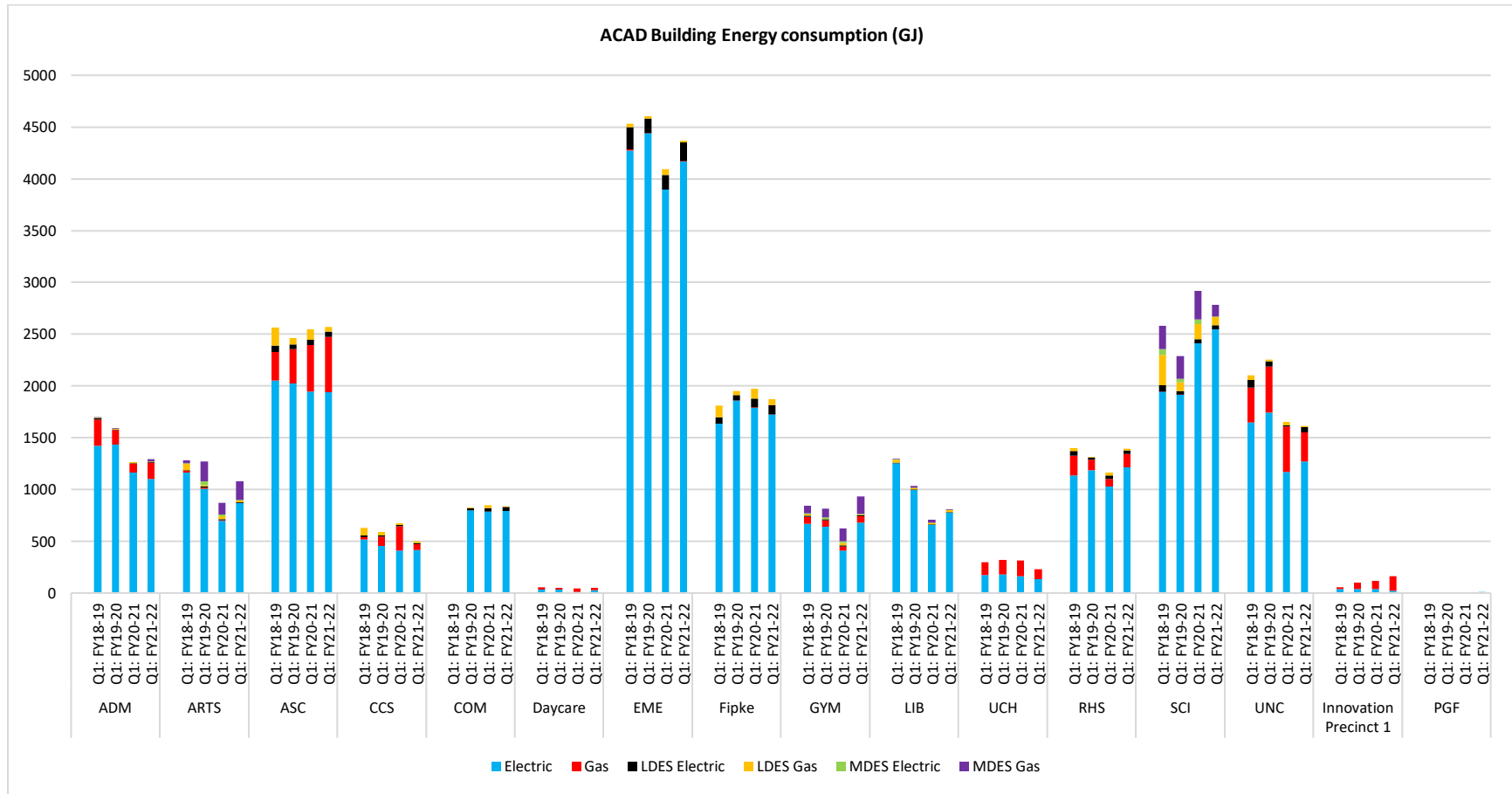
² For section 5, any year listed in the graph is start of the fiscal year.

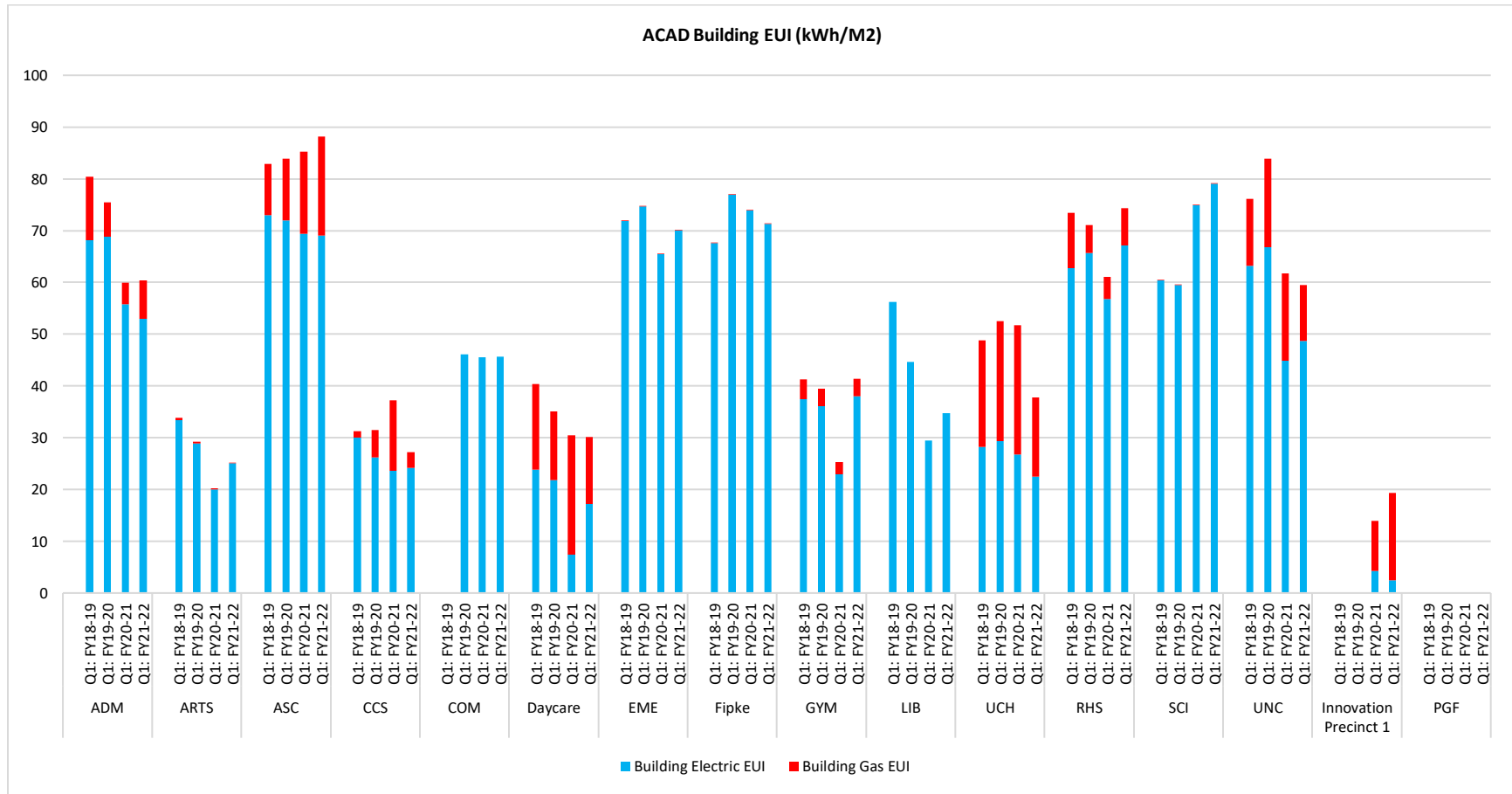


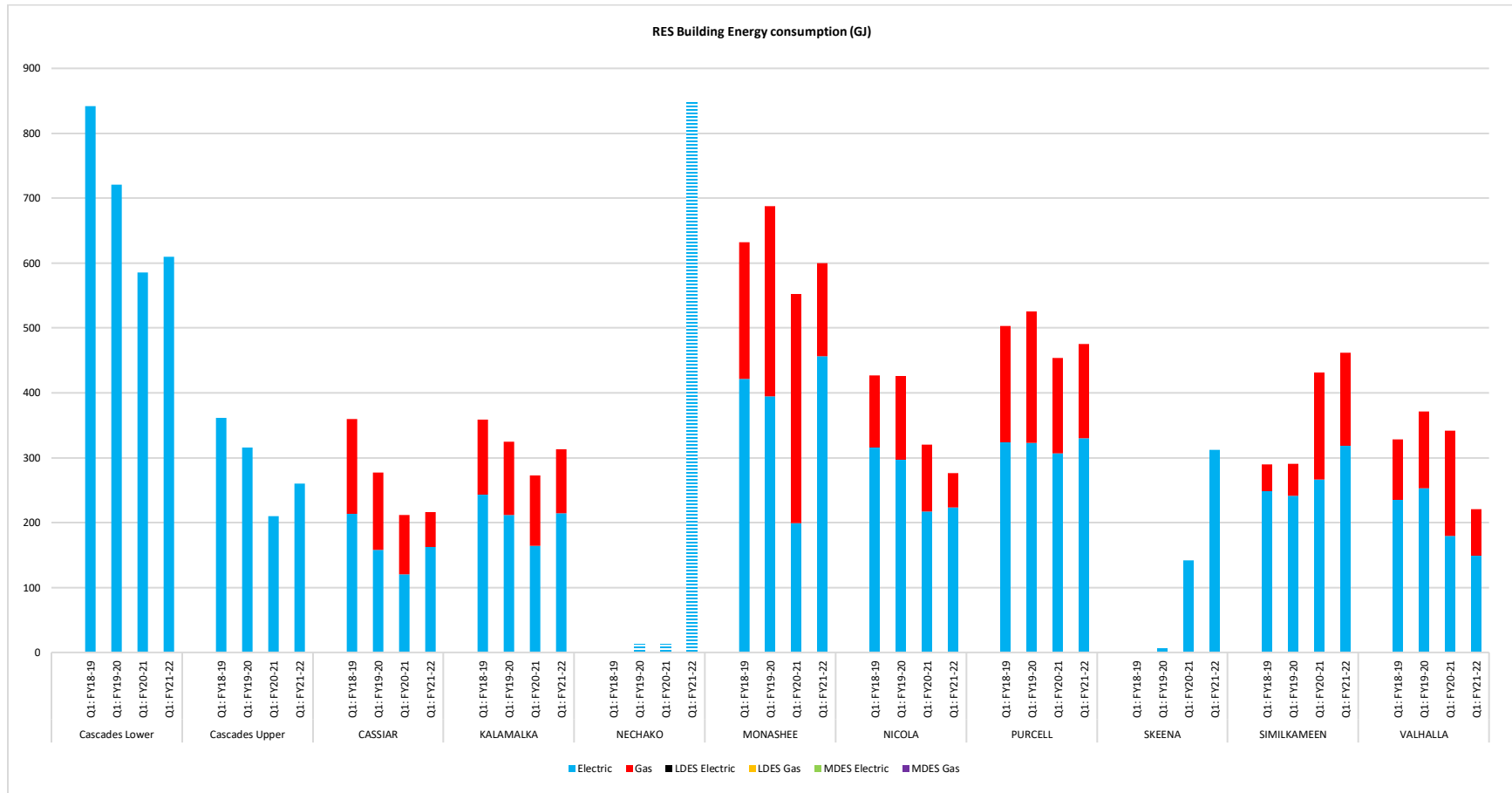


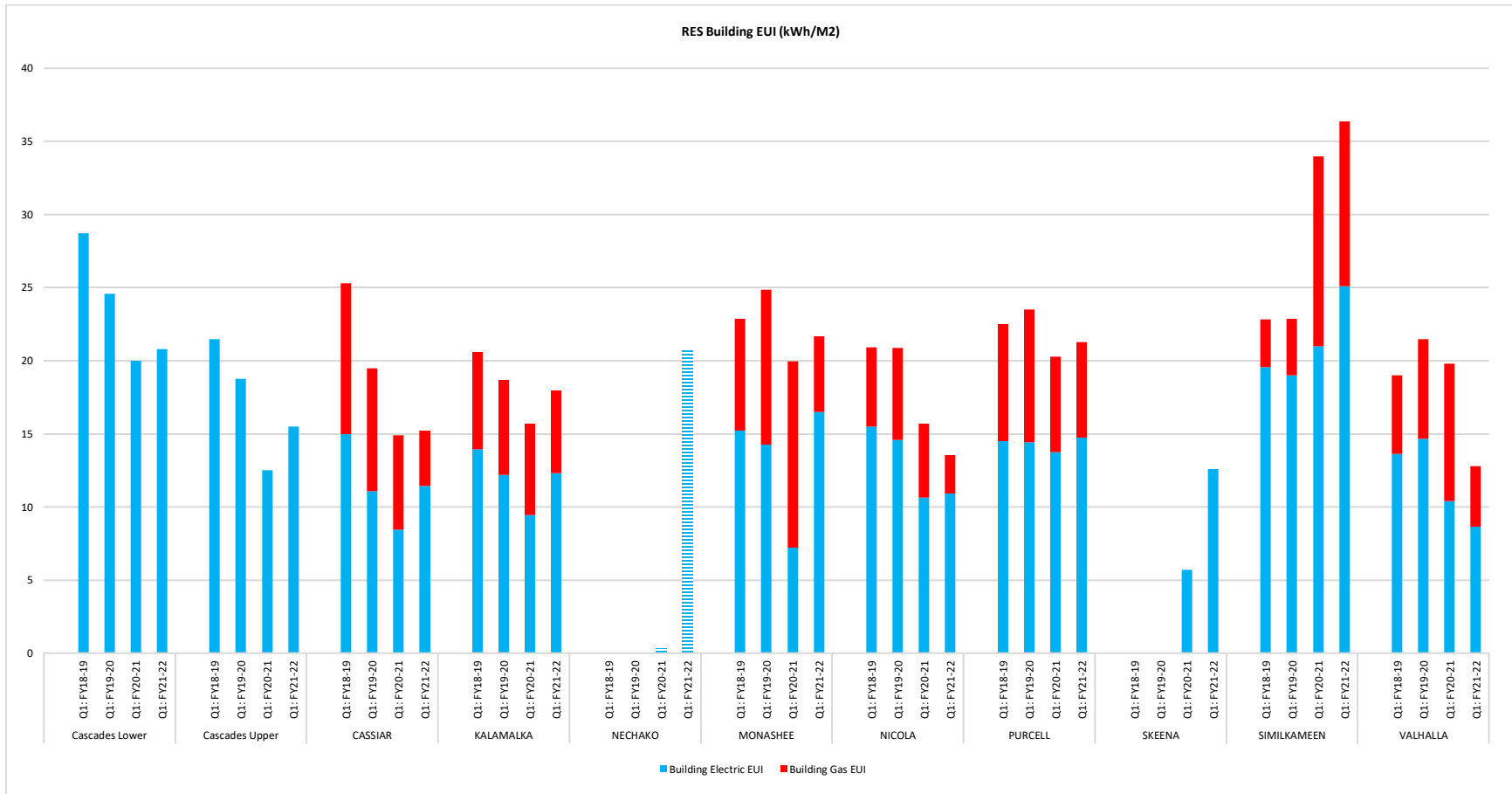


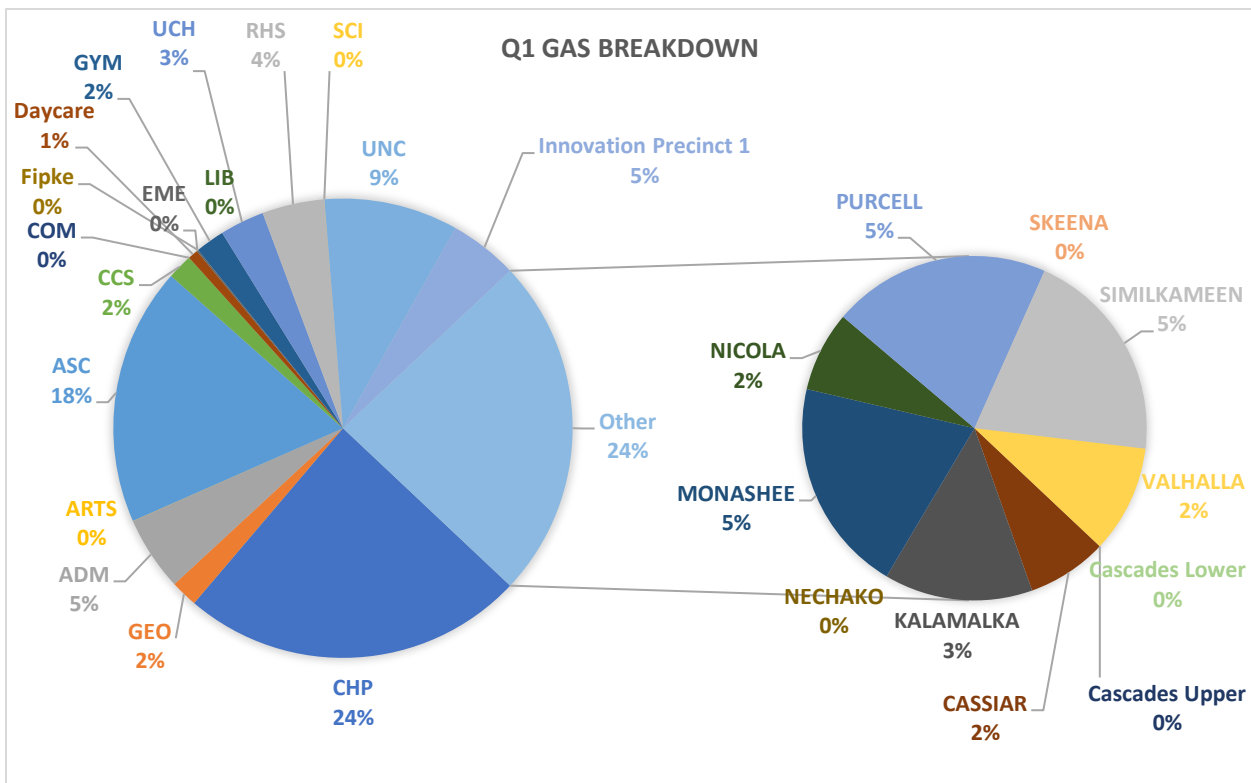
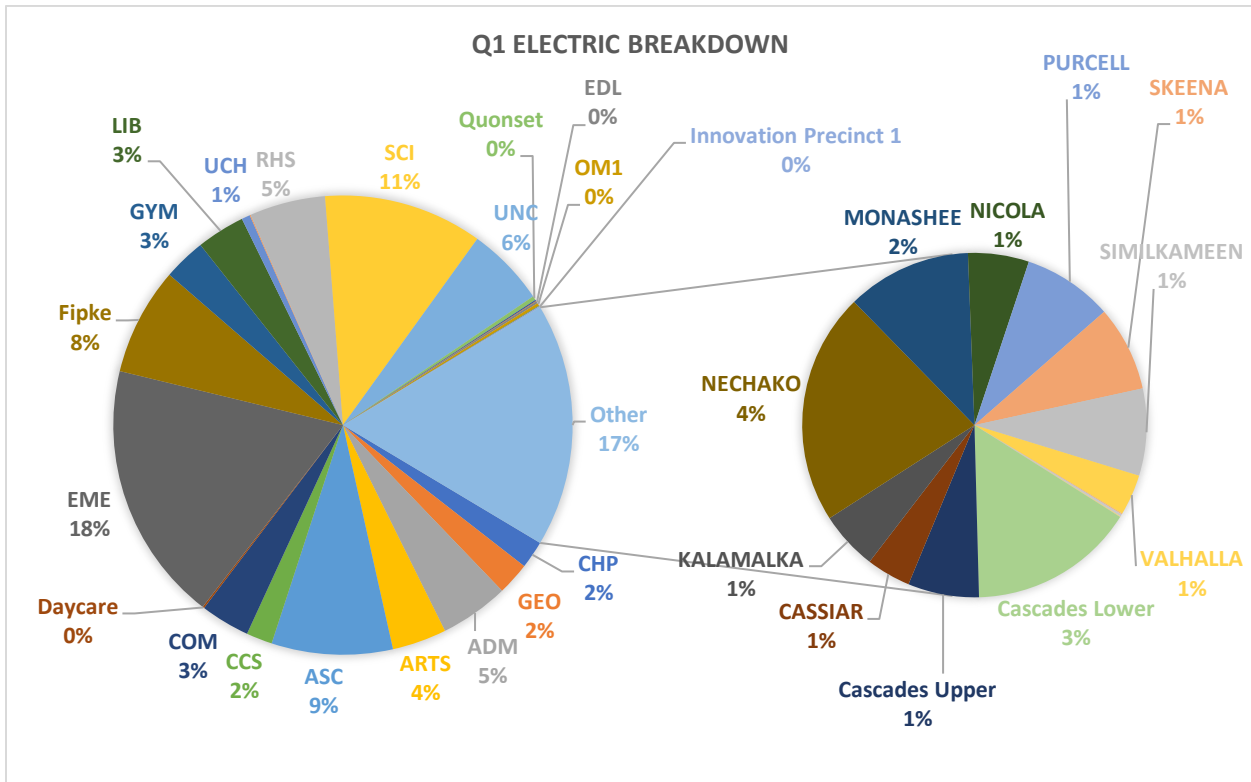












Note: Building electricity and gas consumption values shown are for consumption within the building. Indirect gas consumption via MDES & LDES is not included.

