UBC Okanagan Campus
Energy Team
Quarterly Report
July 2021 – September 2021

Report Date: 2021-10-22

Energy Team
The University of British Columbia |
Okanagan Campus
1060 Diversity Place | Kelowna BC | V1V 1V7 Canada

Contents

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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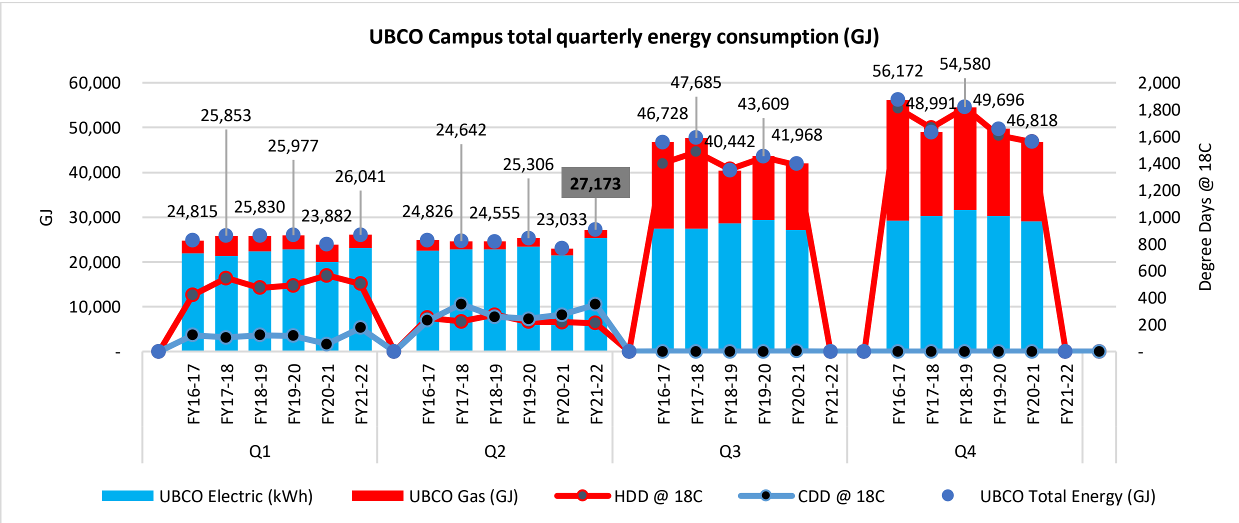
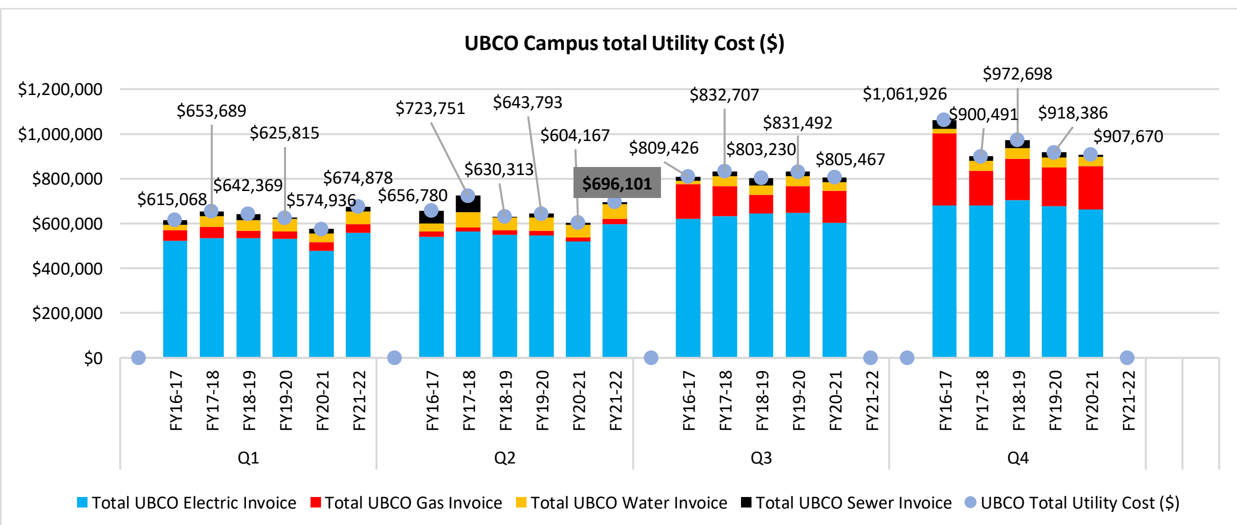
1. Overview of the Second Quarter of FY 2021-2022

UBCO Campus total energy consumption over the past quarter (Q2 2021) was 27,173 GJ compared to 23,032 GJ for Q2 last fiscal year (Q2 2020), a 18% year over year quarterly increase leading to a 16% increase in total campus energy utility cost. This total energy consumption includes an 18% increase in campus Electricity consumption i.e. from 5,986 MWh in Q2 2020 to 7,044 MWh in Q2 2021 and an increase of 22% in campus Gas consumption i.e. from 1,482 GJ in Q2 2020 to 1813 GJ in Q2 2021.





In Q2 2021, a 28% increase in Cooling Degree-Days (CDD) was observed i.e. from 272 degree-days in Q2 2020 to 349 degree-days in Q2 2021. During the same period, Heating Degree-Days (HDD) was observed to be similar to Q2 of previous year i.e. around 218 degree-days in Q2 2020 and around 210 degree-days in Q2 2021.

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The increase in energy consumption is in direct correlation with the degree days experienced during the period along with following key factors:

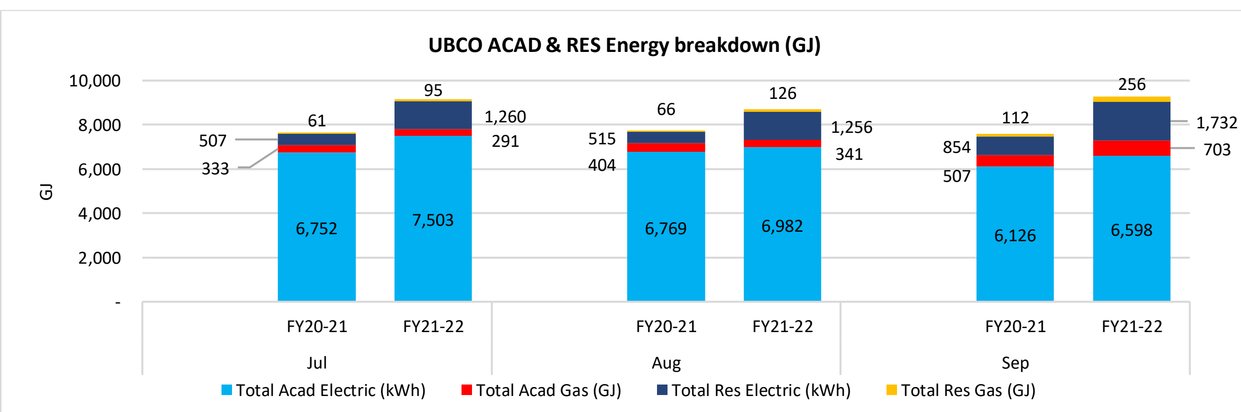
Electricity:

- As UBCO community transitioned back to campus, a 126% increase in Residences electricity consumption was observed i.e. from 521 MWh in Q2 2020 to 1180 MWh in Q2 2021. This can be primarily attributed to operations and commissioning of two new Residences Skeena (91 MWh Q2 2021 vs 35 MWh during construction) and Nechako (280 MWh). Other Residences show a range of 40% to 130% increase in their electricity consumption
- A 7% (400 MWh) increase in electricity consumption for Academic buildings was observed primarily by CHP building (54 MWh to 108 MWh), ARTS building (50% increase i.e. 203 MWh to 311 MWh), SCI building (21% increase from 642 MWh to 775 MWh), EME building (1231 MWh vs 1298 MWh), addition of Plant Growth Facility (68 MWh), and Innovation Annex (14 MWh), and small increases in other buildings (CCS, COM, GYM, LIB, and portables). These increases in campus academic buildings may be attributed to increased HVAC requirement as a result of heat waves, COVID-19 pandemic, smoke mitigation plan etc. GEO, ADM, ASC, FIPKE, RHS, UNC and 1540 Innovation Drive[1] are the buildings that show reduction in electricity consumption.

Natural Gas:

- A 100% increase in Residences gas consumption was observed i.e. from 239 GJ in Q2 2020 to 477 GJ in Q2 2021. This can be attributed to increased domestic water demand in residences.
- A 7% (95 GJ) increase in gas consumption for Academic buildings was observed primarily by CHP building (10 GJ to 100 GJ). The MDES system which is usually not operated in summer months, was started in the month of September this year which was started in the month of October last year. The early operations of MDES system is due to heating demand for GYM as confirmed by MDES Thermal Energy consumption breakdown.

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



[1] A major renovation is underway in the 1540 Innovation Drive building as the building was converted from to a research laboratory building.

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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.

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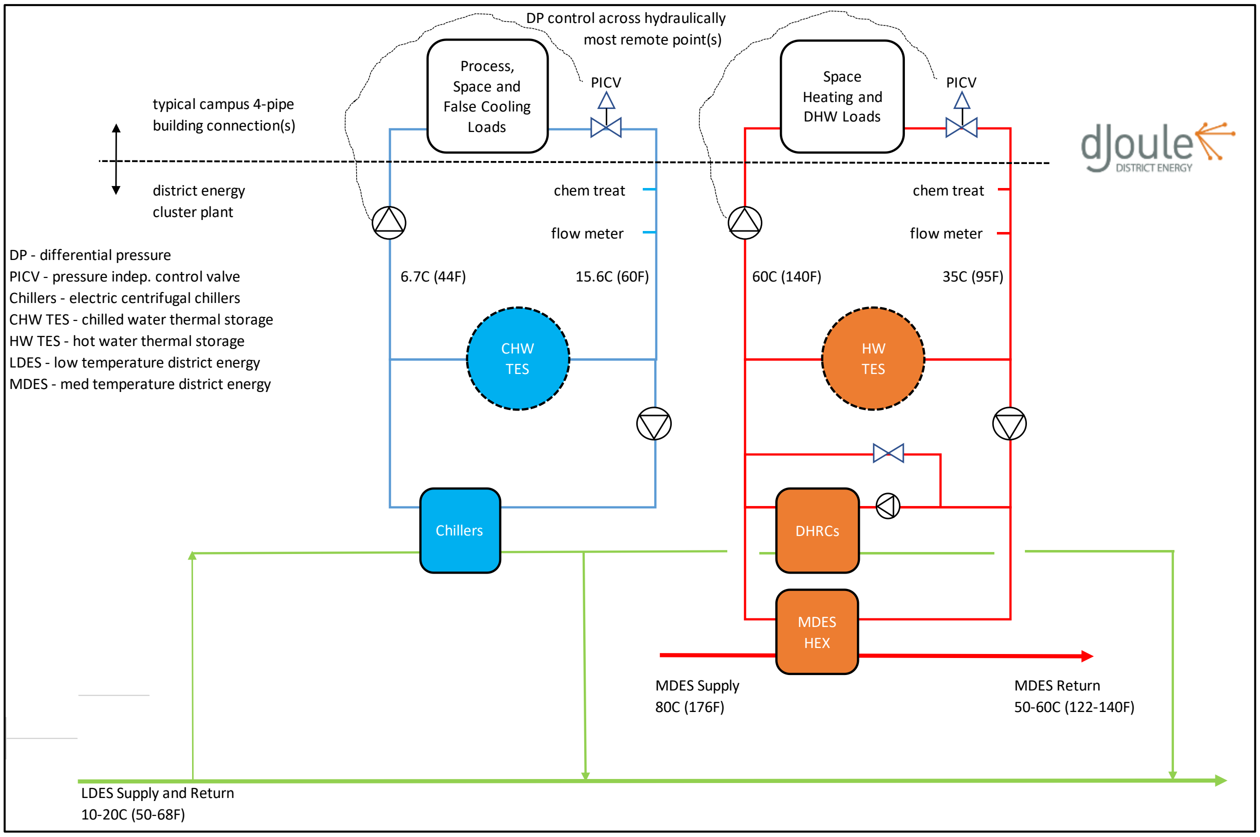

The cluster plant at the ICI building was accepted and approved by UBC executive team. Energy Team has been working diligently with UBC Properties Trust and their consultant in implementation of cluster plant at the ICI building and its associated connection with adjacent buildings.

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, explore other low carbon heating sources/ technologies through a study planned for FY22-23 and install ASHP 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.

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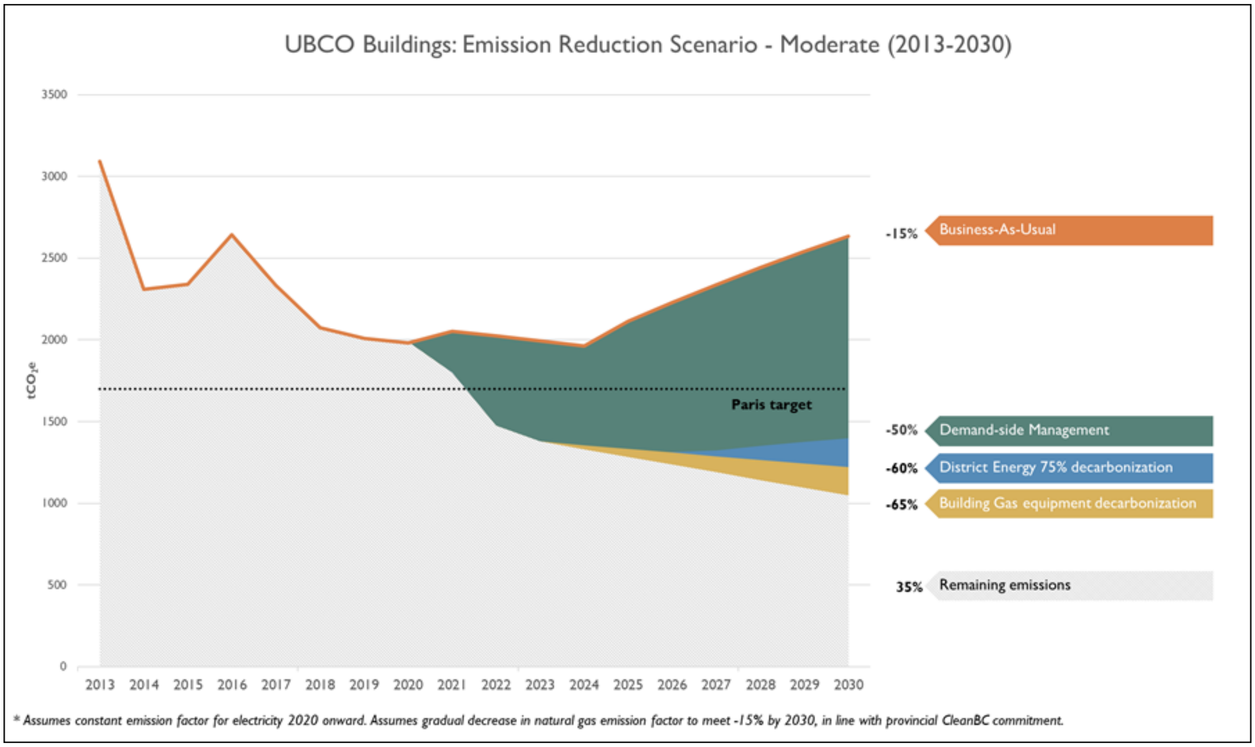

Based on the strategy, a moderate (realistic) target of 65% emission reduction[2] from 2013 levels by 2030 is recommended. This can be achieved by partial decarbonization of the central plant, implementing projects that will reduce energy demand, and connecting select existing buildings to central energy supply systems (district energy). The Campus Action Plan 2030 plan is currently with UBC Executive team for approval.

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 energy models (Student Residence (no kitchen), Campus Rental Housing (with Commercial Retail Units and suite kitchen), Low intensity lab building, High intensity lab building, Classroom/Office building) from the previous 2016 UBC Net Positive Modelling Study and reflect UBC Okanagan campus typologies and climate zones based on current UBCO construction practices.

This work includes formulating ECM bundles to identify achievable energy and greenhouse gas emission targets (TEUI, TEDI, GHGI) specific to UBCO, and then completing costing and financial analysis to identify the most cost-effective strategies to achieve those targets. Applicability of the proposed strategies to existing building retrofits is also considered.

Key assymptions considered in the study in line with Technical Guidelines and future UBCO campus construction practices:

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[2] Note that when conducting the scenario analysis, the electricity emission factor used in 2020 was 2.587 tCO_2e/GWh and assumed constant till 2030. However, in Q1 FY21-22 this factor has been retroactively updated by Ministry of Environmental and Climate Change Strategy to 35 tCO_2e/GWh for 2013 and 40.1 tCO_2e/GWh for 2020. This modelling results do not reflect this change.

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- All archetypes have been assumed to be connected to the campus district energy system for hydronic heating, cooling and hot water.
- Full mechanical cooling have been added to reflect typical practice
- Window to Wall Ratio (WWR) for the reference scenario has been assumed as 40%
- Residence buildings assume centralized HRVs (70% effectiveness) to serve ventilation demand connected with constant volume 4-pipe constant speed Fan Coil Units connected to DE system. Make-up air units provide tempered outdoor air to corridors for pressurization (20 cfm/unit), hydronic heating and cooling coils connected to DE system. This MUA increased to 30 cfm/unit to account for dryer and kitchen exhaust
- Two types of HVAC options have been modelled for the non-lab space of other three archetypes:
    - Option 1: VAV system with central cooling, connected to DE system. Reheat and perimeter heat losses addressed by local hydronic baseboard convectors and integrated heat recovery through 70% effectivess.
    - Option 2: Outdoor air to be provided by Dedicated Outdoor Air System (DOAS)[3] with 70% heat recovery effectiveness. 4-pipe constant speed Fan Coil Units in Classroom/ office areas providing heating and cooling, connected to DE system.
- Laboratory spaces on campus have been modelled as 100% outdoor air delivered via separate system with no re-circulation with 40% heat recovery effectiveness and 4-pipe constant speed Fan Coil Units for heating and cooling.
- Low-intensity lab has a fume hood density of 25 lineal meter of fume hood per 1000 m^2 of lab area with flow rate reduction, wind responsive VFD, and low pressure drop. The fume hood are 6 feet wide and ventilation rate is driven by general air change rate requirement.
- High-intensity lab has a fume hood density of 35 lineal meter of fume hood per 1000 m^2 of lab area with flow rate reduction, wind responsive VFD, and low pressure drop. The fume hood are 4 feet wide and ventilation rate is driven by general air change rate requirement.
- The lab air handler design flow rate is based on largest of "8 ACH" or "100% open @ 188 L/s/m fume hood". During occupied hours, operation flow rate is based on largest of "8 ACH" or "60% closed @ 45 L/s/m fume hood and 40% open @ 188 L/s/m fume hood". During unoccupied hours, operation flow rate is based on largest of "4 ACH" or "95% closed @ 45 L/s/m fume hood and 5% open @ 188 L/s/m fume hood".
- Domestic hot water has been modelled to be served from Central storage tank system (120 F) connected to district heating with electric water heater for top-up.
- Occupant schedules as per NECB and ASHRAE guidelines
    - Residences: Around 30% - 50% between 8 AM to 5 PM and 90% 6 PM to 7 AM[4]
    - Retail: Mon to Sat 7 AM to 9 PM; Sun 9 AM to 7 PM

[3] Although the DOAS + FCUs system has its disadvantages compared to VAV, such as higher maintenance due to terminal filter replacement, it has benefits such as higher heat recovery effectiveness and the ability to decouple the heating and ventilation system and thereby reduce fan and heating cooling energy. Further, the DOAS + FCUs baseline system has the potential to be improved in terms of fan energy and free cooling availability. Free cooling can be achieved by using a high-performance HRV that allows for bypass as needed. However, since the DOAS system is typically sized for the ventilation requirements, the free cooling ability is limited compared to the VAV system which is sized to provide a greater air flow rate than the ventilation requirement alone.

[4] Schedule based on NECB 2015 Table A – 8.4.3.2 (1) G

  - Labs: Mon to Fri 7 AM to 10 PM; Sat, Sun 7 AM to 6 PM
  - Classrooms: Mon to Fri 8 AM to 10 PM; Sat, Sun Unoccupied
  - Offices: Mon to Fri 7 AM to 10 PM; Sat 7 AM to 5 PM; Sun Unoccupied
- Electricity emission factor is assumed at 40.1 tCO_2e/GWh
- Carbon cost is assumed at 250 $/ tCO_2e

Individual ECMs appropriate to each archetype were combined into two ECM bundles for modelling and costing i.e. Enclosure bundle and Mechanical measure bundle. RDH has provided a draft version of the report with some additional scope which is being added to provide TEDI, peak heating demand, peak cooling demand, peak electricity demand, and DHW energy consumption per space type. The additional scope work is expected to be finished by Q4 FY21-22.

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. Currently, work is underway to connect the backend of the dashboard (R platform) with the existing Siemens Desigo system (UBCO is using this system to maintain campus operations through trend log reviews) to create a parallel database which can be further used for energy monitoring.

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. Due to Facilities Management Engineers workload and other issues, progress on this project has been slow. Energy Team is currently working on a plan to collect this information as it will be a critical input to the asset management module of the Enterprise Maintenance Management System that UBCO will be adopting in FY22-23.

2.7. VLAN upgrade

The intent of this project is to segregate the controls equipment for each building on campus into individual VLANs. This project has been undertaken and currently in progress for three key reasons which include communication control, increased security as well as plan for future additions as more equipment in the controls industry operates primarily with IP interfaces. This includes meters, lighting, chillers, and zone HVAC controllers.

The current network infrastructure is a hybrid configuration with a flat "facilities" VLAN that covers multiple building, in addition all new construction since the Commons (TLC) building has been configured into individual VLANs. This project will migrate the older buildings into their individual VLANs, eventually removing the "facilities" VLAN entirely. Once the VLAN migration is complete, the Desigo server is intended to become the central hub for communication control, avoiding broadcast information between buildings and many firewall rules needed to accommodate facilities network access for all BMS systems.

2.8. 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 conducting technical reviews and setting goals, targets, and strategies as early as possible for future campus expansions such as new construction ICI building, Innovation Precinct 1, Nechako Commons, Skeena.

In August 2021, UBC Executive team took a significant step towards sustainable development on campus by approving first cluster plant and provisions for thermal storage within the ICI building currently in design with occupancy anticipated for Jan 2025. This cluster plant is expected to serve thermal demand to surrounding buildings potentially CCS, ADM, EME, GYM including ICI (South and east of main campus). This will provide significant savings with respect to deep building retrofits and new campus buildings.

ICI is intended to include spatial provisions and corridors to allow plant expansion into a nodal thermal energy plant that serves future developments around the ICI building. This "cluster" plant will produce heating water (HW) and chilled water (CHW) using the LDES and MDES interfaces, before distributing HW and CHW to the ICI building and the building cluster downstream of the ICI. Energy Team has been working with UBC Properties Trust and their consultant for successful design and construction of cluster plant at the ICI building. The project is currently at 50% Design Development stage.

2.9. Portfolio Manager

The building energy performance data for UBC Okanagan buildings are updated periodically in the EPA's ENERGY STAR Portfolio Manager and can be accessed using a shared read-only access account. This access allows researchers, consultants, contractors to access energy consumption and related information for UBCO buildings.

Currently, this platform is being used to fulfil the requirements of BC NZER Program for Skeena Residence i.e. set up building in Portfolio Manager and share long-term trending/ logging of the energy data.

2.10. 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.

2.11. CCS deep retrofit

With the distribution and energy transfer station strategy set (Refer to Section 2.2. and 2.8.), the focus now turns to existing building upgrades. Several buildings on campus have a significant range of equipment and systems that are, or are approaching end-of-life. Many of the equipment in the existing building are on deferred maintenance. Many studies have shown that delaying maintenance can increase future costs and capital expenditures by as much as 400% to 600%[5]. It also contributes to safety hazards, energy inefficiency, and reputational damage for organizations.

An assessment of these systems and appropriate recommendations for end-of-life replacements and deep retrofits will enable decisions to be made that will align with the DE strategy and CAP goals and targets. A prior evaluation will realise any enabling projects that will be required ahead of time. Also, if a premature failure occurs an appropriate solution can be implemented.

A study is being carried out to provide deep retrofit recommendations and individual replacement options for main and terminal HVAC equipment within the CCS building. Following are the expected deliverables from this study:

- Overall HVAC system retrofit strategy to fulfill a major building upgrade
- Recommendations for replacement of individual system and terminal HVAC equipment if equipment fails before end of life
- Equipment lists updated to include replacement suggestions and costs

The project is expected to complete by end of March 2022.

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.

[5] Altus Group: Facilities maintenance 101; https://www.altusgroup.com/services/insights/facilities-maintenance-101-how-to-get-the-most-from-your-maintenance-budget/

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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 with an expected completion by November 2021.

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 their 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. Night time flush

Night ventilation, or night flushing, is a passive cooling technique that utilizes the outdoor diurnal temperature swing and the building's thermal mass to pre-cool a building through increased outdoor airflow at night, allowing radiant cooling to take place during the day when the building is occupied.

By using the natural cooling effect of the night and the cooler air at night simply allowing the cool night air to circulate a structure during the night allows the loss of the heat buildup, or heat mass gathered by the structure during the day. In order to achieve this cooling one simply needs to allow the night air to circulate the building. The cool night air carries away the heat absorbed by the structure during the day. The very nature of concrete or other high specific heat capacity materials makes them perfect to use in conjunction with Night Flushing as the structure will take a long time to absorb enough heat during the day to change its temperature and thereby not only decreasing the cost of maintaining a stable internal climate during the day, but would also drastically decrease the cost of cooling as most of the heat absorbed during the day is lost during the night via Night Flushing. Thermal mass is a property enabling structures to absorb, retain and then release heat energy, this coupled with a high specific heat capacity means that buildings made up of concrete need to absorb a substantial amount to heat to effect a change in temperature.

The summer months in Kelowna can have relatively cool evenings with quickly warming mornings. Electricity tends to peak during this startup cooling. For summer months where the evenings are cool and it is anticipated that significant mechanical cooling load will exist throughout the day, a pre-cooling strategy will be implemented utilizing the existing weather predictor, similar to the existing morning warmup strategy.

A sequence of operation for the strategy is being developed by Energy Team which will be subcontracted for implementation in all the Academic buildings where applicable.

3.6. FIPKE waste heat recovery

Currently the strobic system, which is composed of three fans, exhausts air to the atmosphere without any heat recovery. A feasibility study is being conducted in the Fipke building to increase exhaust air heat recovery. This study is expected to provide sufficient level of detail to support a business case whether to proceed with the energy conservation measure.

Heat in the building is currently being served by stand-alone boilers and heat from the LDES. This study is likely to consider installation of a glycol runaround loop to recover heat from the exhaust. This heat can be used to pre-heat supply air to another unit.

3.7. Shut the sash campaign

The “Shut the Sash” behaviour change program is being organized by UBCO Sustainability Office in Fall and Winter terms of FY 21-22. This program was designed to educate users on the benefits of closing fume hoods when not in use and is intended to enhance energy savings and associated carbon reductions achieved by the optimization program completed in the Science building’s laboratories. Science lab users are instructed to shut the sash / fume hood when it is not in use and at the end of class, thus lowering the air ventilation draw, natural gas required to stabilize temperature, and electrical consumption used to power the extra airflow.

Energy Team will be supporting Sustainability Office and this program by estimating energy savings from these campaigns.

3.8. Monitoring improvements

A few monitoring improvements are continuously being implemented by the UBCO Energy Team. For example, resolving the WIFI occupancy reporting issue, working with Siemens to fix the Desigo deficiencies list, resolving integration between Advantage Navigator and Desigo backend to maintain BMS database, adding missing trends on the key hydronic graphics etc.

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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, detailed designs for the building and providing inputs on the building mechanical, electrical systems and energy-related standards/ benchmarks. The project is currently at 50% Design Development stage.

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. Energy Team has been working with the Project Manager UBC Properties Trust and their contractors 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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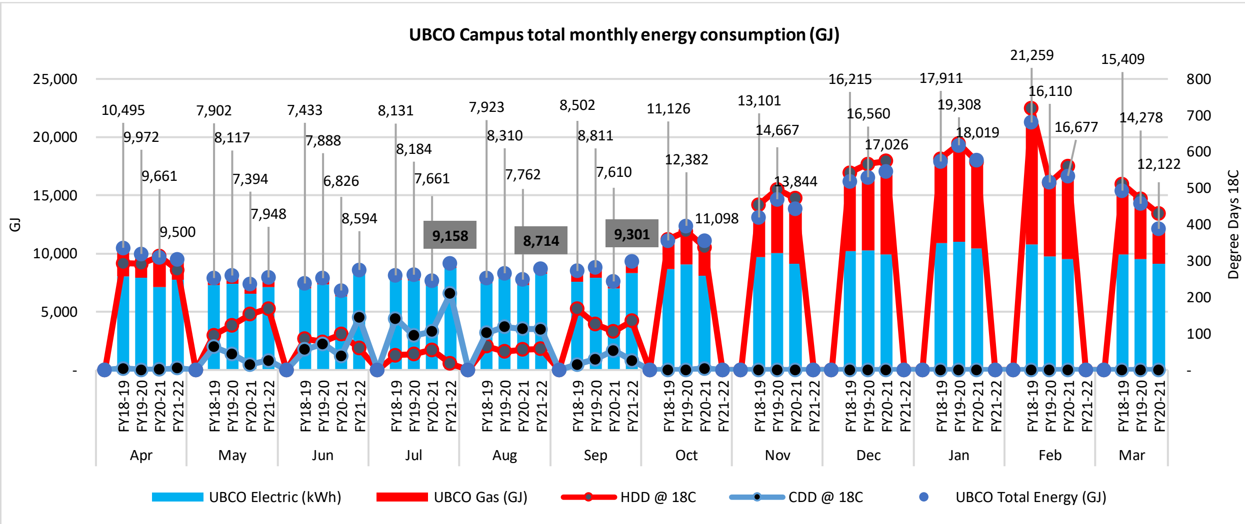
5. Monthly Energy Performance Graphs

This section presents various figures which show and compares the month over month energy consumption from FY 18-19 to FY 21-22[6].



[6] For section 5, any year listed in the graph is start of the fiscal year.

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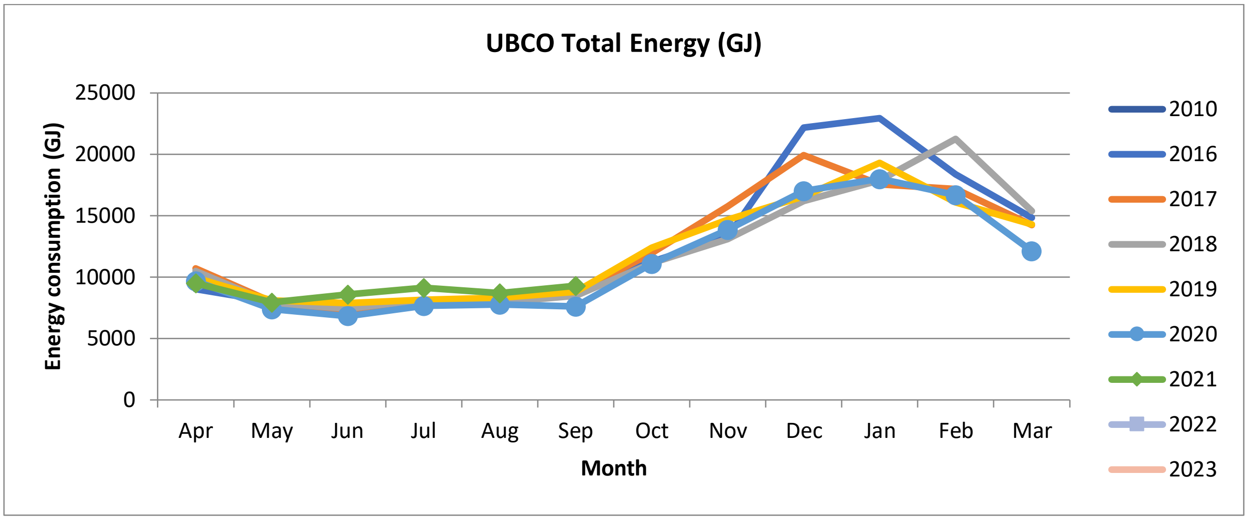
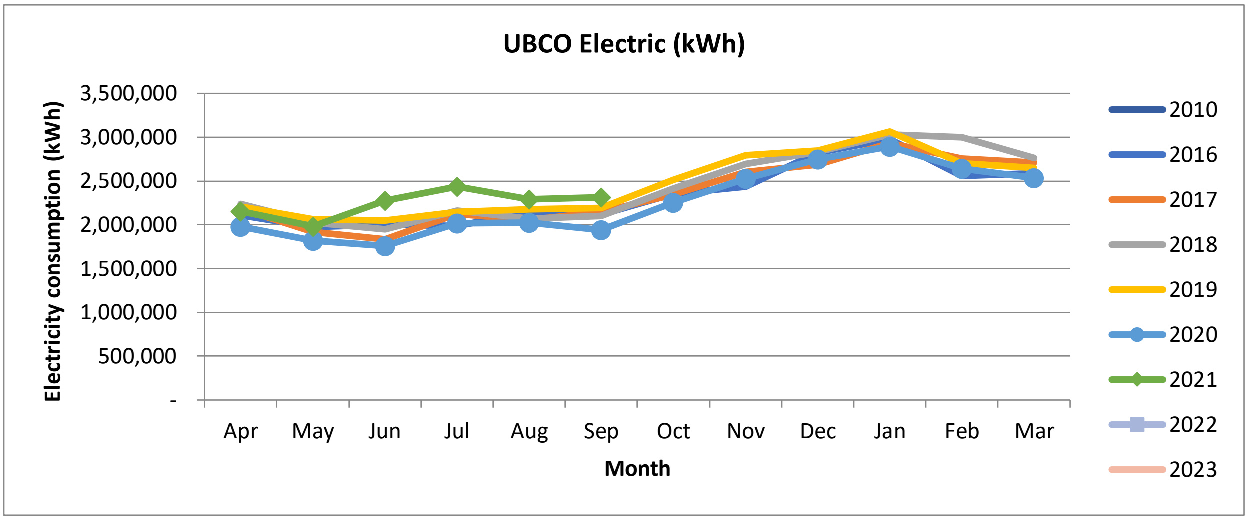
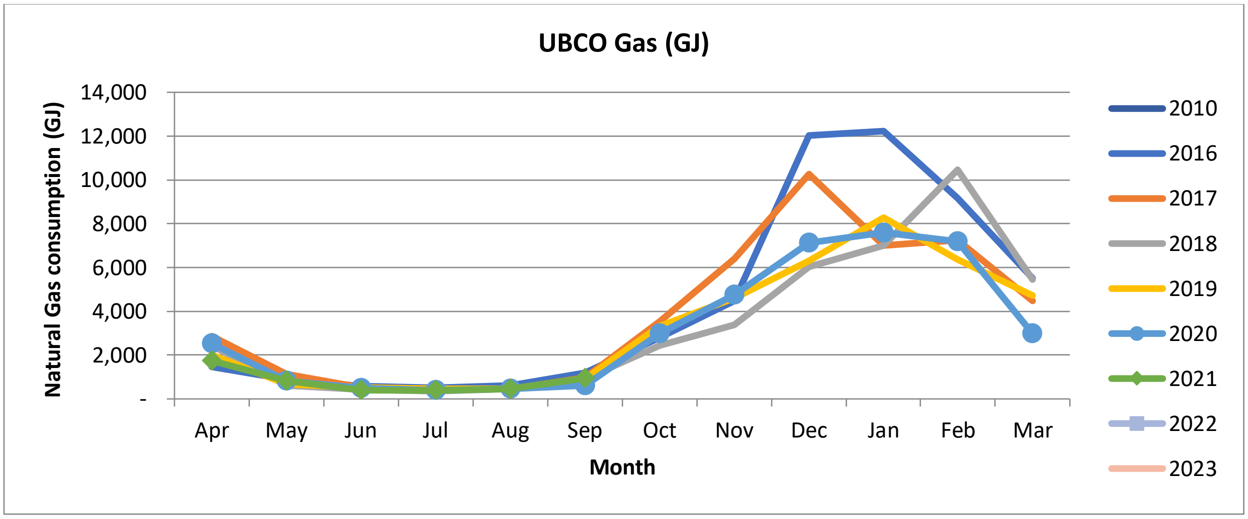
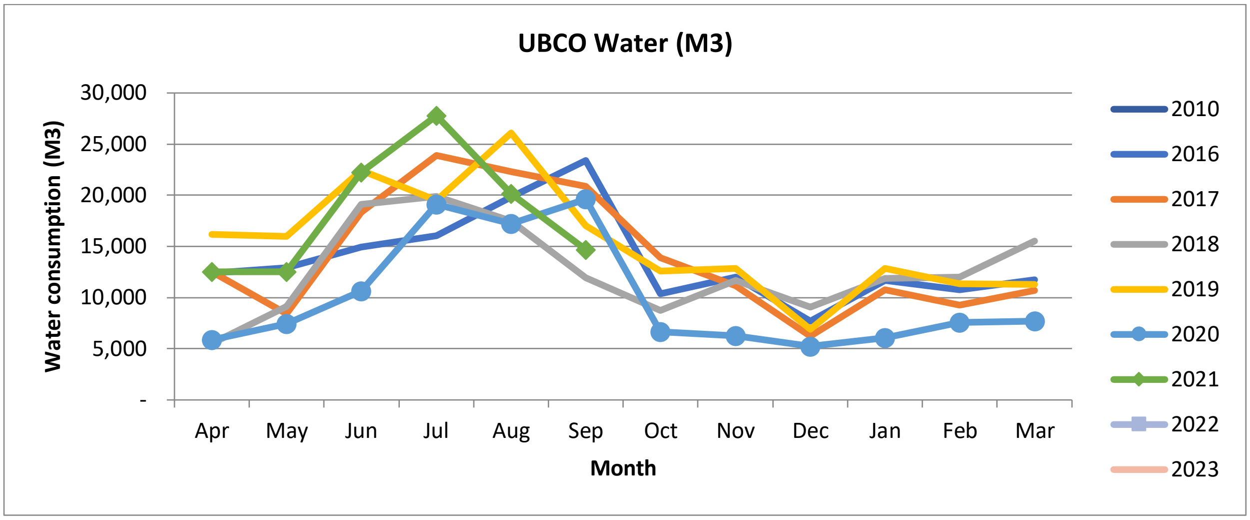
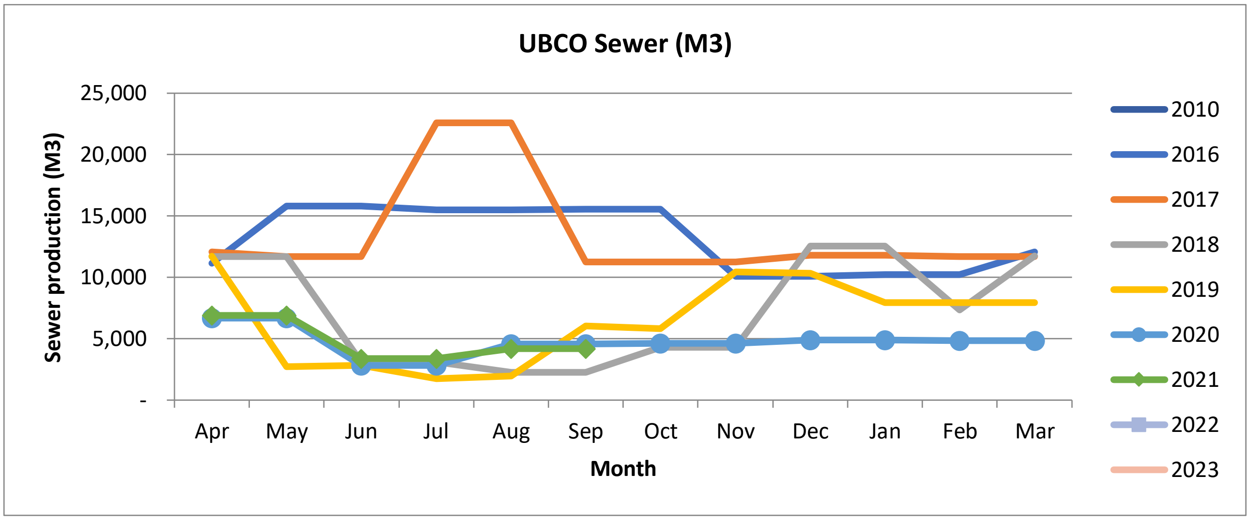







UBCO Water (M3)
Water consumption (M3)
30,000
25,000
20,000
15,000
10,000
5,000
-
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Month
2010
2016
2017
2018
2019
2020
2021
2022
2023


UBCO Sewer (M3)
Sewer production (M3)
25,000
20,000
15,000
10,000
5,000
-
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Month
2010
2016
2017
2018
2019
2020
2021
2022
2023

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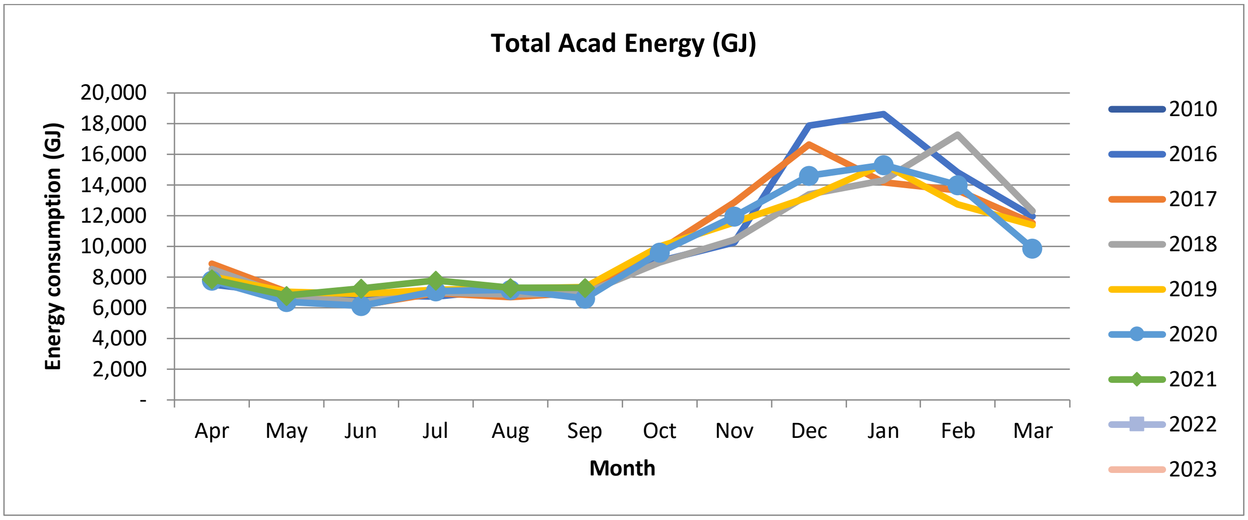

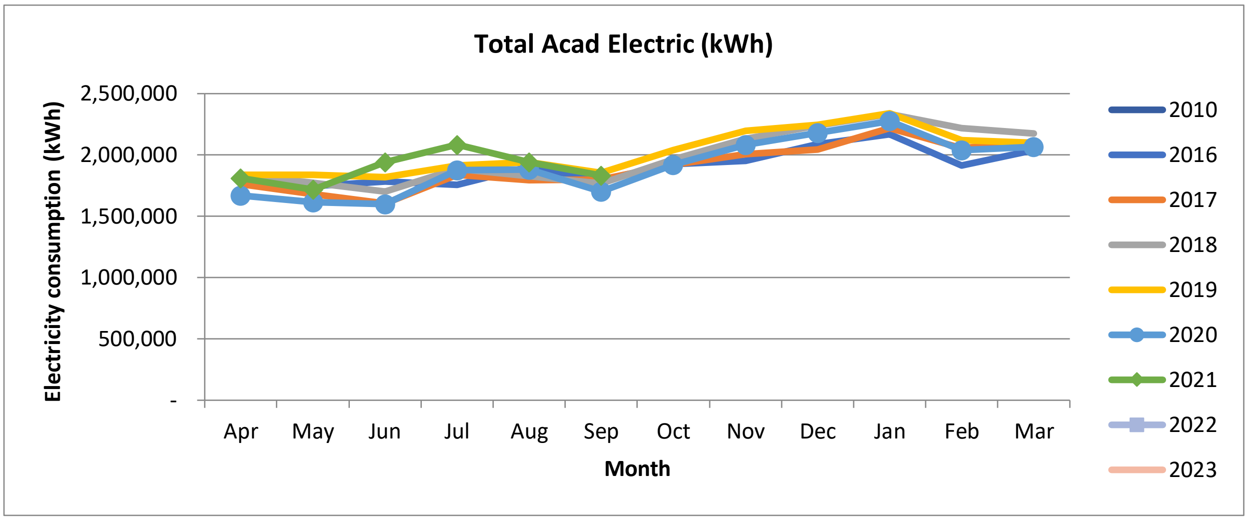

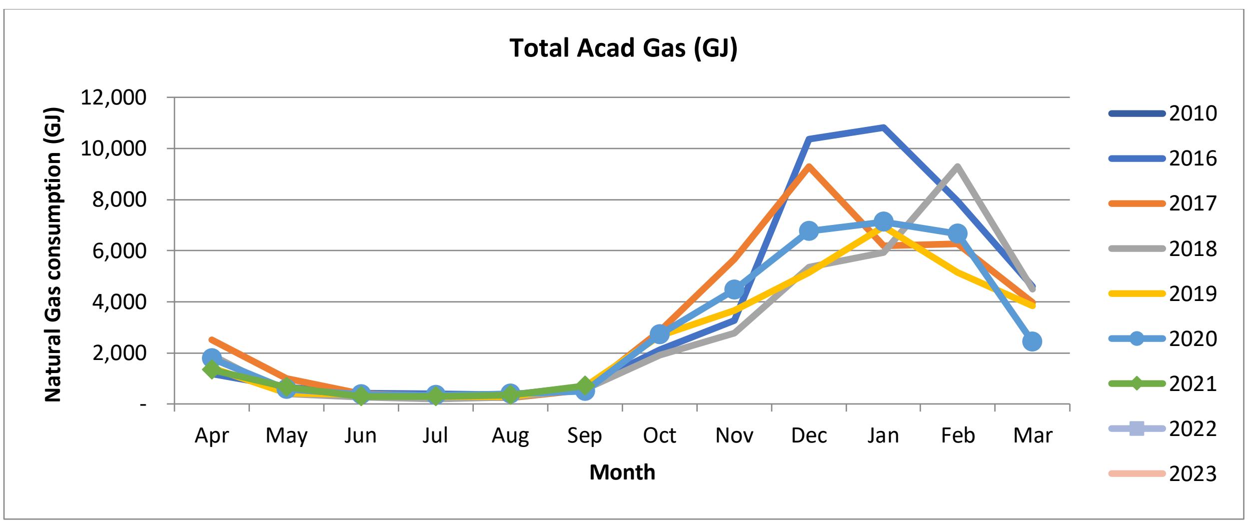

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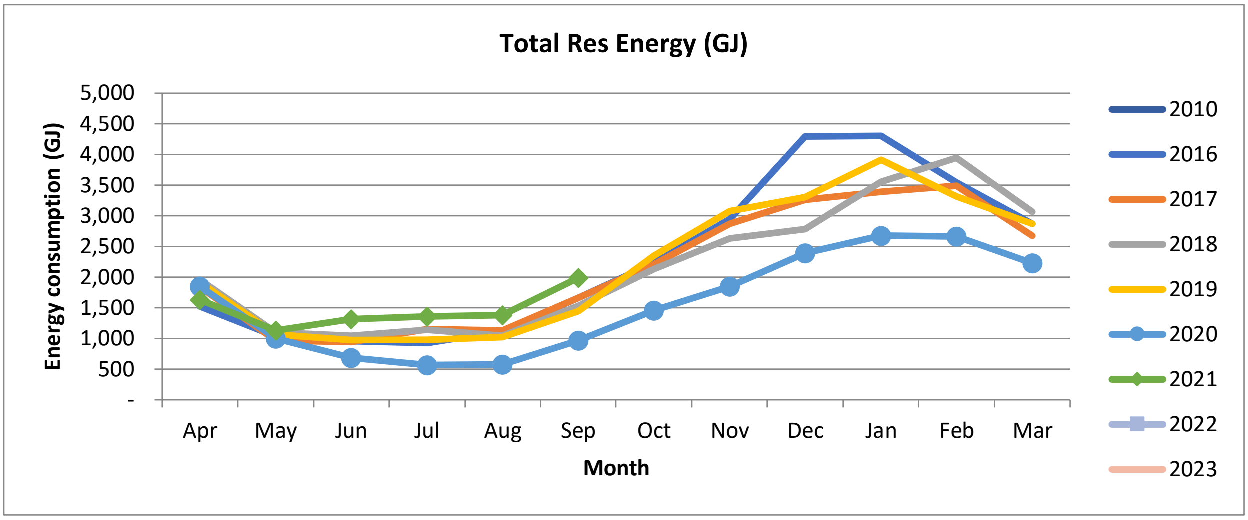

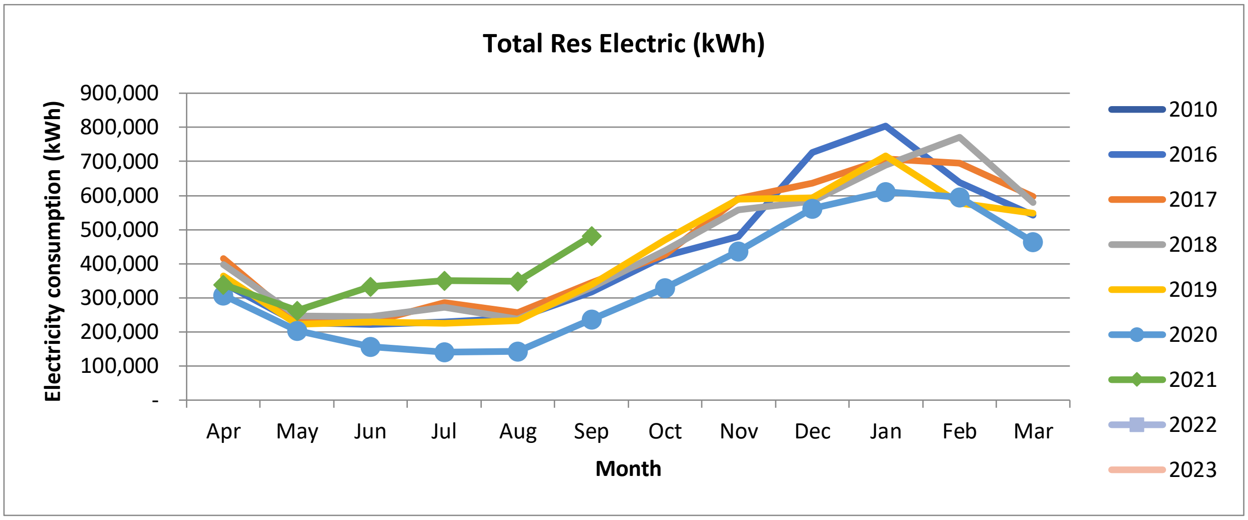

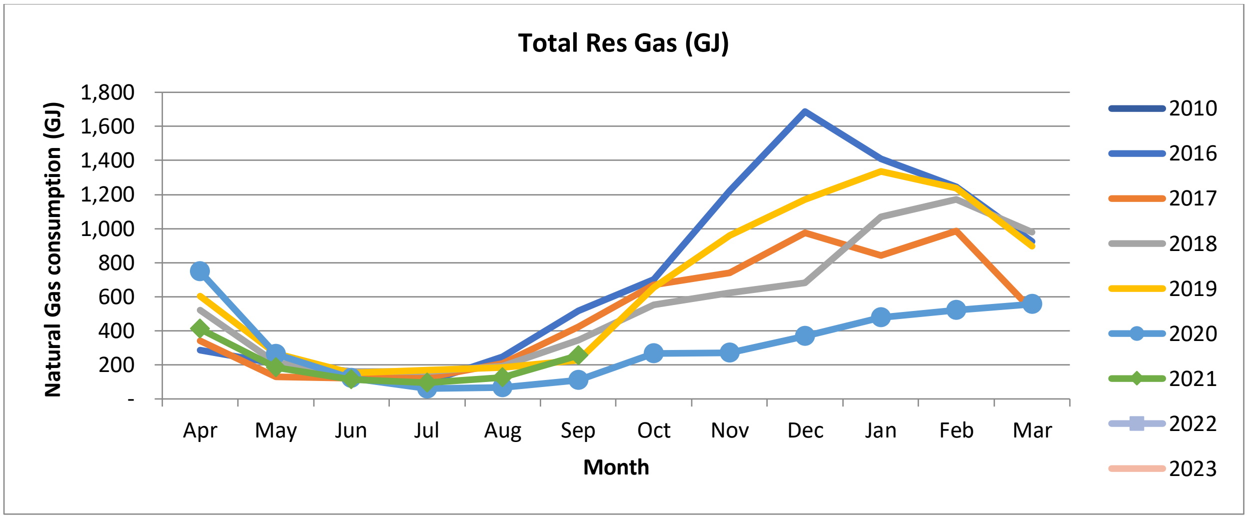

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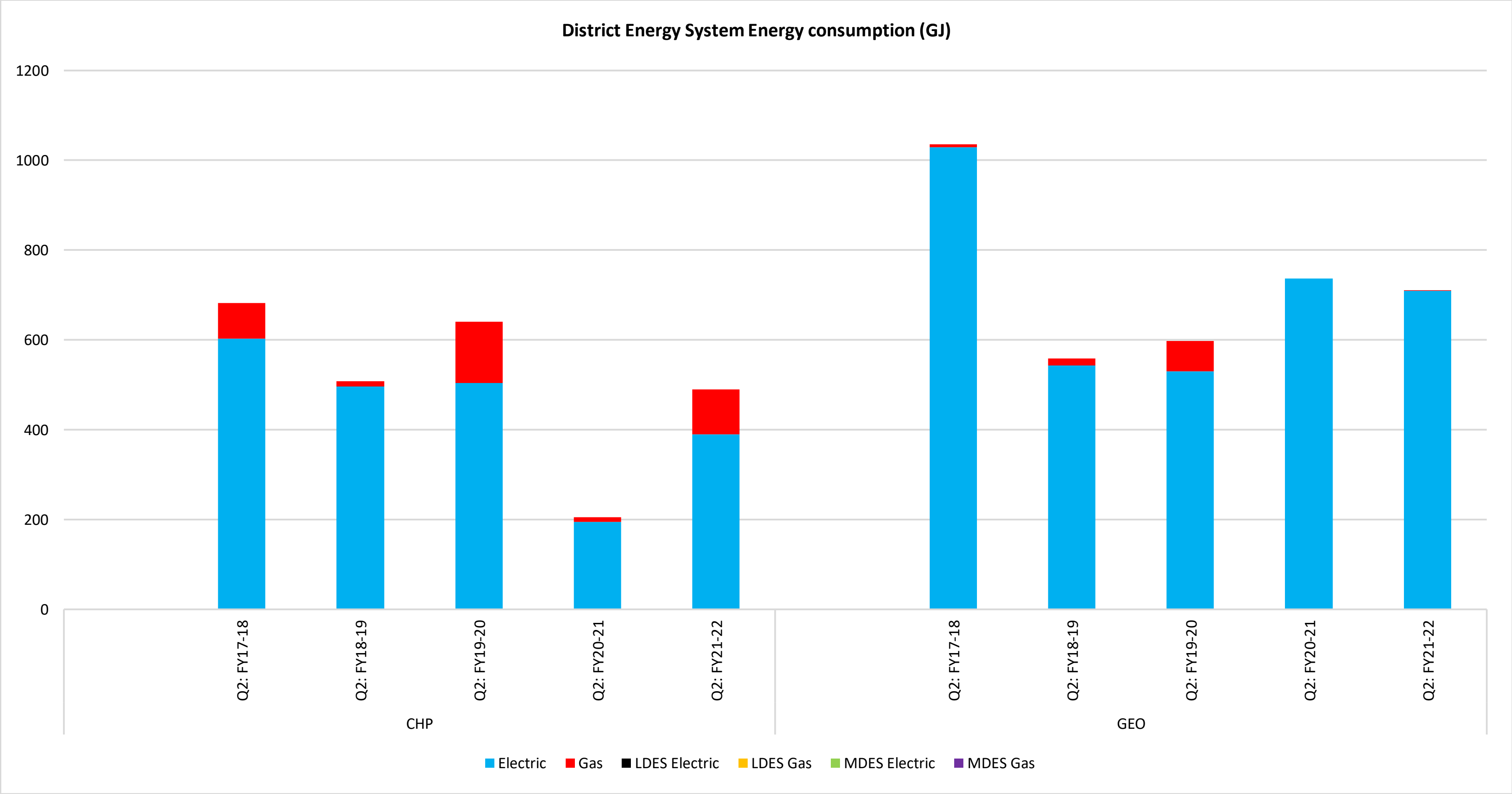

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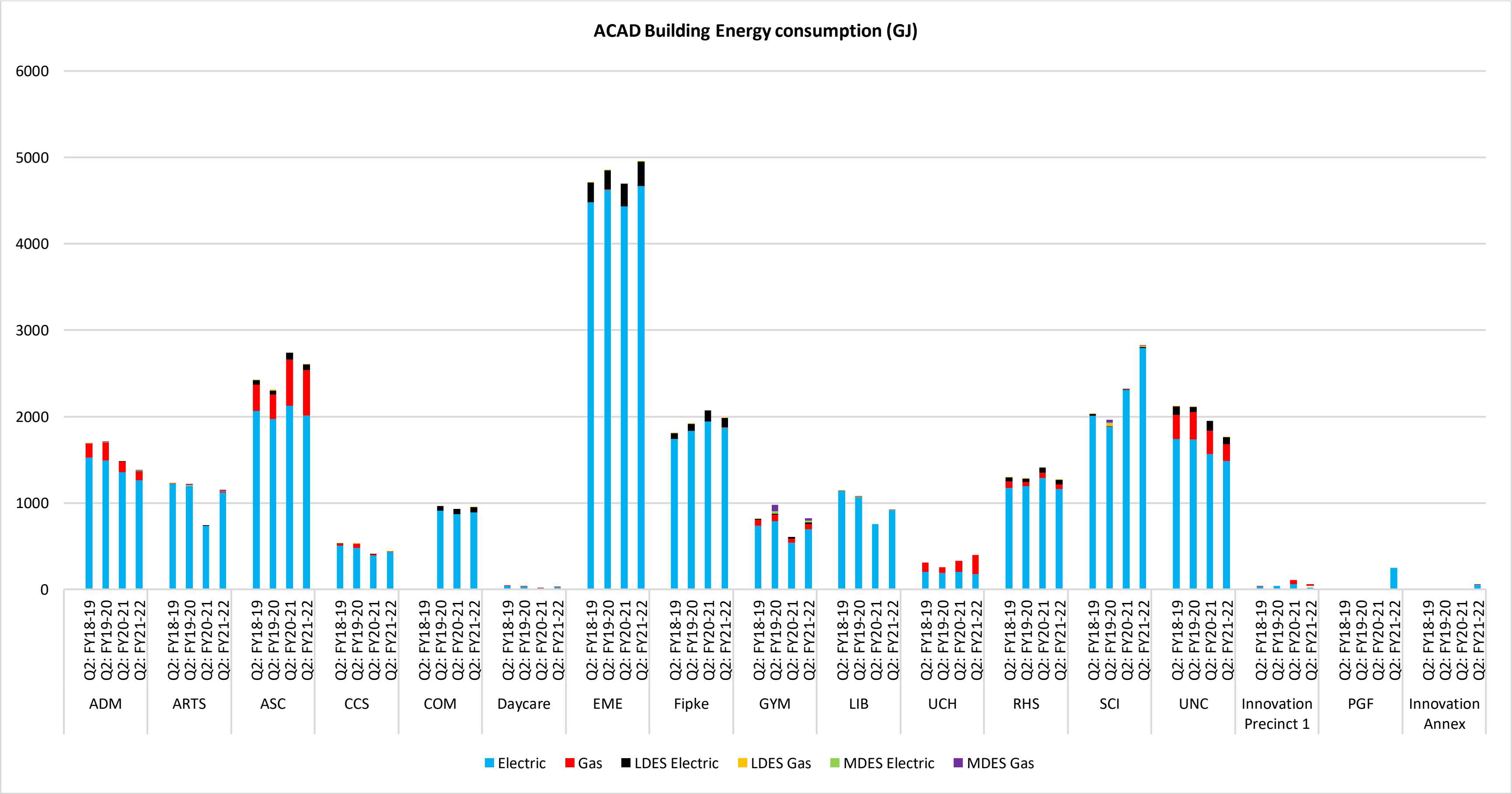

Note: Narrow Horizontal pattern fill represent energy consumption during construction and before building handover.

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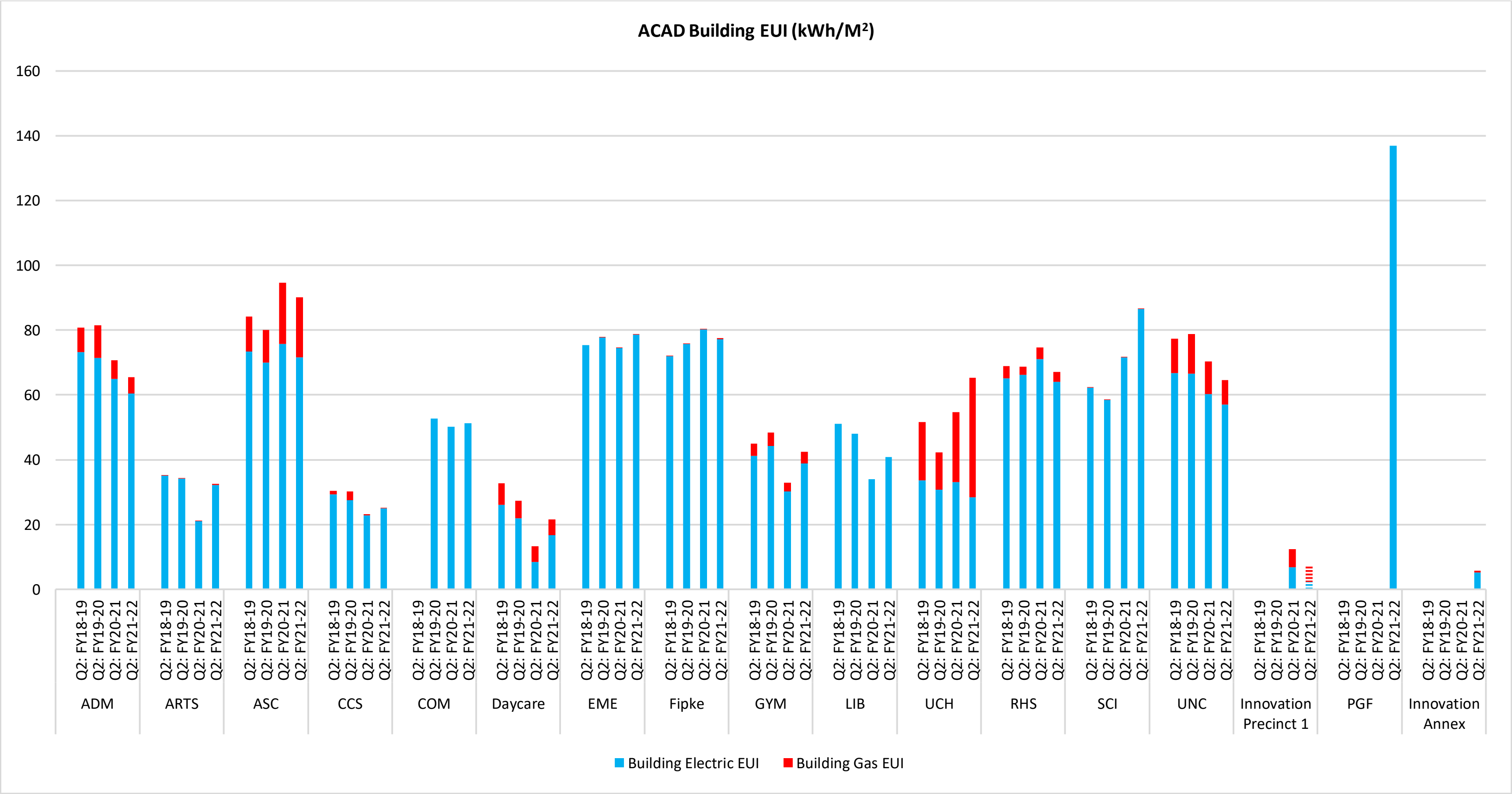
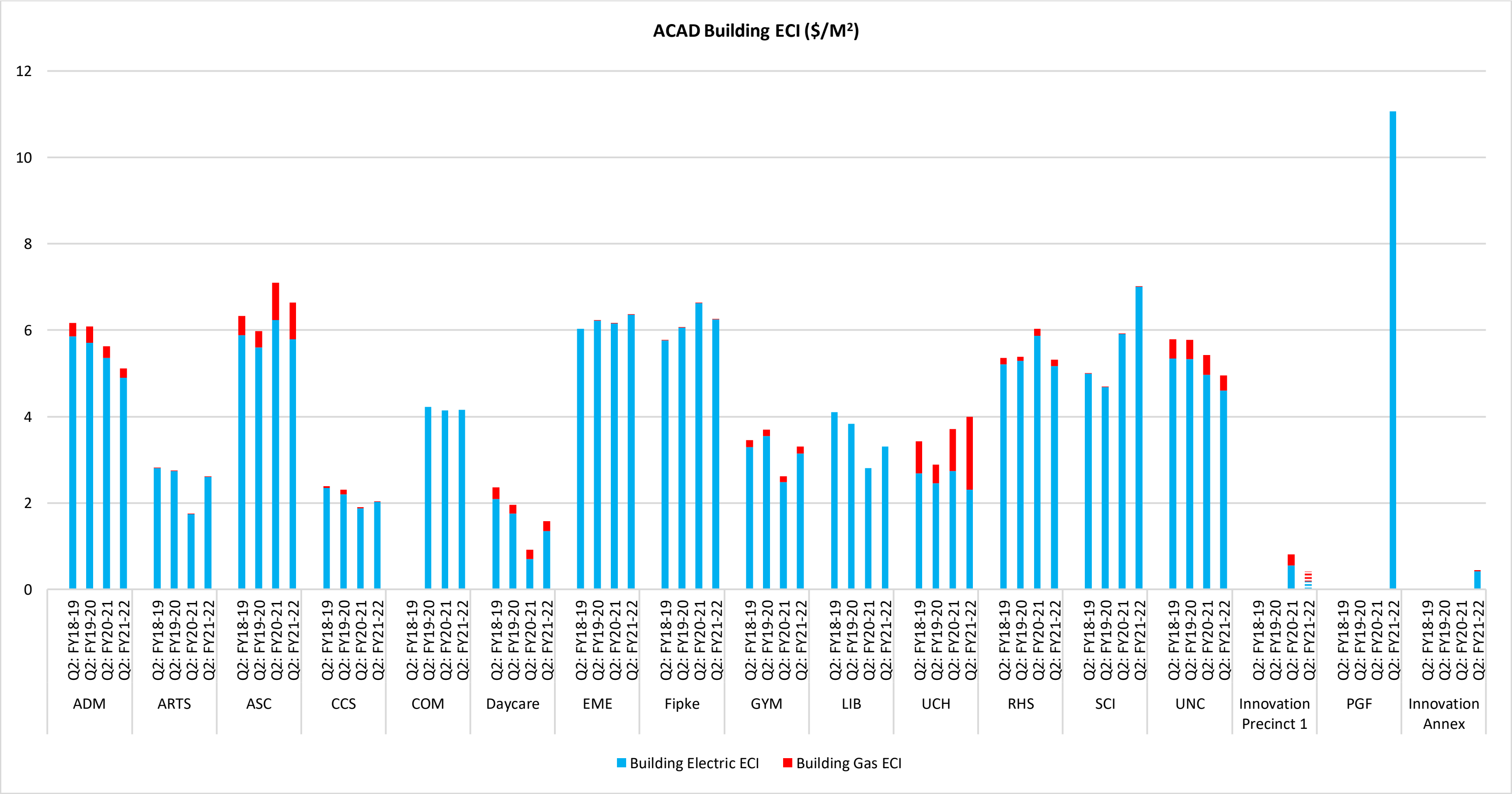
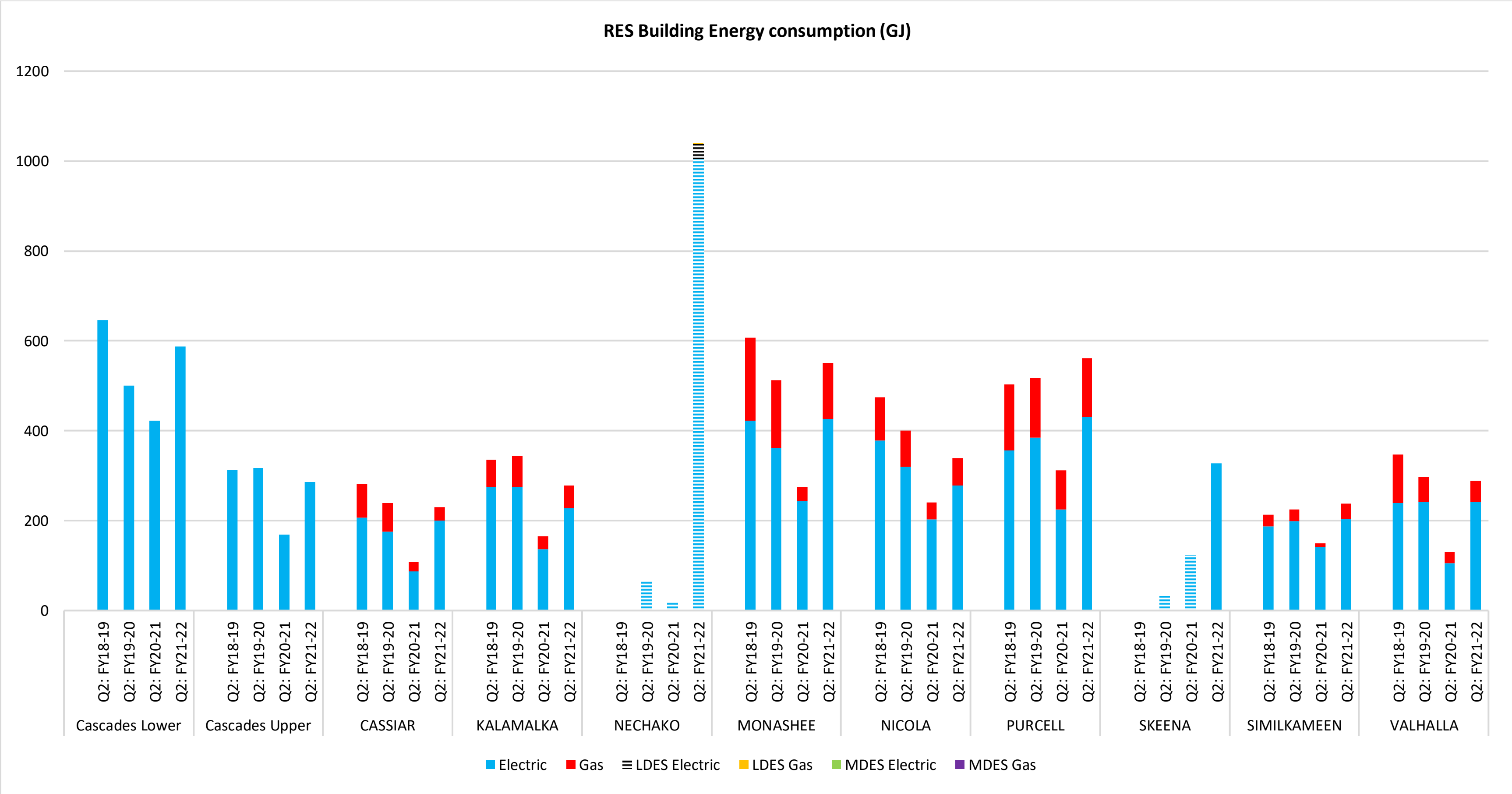


Note: Narrow Horizontal pattern fill represent energy consumption during construction and before building handover.



Note: Narrow Horizontal pattern fill represent energy consumption during construction and before building handover.



Note: Narrow Horizontal pattern fill represent energy consumption during construction and before building handover.

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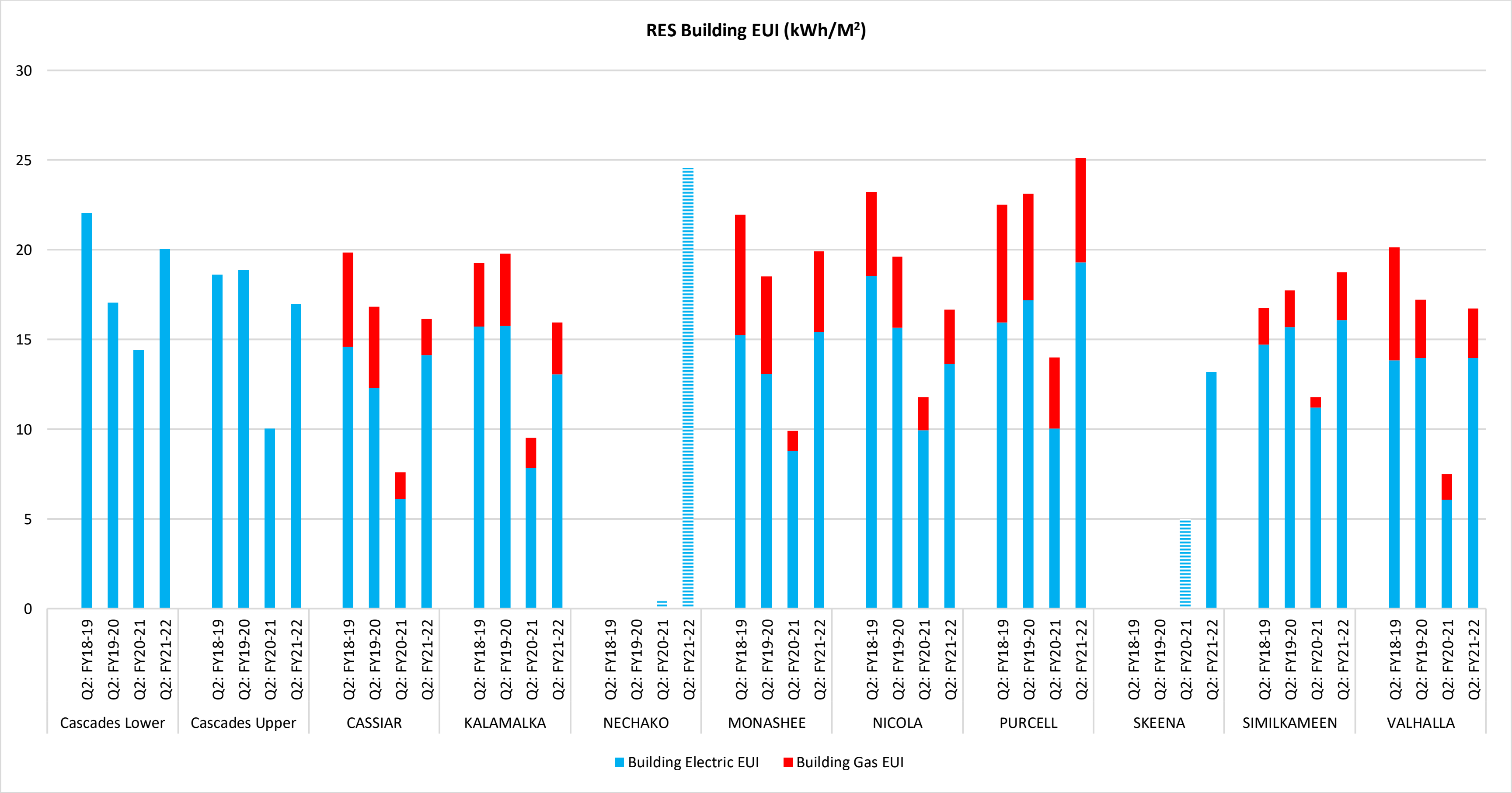

Note: Narrow Horizontal pattern fill represent energy consumption during construction and before building handover.

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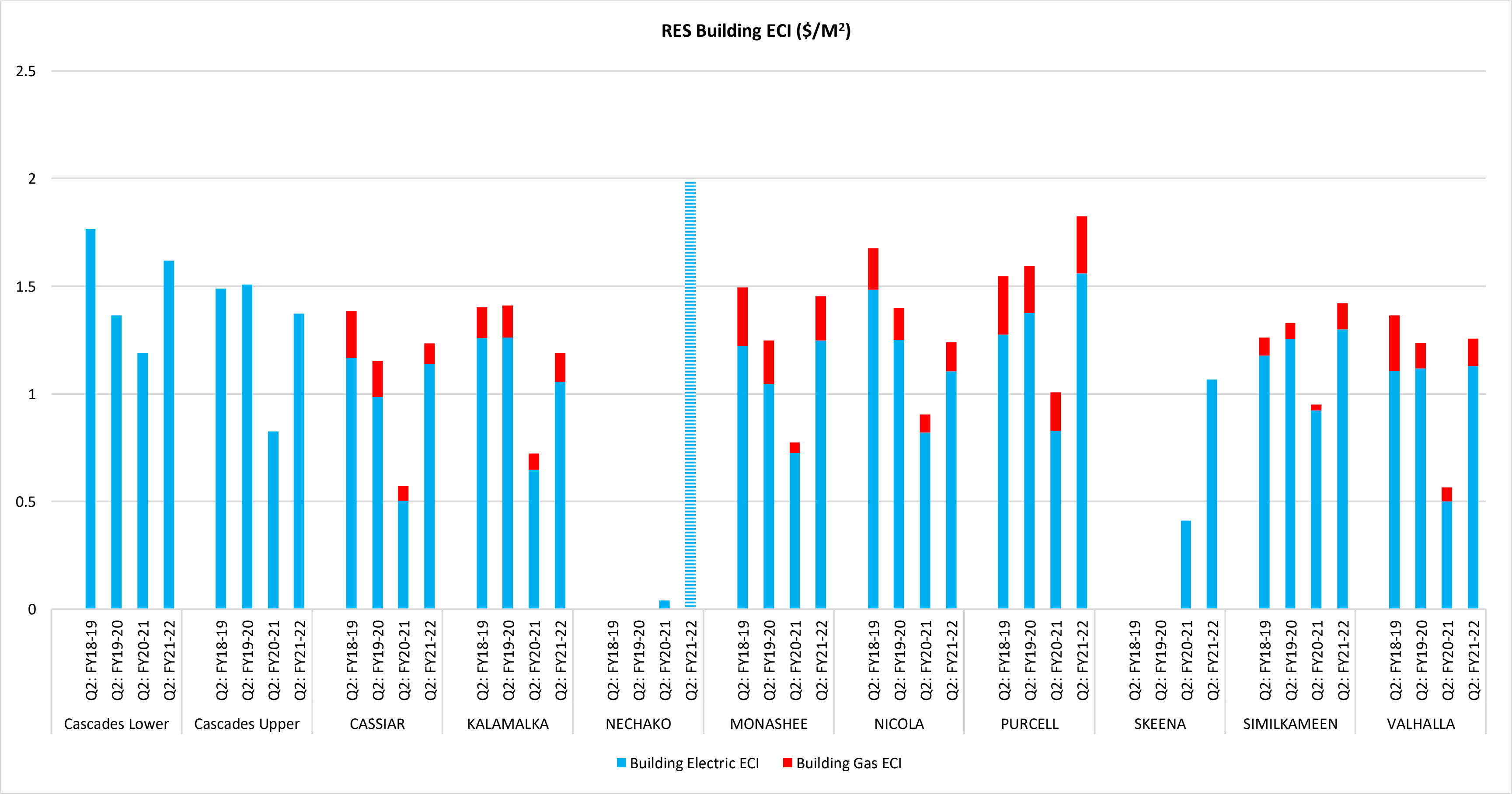

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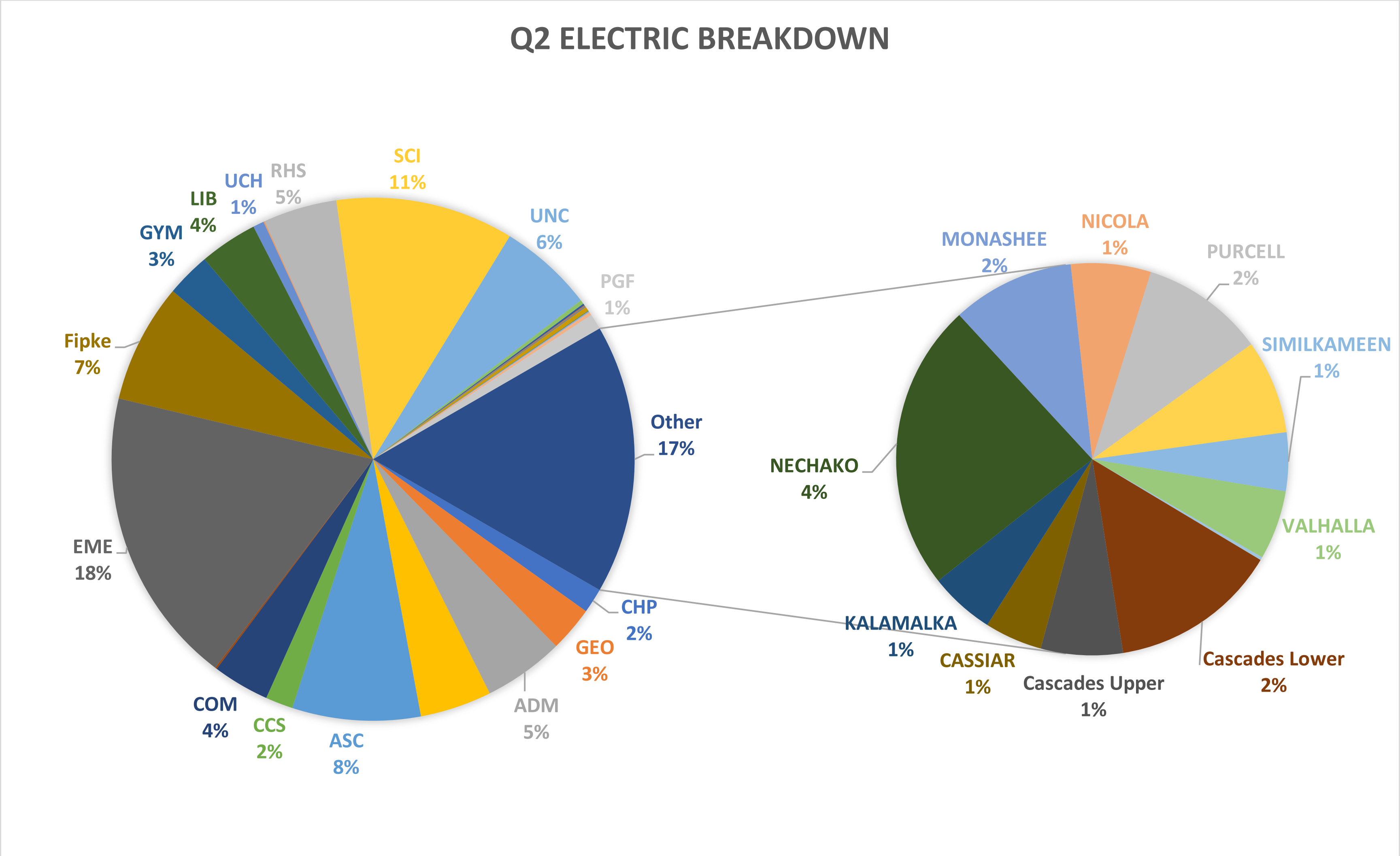

Note: Building electricity and gas consumption values shown are for consumption within the building. Indirect gas consumption via MDES & LDES is not included.

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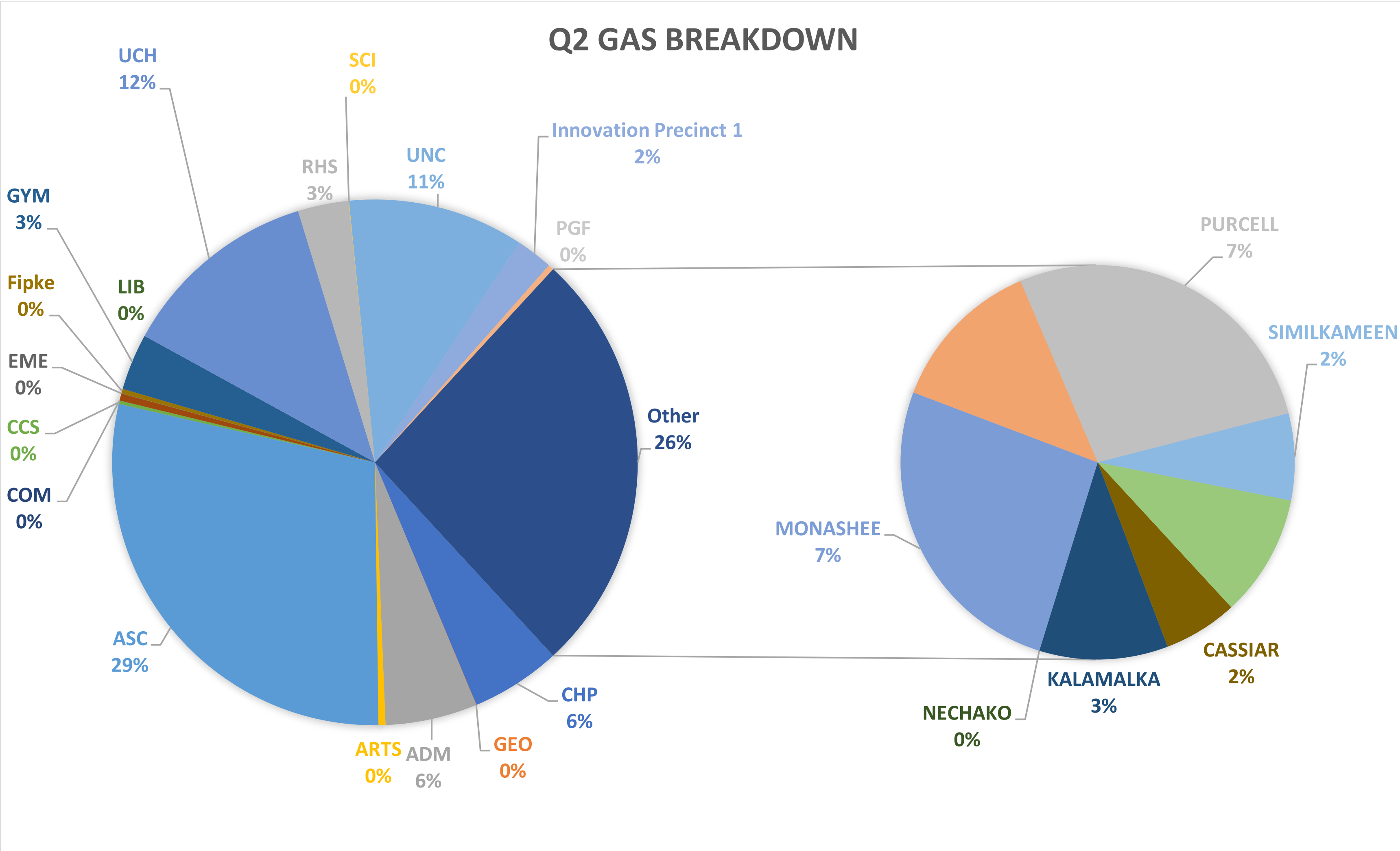

Note: Building electricity and gas consumption values shown are for consumption within the building. Indirect gas consumption via MDES & LDES is not included.

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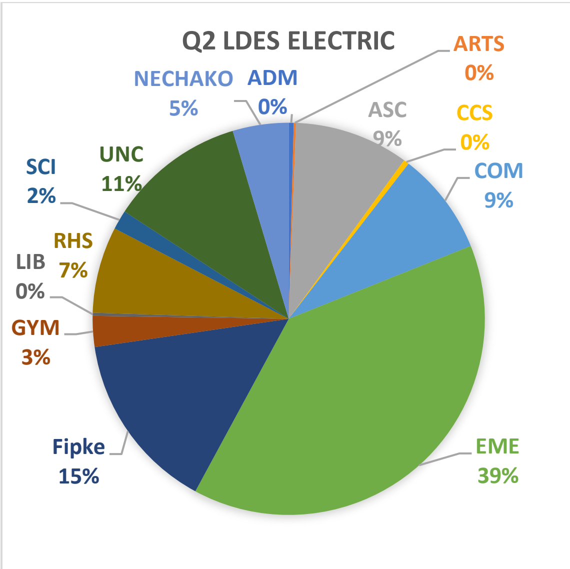
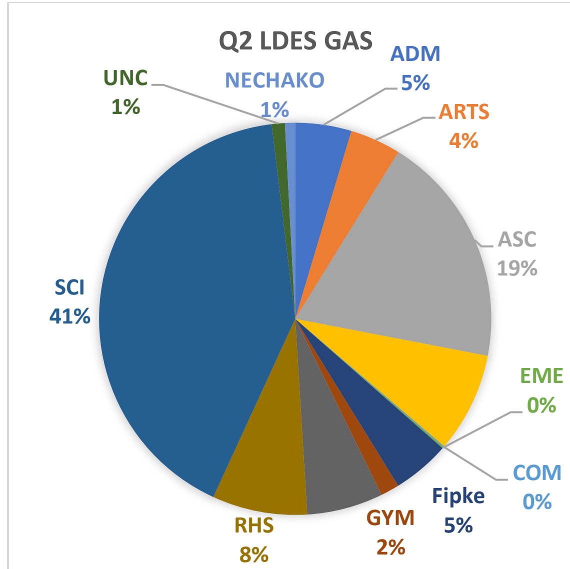
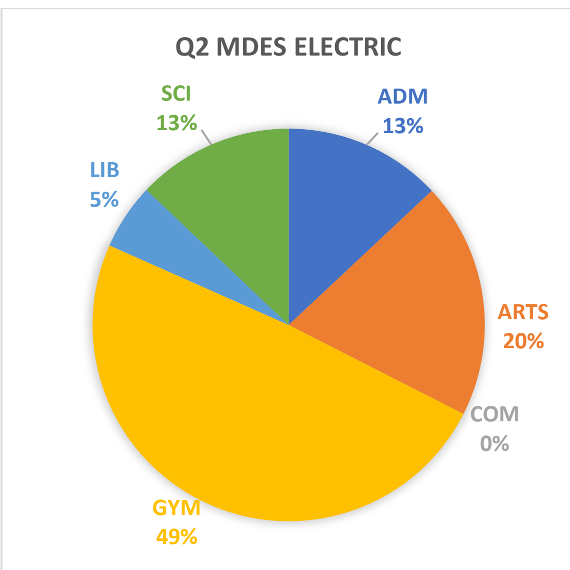
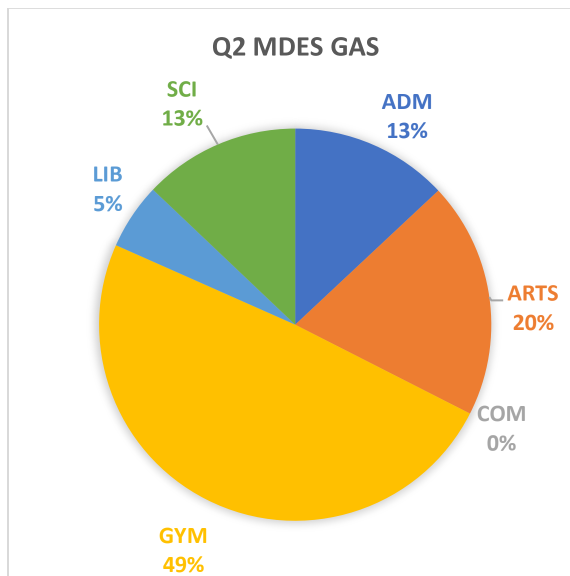
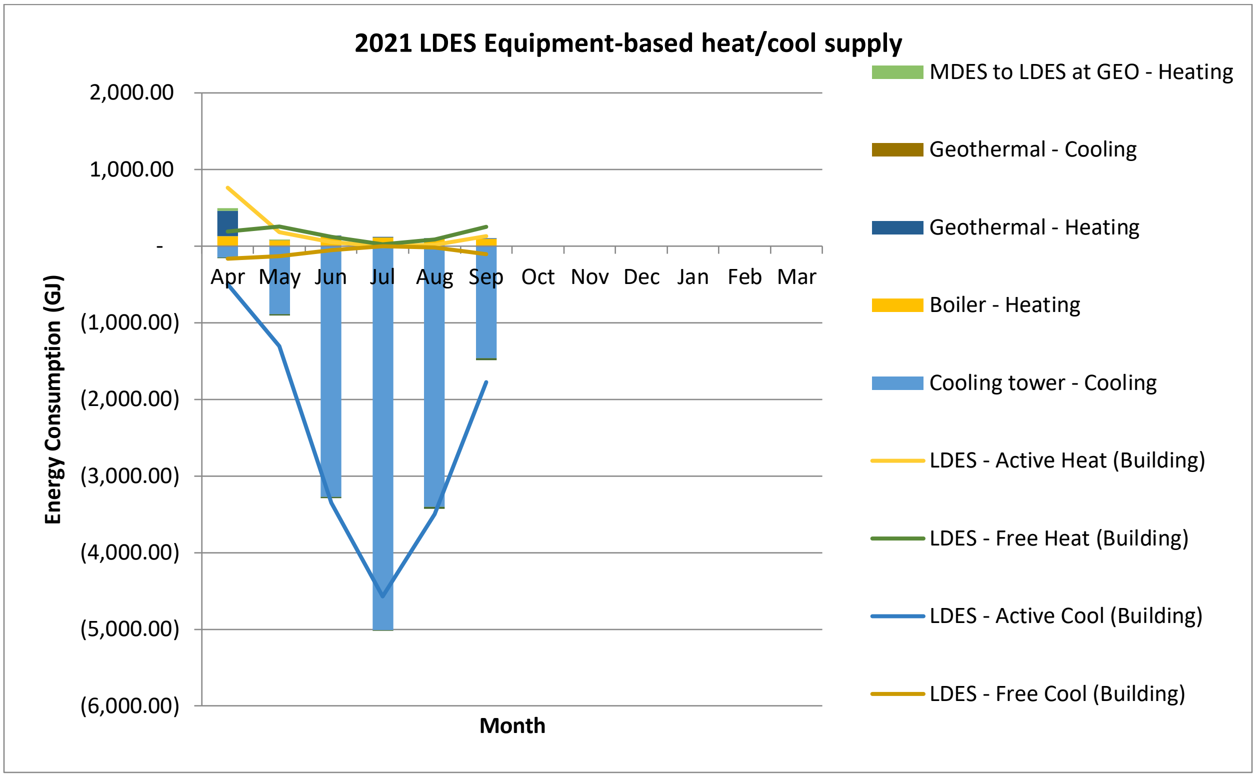
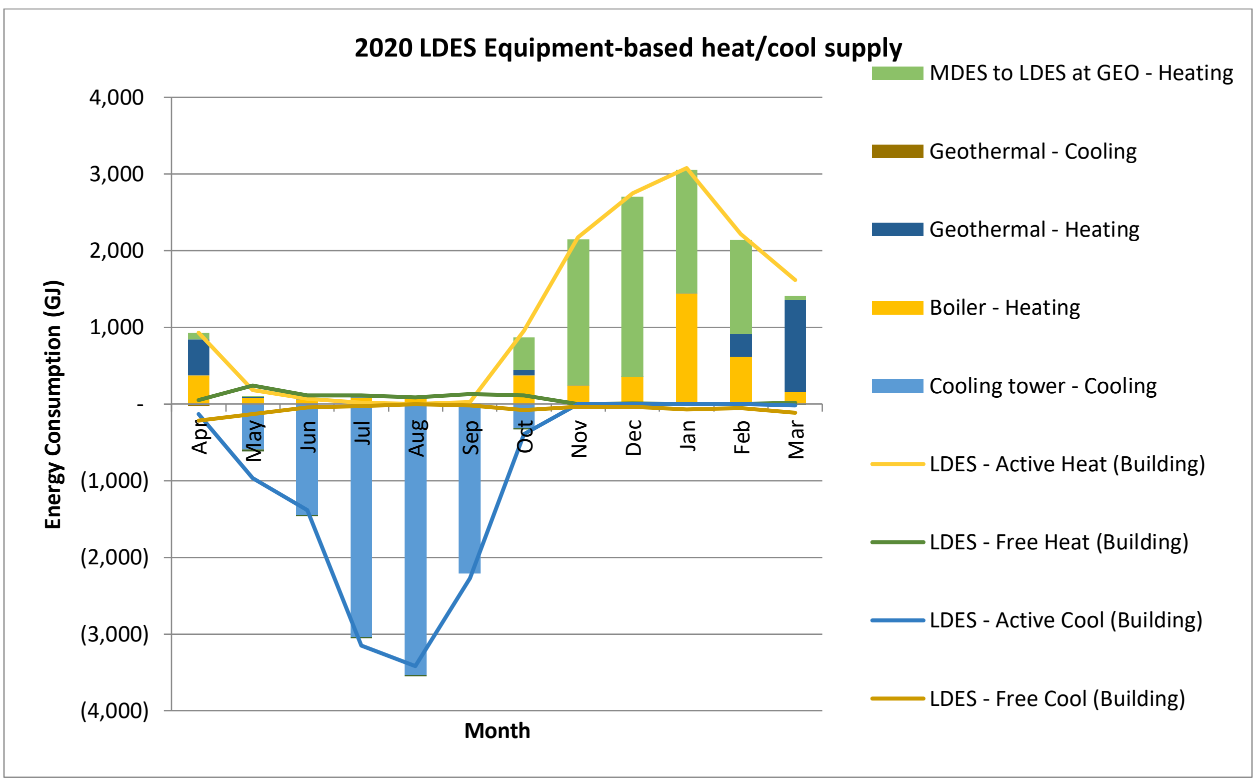









2021 LDES Equipment-based heat/cool supply
2,000.00
1,000.00
-
(1,000.00)
(2,000.00)
(3,000.00)
(4,000.00)
(5,000.00)
(6,000.00)
Energy Consumption (GJ)
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Month
MDES to LDES at GEO - Heating
Geothermal - Cooling
Geothermal - Heating
Boiler - Heating
Cooling tower - Cooling
LDES - Active Heat (Building)
LDES - Free Heat (Building)
LDES - Active Cool (Building)
LDES - Free Cool (Building)


2020 LDES Equipment-based heat/cool supply
4,000
3,000
2,000
1,000
-
(1,000)
(2,000)
(3,000)
(4,000)
Energy Consumption (GJ)
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Month
MDES to LDES at GEO - Heating
Geothermal - Cooling
Geothermal - Heating
Boiler - Heating
Cooling tower - Cooling
LDES - Active Heat (Building)
LDES - Free Heat (Building)
LDES - Active Cool (Building)
LDES - Free Cool (Building)

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