Decarbonization Roadmap

ESC Presentation March 4, 2022



Roadmap Process



Technology Review

- Past-report review
- Gap analysis
- Report out



Decarbonization Report

- Written report
- Decision matrix

Phase 1

Phase 2

Phase 3

Phase 4

Visioning

- ESC Engagement
- Planning & Facilities Engagement



Engagement Roundup

- Site visit
- Decision matrix review



What We Heard



Visioning Workshops

1. Environmental Sustainability Committee

- Identify **opportunities** and **challenges** associated with reducing GHG emissions from KPU's buildings?
- Identify and rank priorities

2. Facilities and Campus and Community Planning

- Chose a selection of priorities based on past conversations with Facilities and CCP
- Ranked these priorities

KPU Values / Climate Action

ESC: "What our purpose is as a university is established in the Vision 2023 and this work should align with the university's mission / vision. There is an expectation for the university to be a leader."

ESC: "Recently came from President's Council discussion - some people are saying 2050 is too far out for our GHG reduction targets. We should go for 2030. There is appetite to go more aggressively than we had thought. Appetite to do this quicker if possible."

ESC: "It is not so much an opportunity, as it is our duty to be a leader in reducing our GHGs. We should be exemplars, and take some risks."

ESC: "Lead by example, showcasing progressive systems, which move towards decarbonization."

Flexibility

ESC: "We can't always anticipate when change may occur either, but we can build in flexibility into all three approaches to accommodate future divergent opportunities (e.g. if we get money we can make bigger changes, faster)."

Facilities and CCP: "Scalability - e.g. if funding opportunities open up, can adapt to funding available (can expand or contract based on funding availabilities."

Facilities and CCP: "From a facilities perspective we see the incremental and windfall approaches as almost same thing. Either way the roadmap will be developed. The timescale is different: the roadmap stays the same and timescale may adjust."

Facilities and CCP: "Don't want to be landlocked into pathways."

Innovation

ESC: "New management and maintenance skills may be needed to run new systems."

ESC: "Demonstrating new ideas/innovations to our community."

ESC: "There are huge opportunities for education."

Facilities and CCP: "Showcase teaching or research element can be used to pitch to funders"

Facilities and CCP: "Looking for newer age, leading technology, innovative options rather than an asset replacement plan."

Budget

ESC: "I think that we need to have a real idea of what cost means. Dollars are just numbers but the cost of doing nothing is clear. Real world effects are already being felt and we are hand wringing over money while facing an extinction level event."

Facilities and CCP: "Fixed operating budgets... Limited funding to spend on capital, but operating budgets are also tight. If spend more \$ on electricity, cost implications"

Facilities and CCP: "The interests of reducing emissions in a timely way may not be consistent with the interests of being cost effective. In other words, there may be a premium to be paid to reduce emissions quickly vs taking a long-term replacement approach."

Facilities and CCP: "If we had the money we would do it quicker. 2050 doesn't feel good- we would like to move faster but budget is a limitation. There may be new targets that come in."

Visioning Sessions - Outcome

Priorities	Theme	Session	Rank (23=High, 1=Low)
Leverage internal or external funding	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	23
Demonstrate sustainability and climate action leadership	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	21
Improve social and environmental outcomes	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	21
Tackle climate change as quickly as possible	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #1 (ESC)	20
Improve climate resiliency of our facilities	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	19
Learn from and collaborate with peer institutions	Innovation	Stakeholder Engagement Session #1 (ESC)	18
Maximize innovation	Innovation	Stakeholder Engagement Session #1 (ESC)	16
Leverage research & development opportunities	Innovation	Stakeholder Engagement Session #1 (ESC)	16
Align with long term KPU master plans	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	12
Meet our incremental targets on schedule	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	12
Align with KPU values	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	12
Enable flexibility	Flexibility	Stakeholder Engagement Session #2 (Facilities & Planning)	12
Engage researchers and students in testing new technologies	Innovation	Stakeholder Engagement Session #1 (ESC)	11
Meet our targets ahead of schedule	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	10
Take into account total cost of ownership / life cycle costing	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	8
Align with long term capital planning	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	8
Keep operating costs low	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	7
Taking a whole systems approach to retrofit	Flexibility	Stakeholder Engagement Session #2 (Facilities & Planning)	6
Meet our targets at the lowest life cycle cost	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	5
Align with or exceed provincial targets	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	3
Align with Other Prov Priorities (other than targets)	KPU Values / Climate Action Leadership	Stakeholder Engagement Session #2 (Facilities & Planning)	3
Meet our targets at the lowest capital cost	Budget	Stakeholder Engagement Session #2 (Facilities & Planning)	2
Minimize costs	Budget	Stakeholder Engagement Session #1 (ESC)	1

KPU Priorities

KPU Values / Climate Action Leadership Demonstrates sustainability and climate action leadership Achieves all GHG targets on time, or earlier **Demonstrates** innovation **Budget** Flexible roadmap Low cost per ton of avoided carbon **Highest NPV Operations** Low maintenance requirement High system reliability Systems operations are aligned with current staff resources **To Consider** 10 Equipment lifespan Considers a whole systems approach to retrofits 12 Peak load 13 Obsolescence

Retrofit Pathway Exploration





1. Optimize Systems

- Reduce waste
- Enhance controls



2. Improve Efficiency

- Equipment upgrades
- System redesign







3. Recover Heat

- Air and water
- Cooling and process systems



4. Low Carbon Electrification

- Heat pumps
- Process electrification



5. Renewable Supply

- Passive options
- Solar thermal and PV
- Geo-exchange



6. Offset Remaining

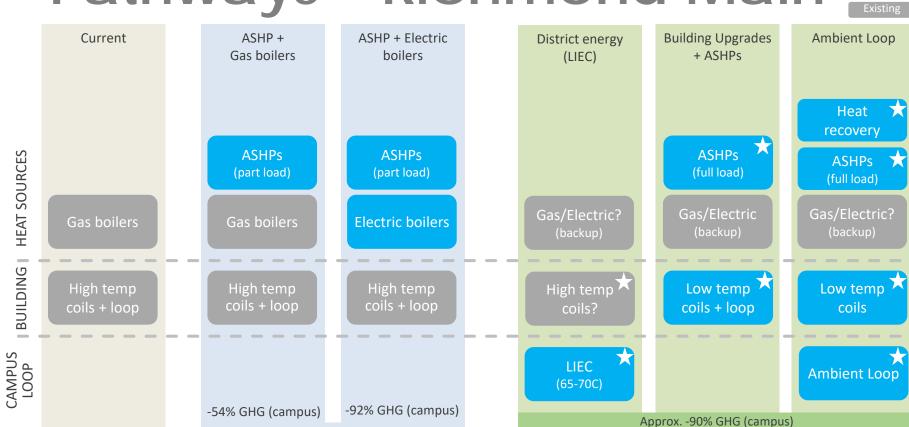
- Renewable Natural Gas (RNG)
- Renewable energy credits and offsets



Pathways - Richmond Main

New

Holistic Retrofit Pathway



Conventional Retrofit Pathway

Pathways - Surrey Campus

Existing

Existing Geo

Gas boilers

HEAT SOURCES

BUILDING

AMPUS LOOP ASHP + Gas boilers

ASHPs (part load)

Existing Geo

Gas boilers

ASHP +
Electric boilers

ASHPs (part load)

Existing Geo

Electric boilers

ASHPs + Building Upgrades

ASHPs (full load)

Existing Geo

Gas/Electric (backup)

Low temp

coils + loop

Ambient Loop

Heat x

ASHPs (full load)

Existing Geo

Gas/Electric (backup)

Low temp ★ coils + loop

High temp loop + coils

High Temp

Geo Loop

High temp

Hi/Lo Temp

Geo Loop
-43% GHG (campus)

High temp loop + coils

Hi/Lo Temp

Geo Loop

-77% GHG (campus)

Conventional Retrofit Pathway

Low Temp

Geo Loop

Approx. -90% GHG (campus)
Holistic Retrofit Pathway

Ambient X Loop



New

Existing

Pathways - Tech Campus

Current

Gas boilers

ASHP + Electric boilers

Building Upgrades + ASHPs Building Upgrades

District energy

Gas heaters

Gas boilers

HEAT SOURCES

BUILDING

SAMPUS LOOP ASHPs (part load)

ASHP +

Gas boilers

ASHPs (part load)

Electric boilers

ASHPs (full load)

Gas/Electric (backup)

District Energy

Gas/Electric (backup)

Low temp 🗡

Low temp *

High temp coils + loop

High temp coils + loop High temp coils + loop

-41% GHG (campus)

-91% GHG (campus)

Conventional Retrofit Pathway

Approx. -90% GHG (campus)

Holistic Retrofit Pathway

Current

ASHP + Gas boilers ASHP + Electric **boilers**

Building Upgrades + Geo exchange

Building Upgrades + ASHPs

Ambient Loop

ASHPs (part load)

Gas boilers

ASHPs (part load)

Electric boilers

Geo exch.

Gas/Electric

ASHPs (full load)

Gas/Electric

Heat recovery

ASHP/Geo

Gas/Electric

High temp

Gas boilers

High temp

High temp

Low temp loop + coils

Low temp loop + coils

Low temp loop + coils

High/Low Temp

-50% GHG (campus)

High/Low Temp

-91% GHG (campus)

Conventional Retrofit Pathway

Geo or Low **Low Temp** Temp Loop

Ambient Loop

Approx. -90% GHG (campus) **Holistic Retrofit Pathway**

SAMPUS LOOP

HEAT SOURCES

BUILDING

The Crossroads

Conventional Retrofit

- Focus primarily on supply
- Energy reduction not a primary focus



Holistic Carbon Retrofit

- Whole building approach
- Opportunities for significant GHG and energy reduction

Financing

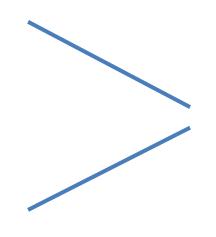
Conventional Retrofit

(focus on supply,

Holistic Carbon Retrofit

> (focus on whole buildings)

Self-Funded



Outsource Financing

Third Party Financed

Next Steps



Next Steps

Phase 4: Decarbonization Roadmap Report

- 1. Overall project approach, methodology and assumptions
- 2. A comparison of each retrofit pathway including:
 - a. Reviewed technologies
 - b. Alignment with Vision
 - c. Potential implementation timeline
 - d. GHG impacts over time
 - e. Capital and Operations forecast
 - f. Technological risk assessment
- 3. Provision of a decision making matrix

Post-Project



Refine Decarbonization Plan



A

B

 C

Detailed Feasibility Assessments



Design
Development and
Implementation