



# CampusEnergy2021

BRIDGE TO THE FUTURE

Feb. 16-18 | CONNECTING VIRTUALLY

WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16



Northern Alberta Institute of Technology (NAIT)

# MASTER ENERGY STRATEGY

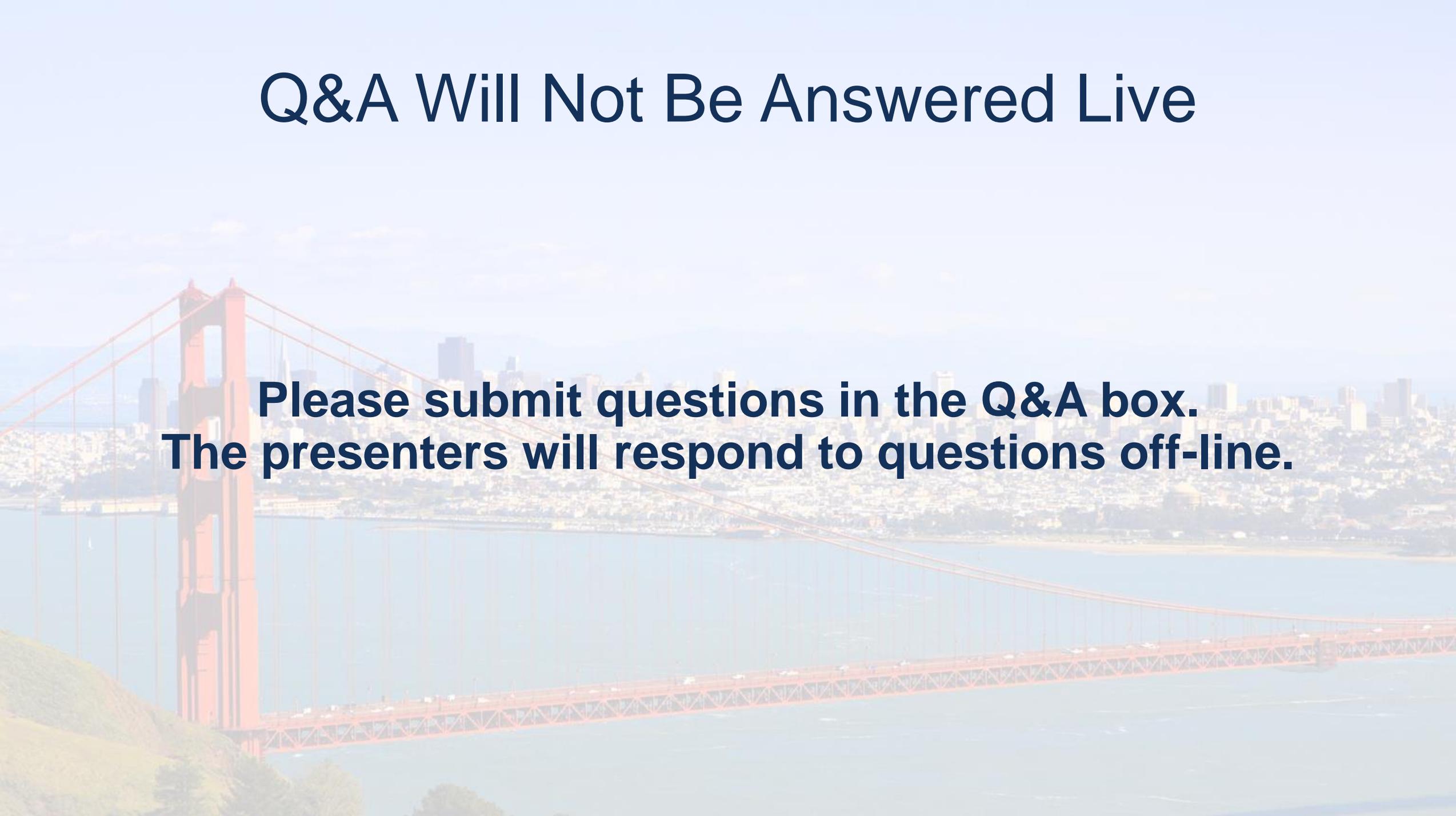
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Robert Akkerman, NAIT  
Jim Sandercock, NAIT  
Kenneth Teeter, AECOM

February 18, 2021

# Q&A Will Not Be Answered Live

**Please submit questions in the Q&A box.  
The presenters will respond to questions off-line.**



# CONTEXT & OPPORTUNITY

## Northern Alberta Institute of Technology (NAIT)

- Leading polytechnic in the region
- Hands-on, technology-based education and applied research center
- Alternative energy industry innovator
- Complex campus with ambitious growth plans

# CONTEXT & OPPORTUNITY

## Community Generation Capacity Building Program

- \$500,000 grant award
- Examine the viability of community energy generation on NAIT lands
- Develop enhanced training centers focusing on multiple clean energy strategies

## City of Edmonton's Blatchford Development

- Vision to become a Net Zero community
- Municipal GHG reduction target & Climate Emergency
- Federal trend to transition away from hydrocarbons

# CONTEXT & OPPORTUNITY

## Why is Community Power important to NAIT?

- NAIT is on track to double main campus area
- Trend away from fossil fuels means future campus must rely on electricity for heating and cooling
- Campus growth requires coordination with City sustainability goals

| Edmonton's Goals                            |                                     | NAIT's Goals                        |   |                                     |   |  |
|---|-------------------------------------|-------------------------------------|---|-------------------------------------|---|--|
| GHG Reduction Target                        | Blatchford Community                | GHG Reduction Target                | Energy Efficient Buildings              | Operating Costs                     | Campus Resilience                         | Strategic Goals  |
| <b>50%</b><br>less than 2005 levels by 2030 | <b>ZERO</b><br>net carbon emissions | <b>30%</b><br>less than 2009 levels | <b>LEED</b><br>Silver Certified minimum | <b>STABILITY</b><br>in energy costs | <b>BACKUP</b><br>power for critical loads | <b>ACADEMIC</b><br>integration and industry partnerships |

# PROBLEM STATEMENT

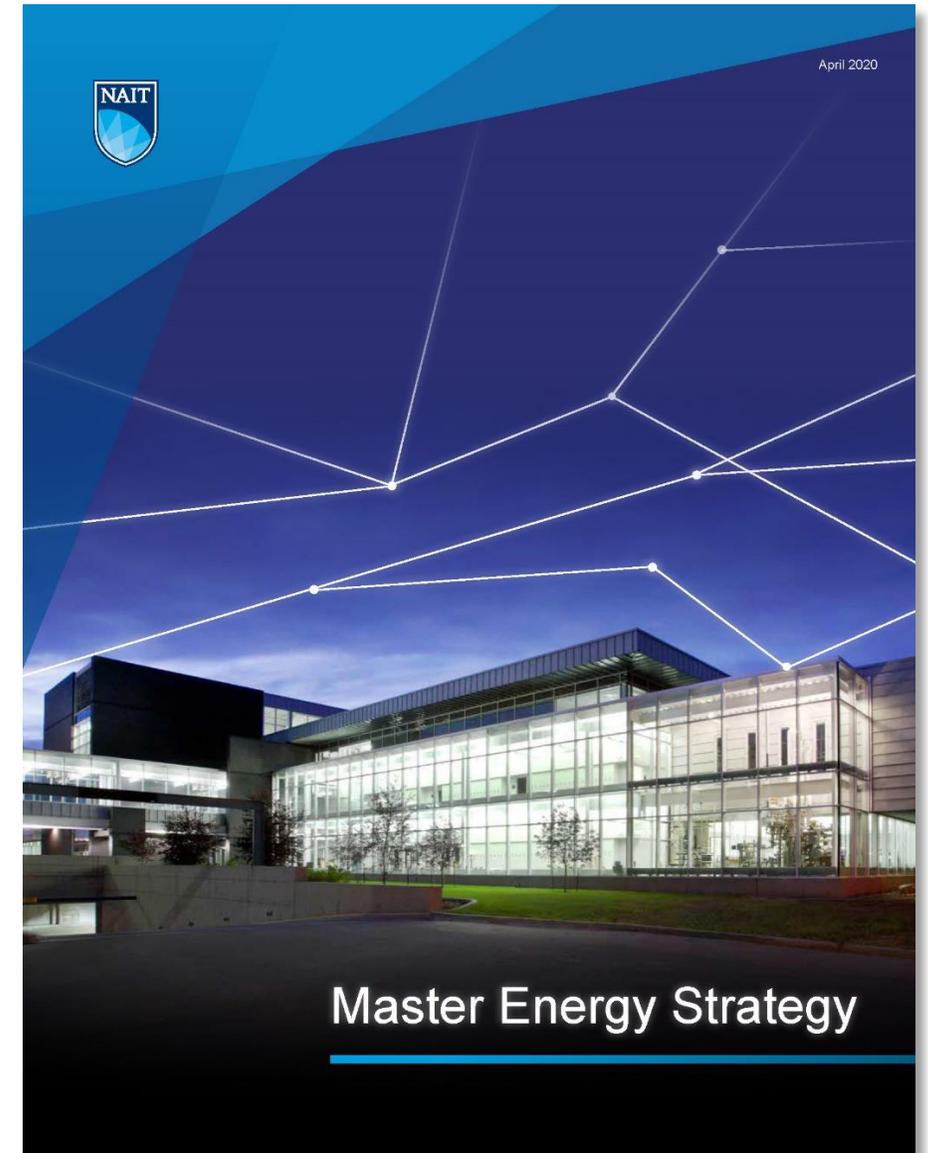
## How Can We...?

- Partner with Blatchford for a Net Zero community
- Cost-effective electrification of campus energy systems
- Optimize on-site community energy generation
- Fulfill NAIT's promise to Alberta industry by supporting diversification
- Enhance energy resilience through dynamic growth plans

# SOLUTION: NAIT MES

## NAIT Master Energy Strategy is designed to...

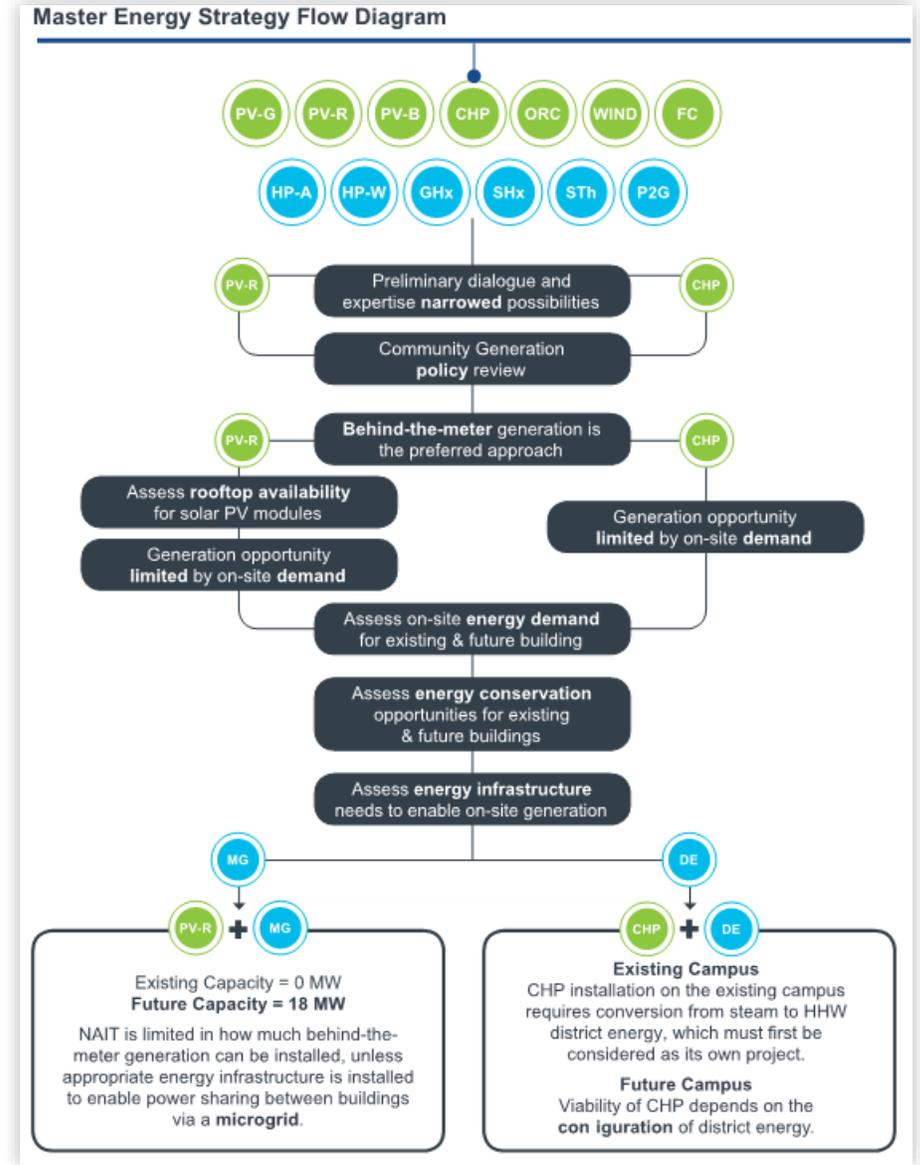
- Study community power generation feasibility on NAIT properties
- Understand our energy profile, now and into the future
- Maximize on-site, behind-the-meter energy generation
- Tie the campus into the Net Zero Blatchford District Energy Sharing System
- Enhance student learning experience



# SOLUTION: NAIT MES

## Potential Achievements

- Up to 18 MW of future rooftop PV capacity
- Up to 500 kW of future CHP capacity
- Up to 2 MW of existing emergency power generation
- Up to 35,000 MWh per year of avoided consumption through energy conservation in future buildings
- Up to 20,000 mtCO<sub>2</sub>e of avoided emissions
- Up to a 50% reduction in campus-wide EUI
- Nearly flat growth in utility demand (electricity + gas) despite a twofold increase in gross floor area



# SOLUTION: NAIT MES

## Existing Energy Systems

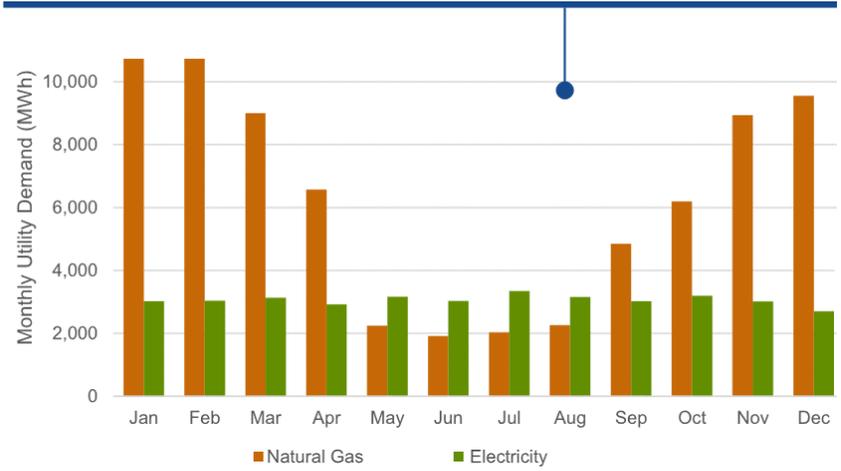


# SOLUTION: NAIT MES

## Existing Energy Use Intensity

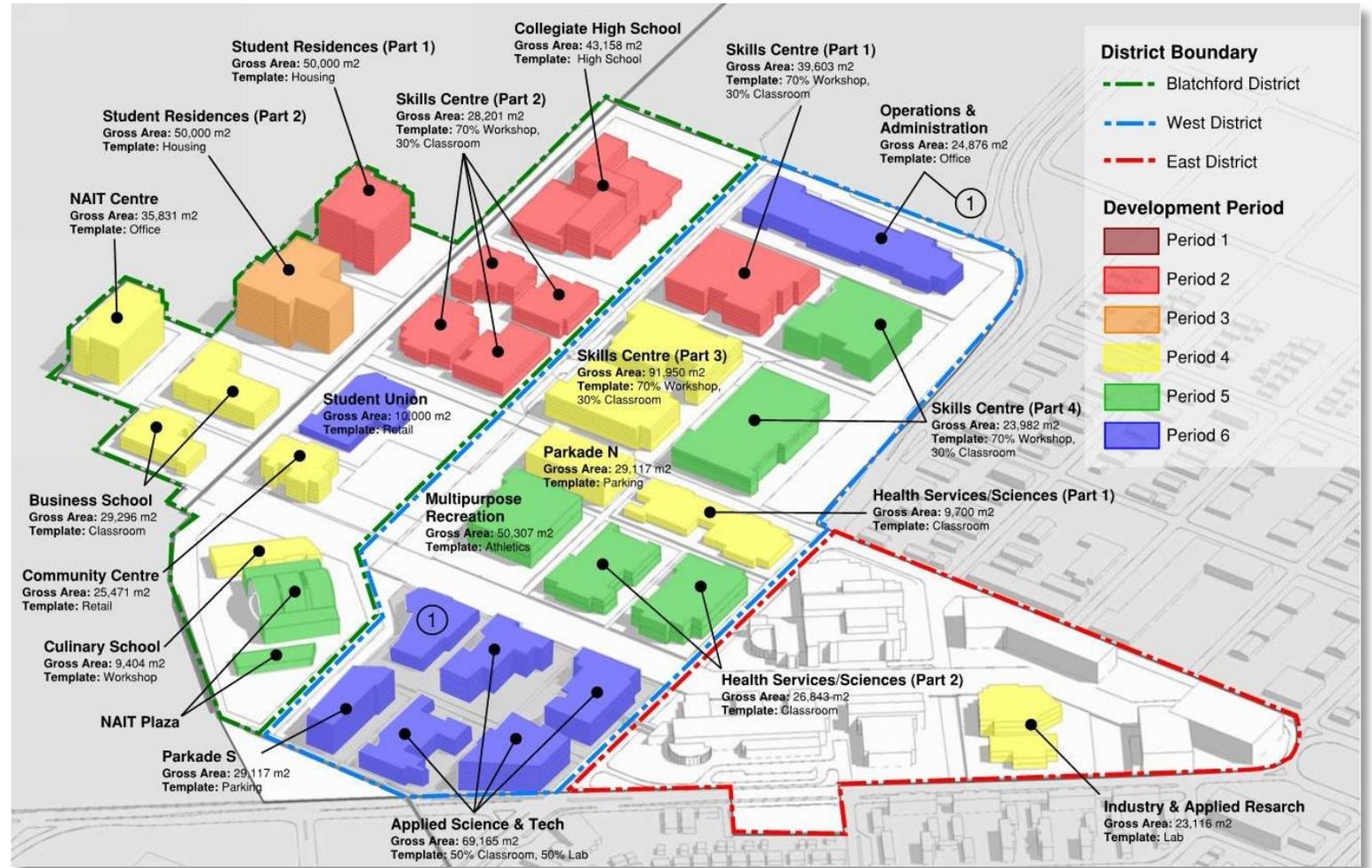


Annual Utility Demand Profiles (Existing Main Campus)



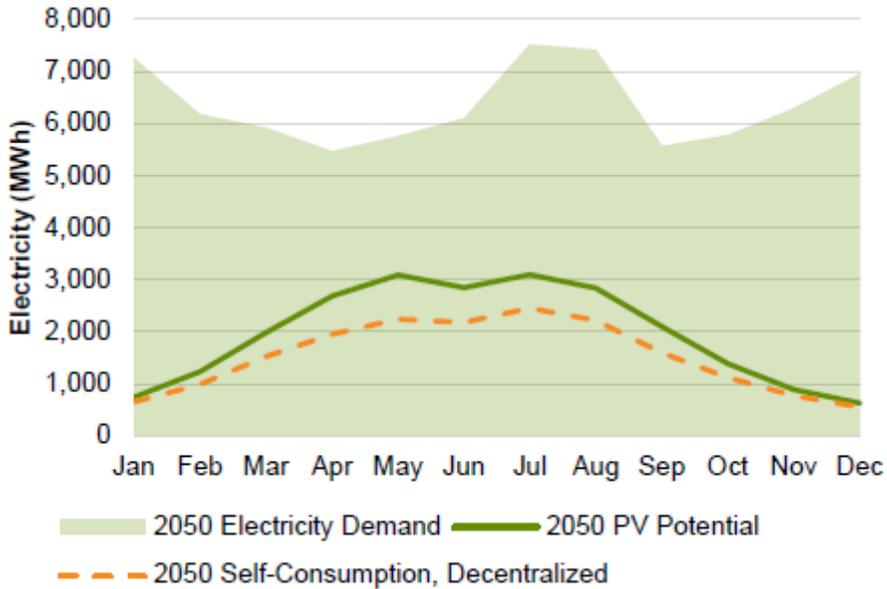
# SOLUTION: NAIT MES

## Future Campus Development



# SOLUTION: NAIT MES

## Energy Generation Opportunity (PV)



# SOLUTION: NAIT MES

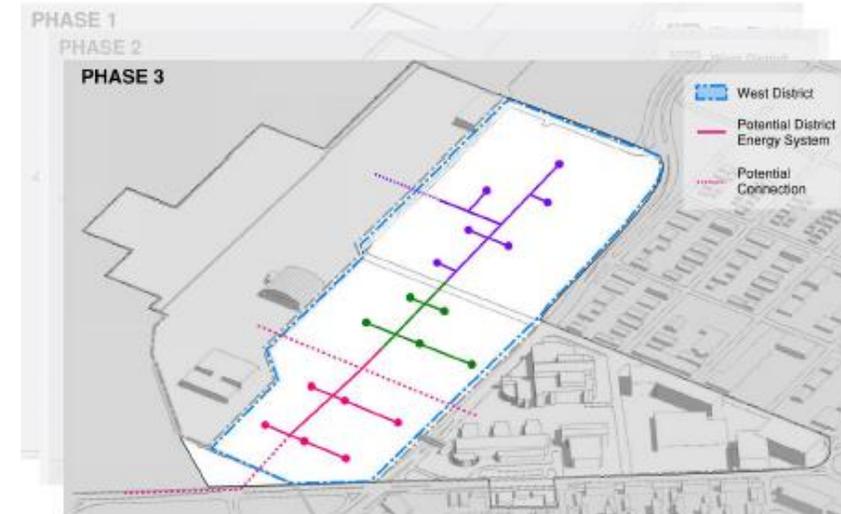
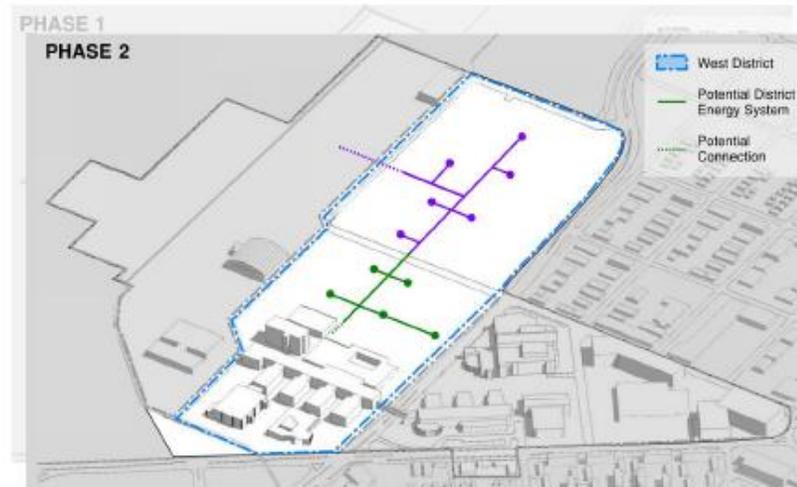
## Future Campus Energy Infrastructure



# SOLUTION: NAIT MES

## Infrastructure Phasing Plan

- Phased implementation of primary utility “spine” for flexibility



# ALTERNATIVE ENERGY TECHNOLOGISTS (dipl)

## Four Pillars of Alternative Energy...

### **ENERGY EFFICIENCY / BUILT ENVIRONMENT**

2D/3D CAD, advanced construction  
Modeling Heating/Cooling loads  
Ground and Air source heat pumps  
Cogeneration, fuel cells

### **RENEWABLE POWER**

Solar, wind, hydro, storage design  
System Assembly and Commissioning  
Energy and Financial Modeling  
Hybridization and Microgrids



# ALTERNATIVE ENERGY TECHNOLOGISTS (dipl)

## Educational Training

- Real-world training
- Authentic assessment
- NAIT as a living lab

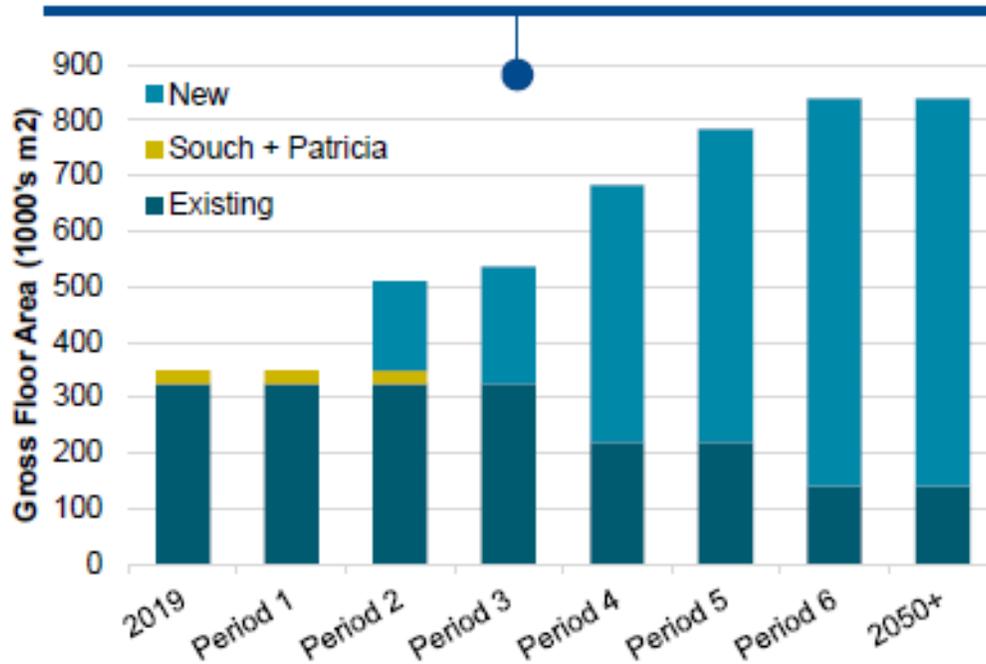


NAIT Alternative Energy Competency Hierarchy  
Based on IERC, ETA, EERE, NREL, 2017

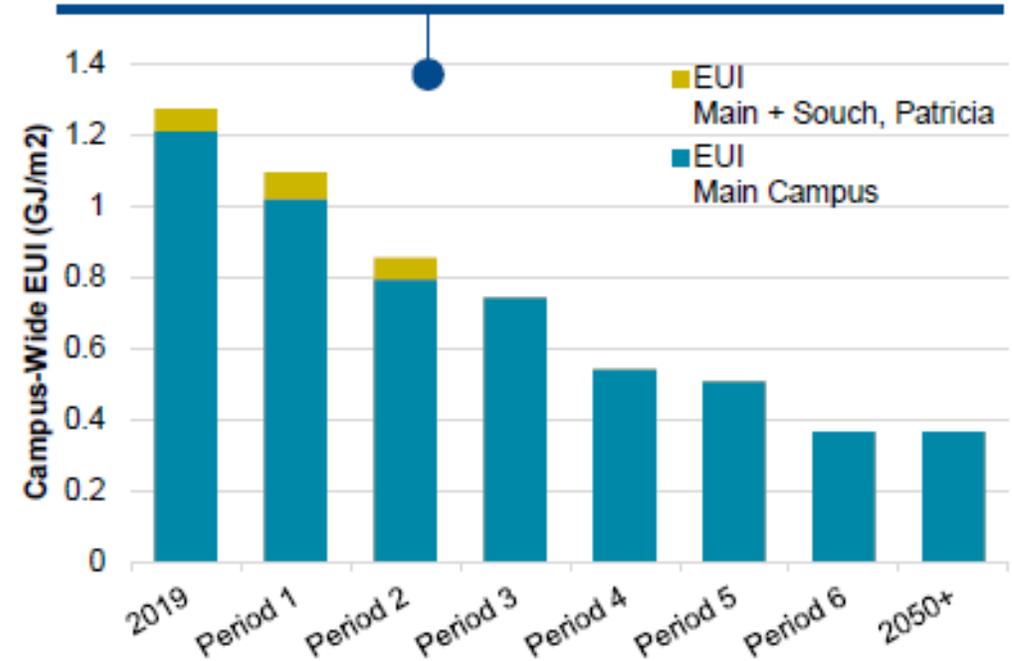
# CONCLUSIONS & ACHIEVEMENTS

## Implementation Roadmaps

Campus Development Plan  
Growth in Floor Area



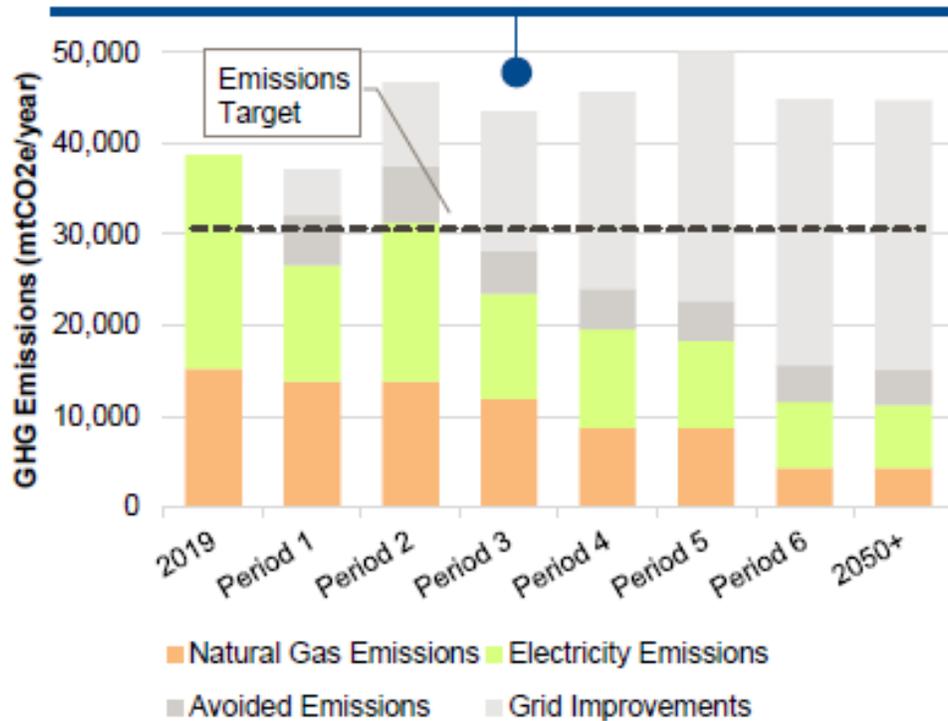
Projected Reduction in Energy Use Intensity per Development Period



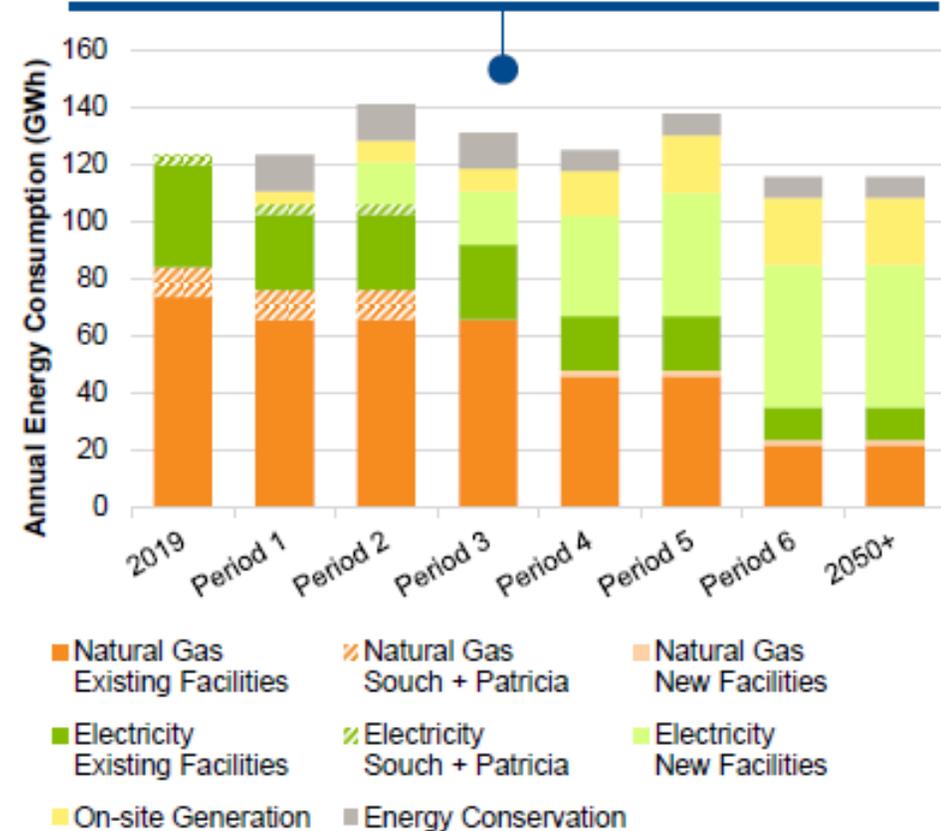
# CONCLUSIONS & ACHIEVEMENTS

## Implementation Roadmaps

### Projected Reduction in Greenhouse Gas Emissions Compared to Target



### Projected Growth in Energy Demand



# CONCLUSIONS & ACHIEVEMENTS

## In Summary...

- On track to Net Zero, but more work is needed
- On track to electrify most facilities, at less than BAU cost
- New campus optimized for efficiency and on-site generation
- Flexible infrastructure that enables dynamic growth plans
- Enhanced educational capabilities
- Tie-in to Net Zero Blatchford Community District System

# CONCLUSIONS & ACHIEVEMENTS

## Lessons Learned

- Efficiency-first approach unlocks broader energy generation opportunities
- Electrification and substantial GHG Emissions reductions are possible in a cold climate
- Community partnership with Geo-Exchange system unlocks full electrification
- Planning for uncertainty helps and careful risk mitigation is critical for successful campus development (COVID-19, phasing out of hydrocarbons, evolving workforce, economic diversification)
- On-campus solutions present living case study opportunities for students

Northern Alberta Institute of Technology (NAIT)

# QUESTIONS?





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**THANK YOU!**