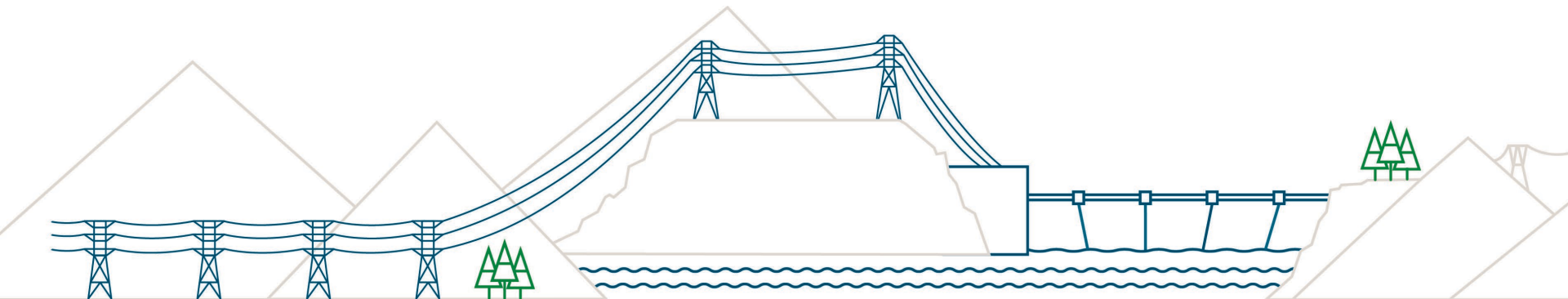


# 2021 Integrated Resource Plan (IRP) Technical Advisory Committee (TAC) Meeting #1



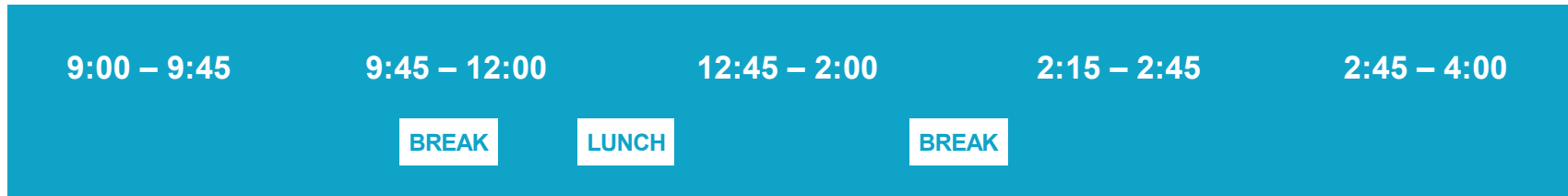
March 9, 2020

# Welcome & introduction

Bill Clendinning, BC Hydro

Basil Stumborg, BC Hydro

# Purpose and agenda review



Welcome & Intro	IRP overview	Decision framework	Electrification scenarios	Next steps
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Bill Clendinning Basil Stumborg	Kathy Lee	Basil Stumborg	Sanjaya De Zoysa	Basil Stumborg
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# Rules of engagement

These should make our meetings more effective

- One conversation at a time
- Keep the conversation respectful by focusing on ideas, not the person
- Stay curious about new ideas
- Share the air time – to ensure everyone gets heard
- Minimize phone use – and take calls outside

# Round table and terms of reference

What topics or questions would you like to see addressed?

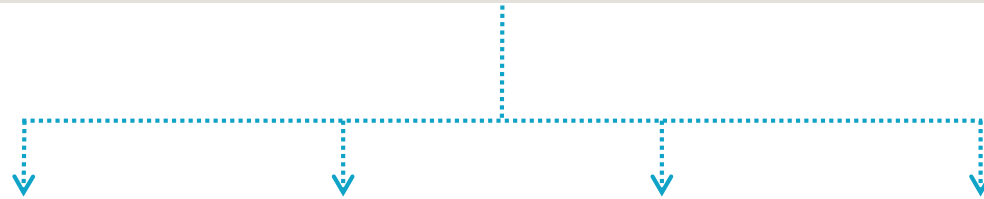
- Part of our task today is to help shape the areas of inquiry for TAC
- We would like to hear from you now on this
- Will close off the day with a more detailed discussion on prioritizing discussion topics

# IRP overview

Kathy Lee, BC Hydro

# IRP is BC Hydro's plan for the power system

The what, when, and why of our actions to meet customers' evolving electricity needs in the long run



Specify actions to inform downstream activities

e.g., demand-side management plan,  
electricity purchase agreement renewal approach,  
major resource investments in capital plan etc.

# IRP is required by law

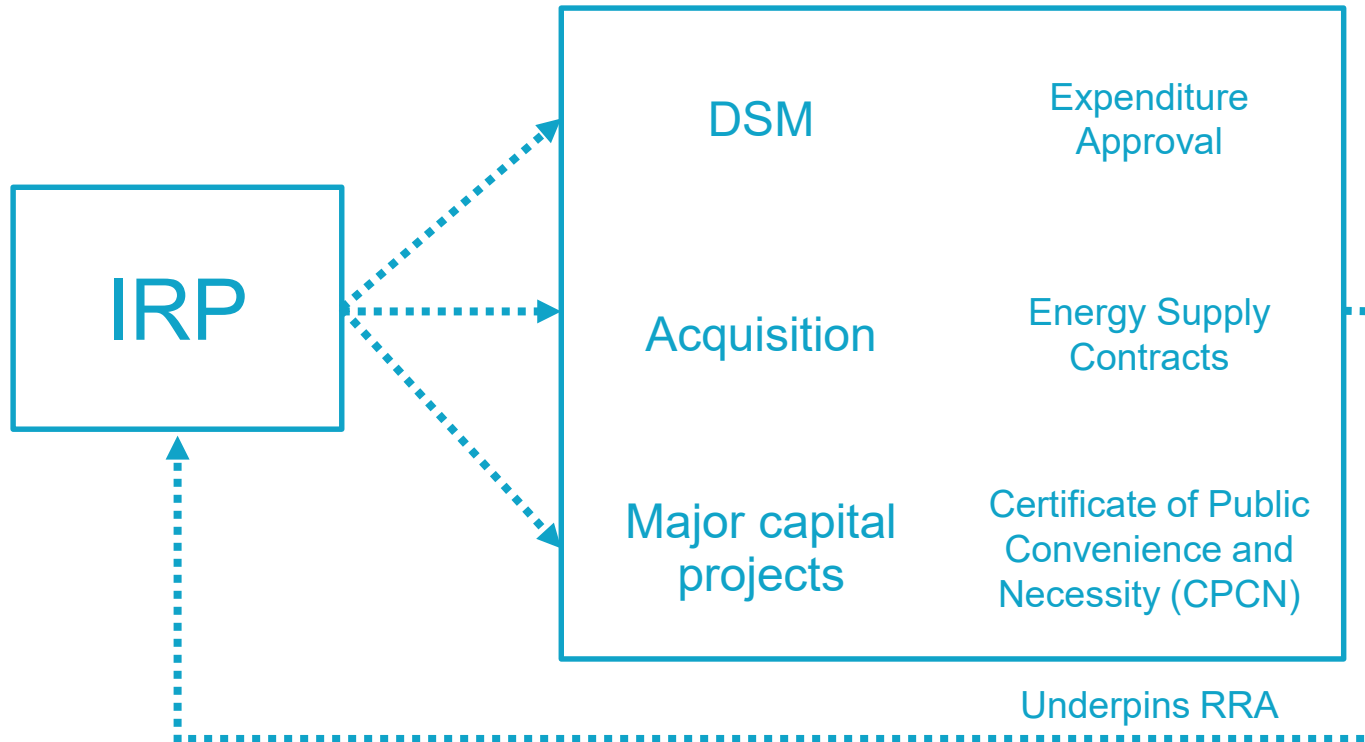
## Utility Commission Act requires IRP submission to BCUC

- BC Hydro's last IRP was submitted to the Province and approved in 2013
- As part of the Comprehensive Review of BC Hydro in 2018, legislative changes were made that require BC Hydro's future resource plans to be reviewed by the BCUC
- Section 44.1 of the Utilities Commission Act will apply
- BC Hydro is not required to file before February 28, 2021



# IRP and future regulatory applications

Utilities Commission Act requires BCUC to consider approved IRP



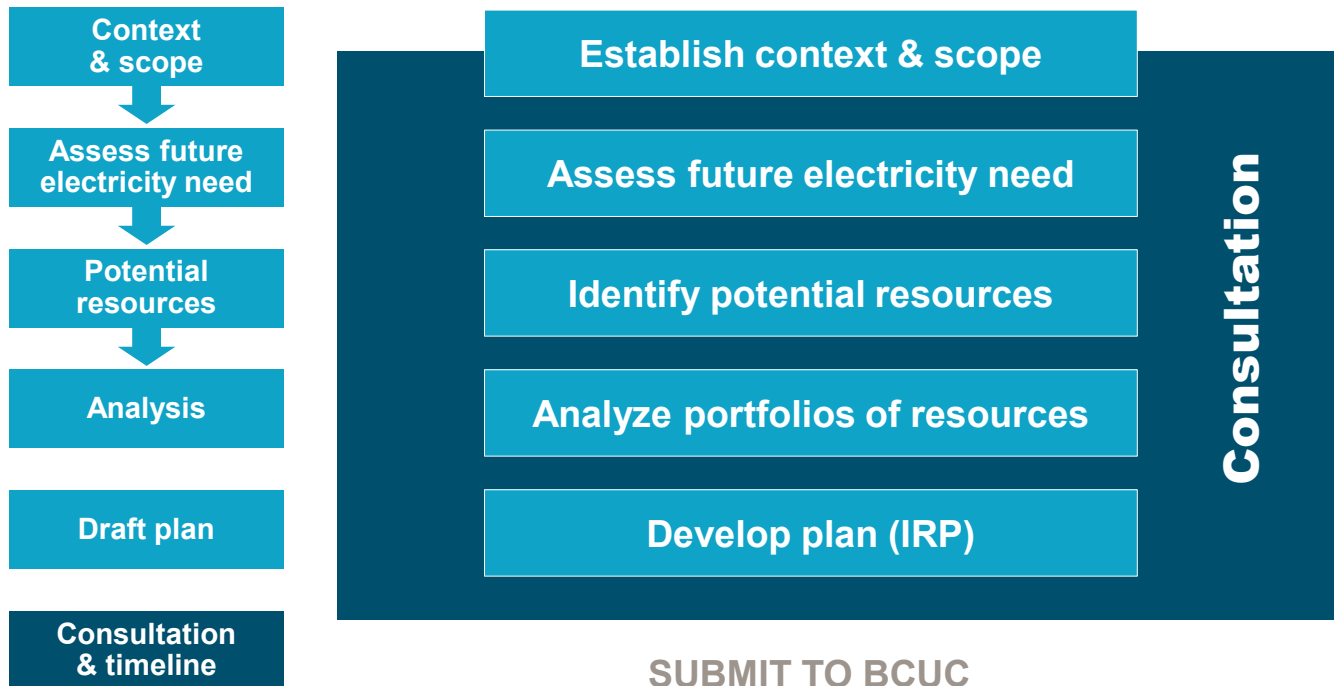
# Benefits in developing an IRP

## IRP is good utility practice

- Opportunity to seek early input on planning direction
- Increased regulatory efficiency – a central document providing context for various regulatory applications
- Overall big picture planning (integrated and trade-off) to address uncertainties in light of rapidly changing energy landscape

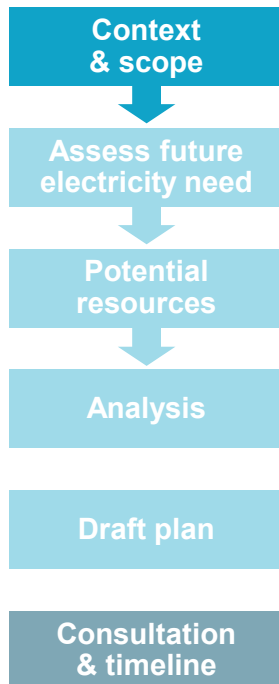
# IRP development is a multi-step process

Feedback from consultation is considered along the way



# Policy context

Government objectives come in the form of legal requirements and policies



## Key legislated requirements:

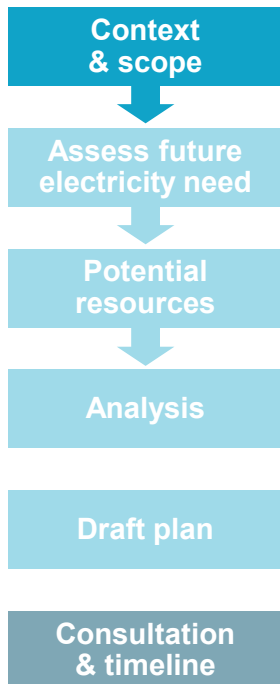
- Utility Commission Act (Section 44.1 applies)
- Clean Energy Act

## Key policies:

- CleanBC Plan
- Outcomes of the Transformative Review (Gov Review Phase 2)

# Clean Energy Act

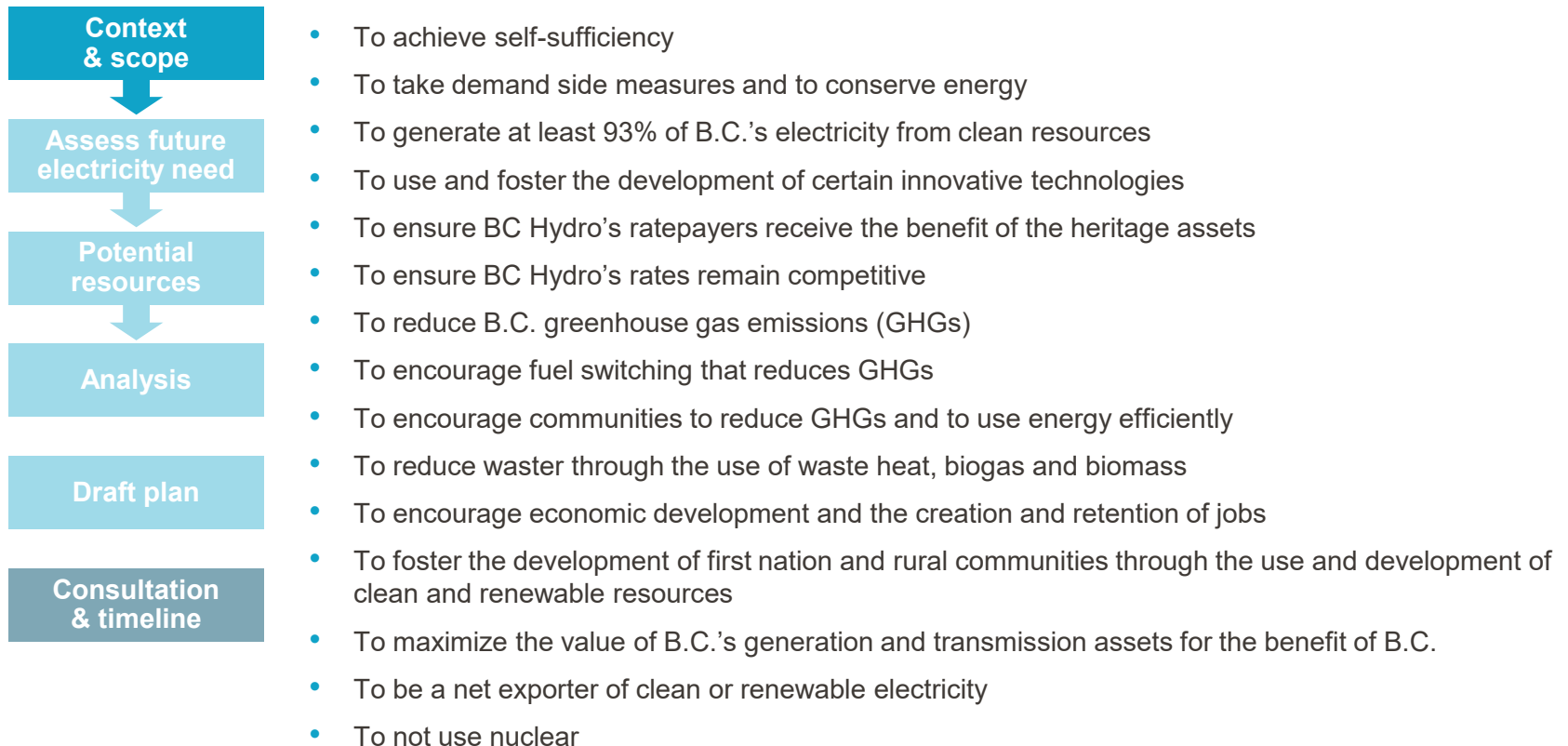
The Clean Energy Act provides additional legislative context



- BCUC must “consider” the legislated energy objectives
- BC Hydro is effectively prohibited from pursuing large hydro projects
- Certain projects, programs and expenditures are exempt: Revelstoke 6 and Section 18 “prescribed undertakings” relating to greenhouse gas reductions in the province

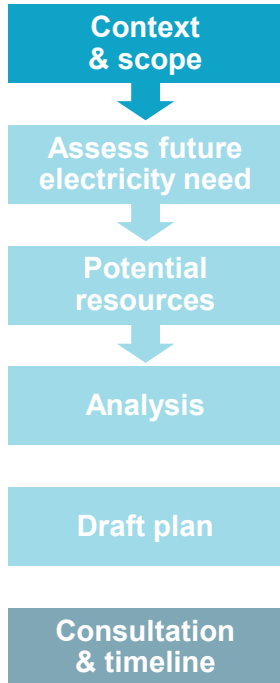
# Clean Energy Act – energy objectives

## Fifteen energy objectives



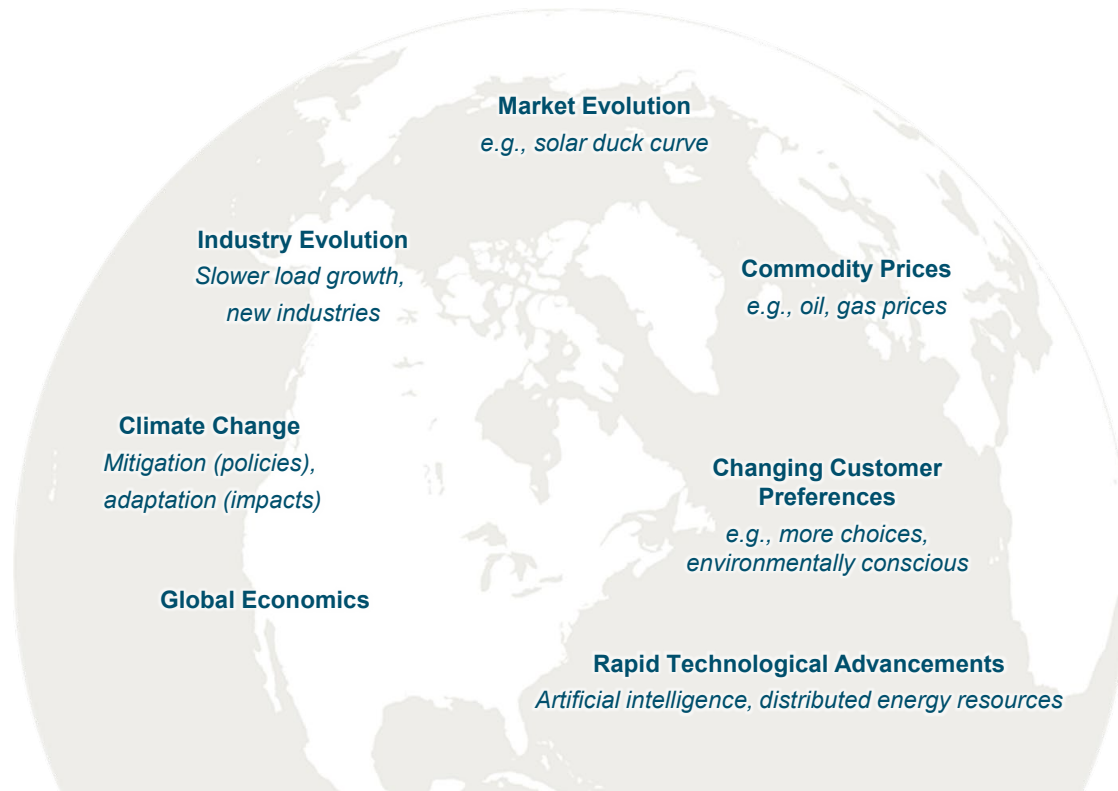
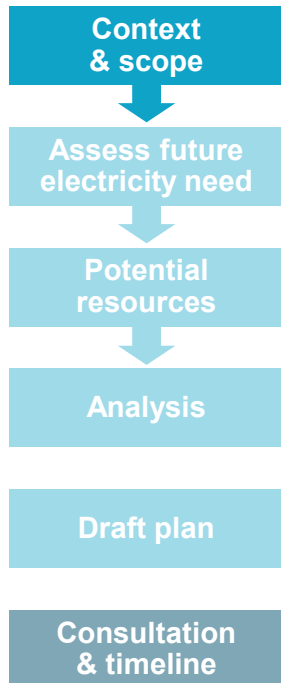
# Evolving government policy

CleanBC to result in additional electricity demand



# Operating environment

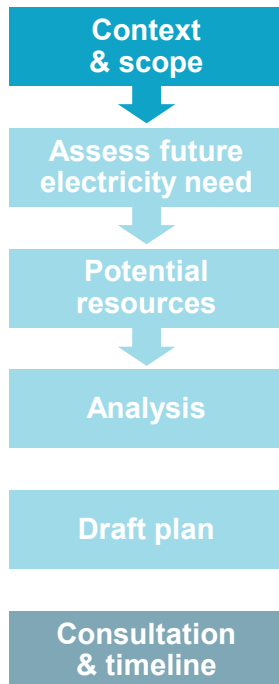
The energy landscape is rapidly evolving and uncertain





# Scope for this IRP

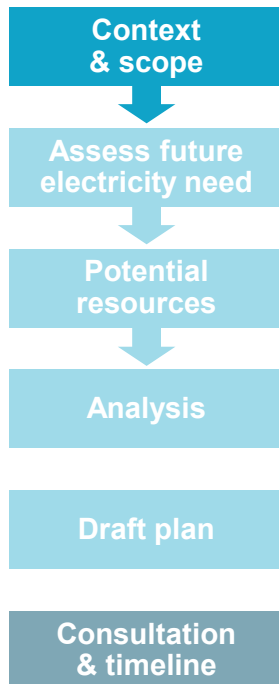
## Long-term planning for the integrated system



- Planning for BC Hydro's integrated system excluding Fort Nelson and non-integrated areas
- Identifying resource needs driven by demand growth
- Focus on generation and transmission between major regions
- 20-year load resource balance to 2040, with electrification scenarios to 2050

# Scoping considerations

This IRP has new foci

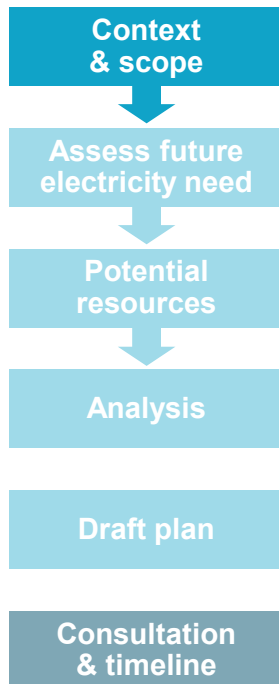


What resources are needed to meet energy and capacity requirements, when and where?

- Shift from energy to capacity focus
- Shift from system wide to regional focus
  - Load center: Lower Mainland and Vancouver Island
  - Uncertain LNG and electrification: North Coast, Peace Region
  - Tradeoff between transmission versus local resources

# Characterizing our operating environment

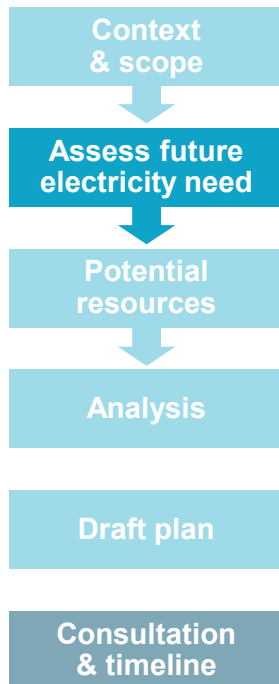
## We update market information



- Characterization of electricity markets
- Market price forecasts (natural gas, electricity, GHG, renewable energy credits)
- Carbon tax

# Assessing future electricity need

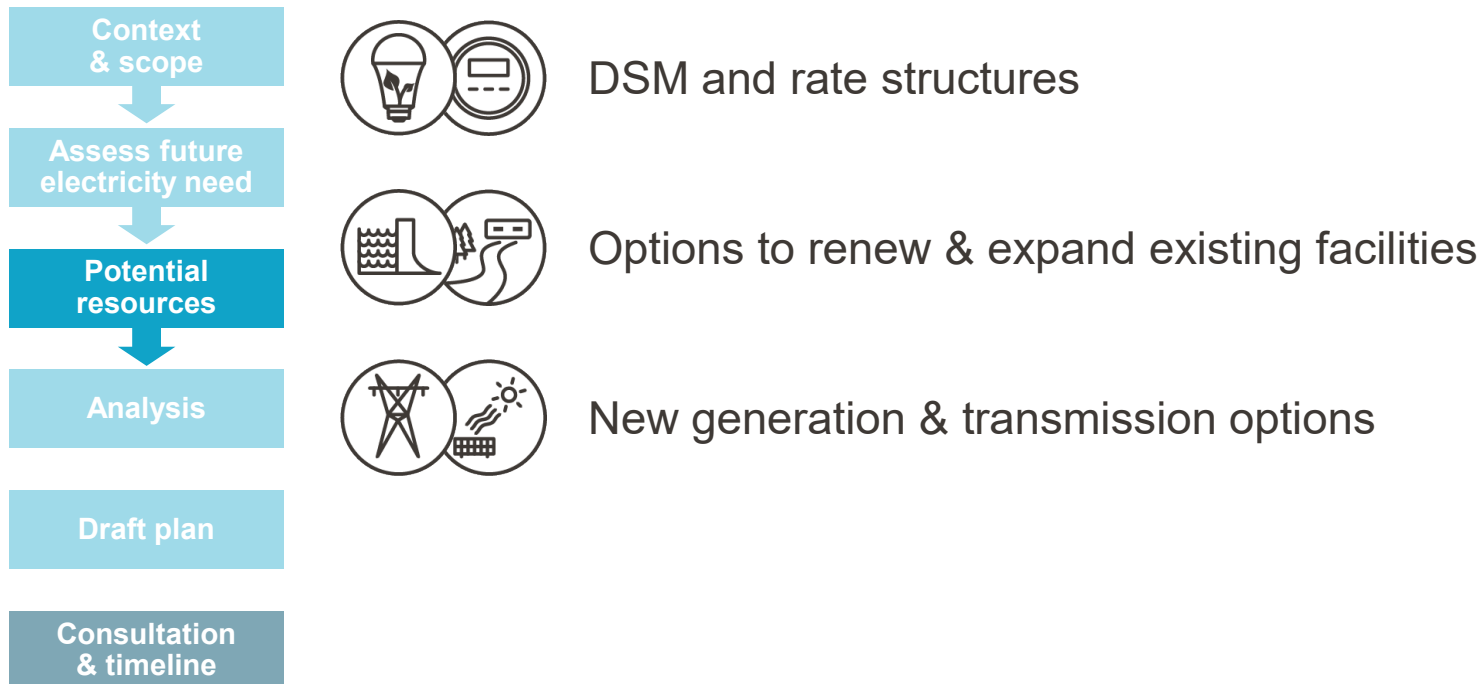
Comparison of our demand and supply forecasts determines need



- Demand forecast
- Supply forecast
- Demand supply outlook (load resource balances)
- Electrification scenarios
- Climate change effects
- Planning criteria
- Customer distributed generation uptake

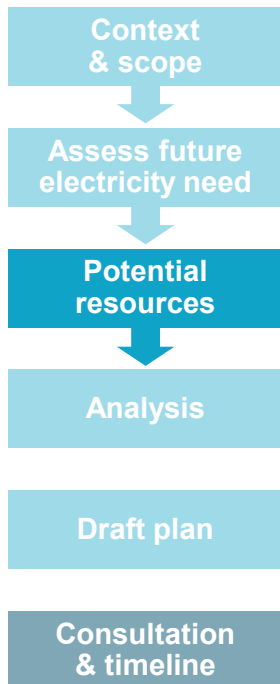
# Identifying potential resources

We are updating our resource option inventory



# Potential resources characterization

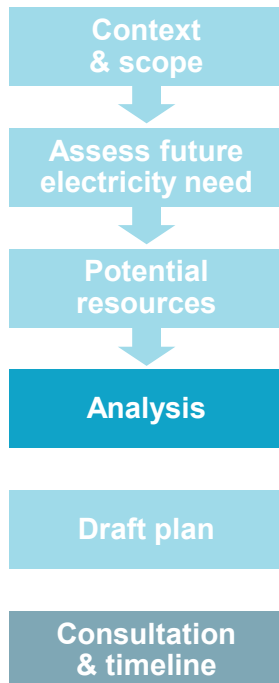
We characterize the resource options with various attributes



- Technical  
e.g., energy, capacity, location, lead time, project life
- Financial  
e.g., capital and operating cost
- Technology trends
- Social (direct jobs) and environmental (GHG and footprint)
- System integration considerations

# Analysis

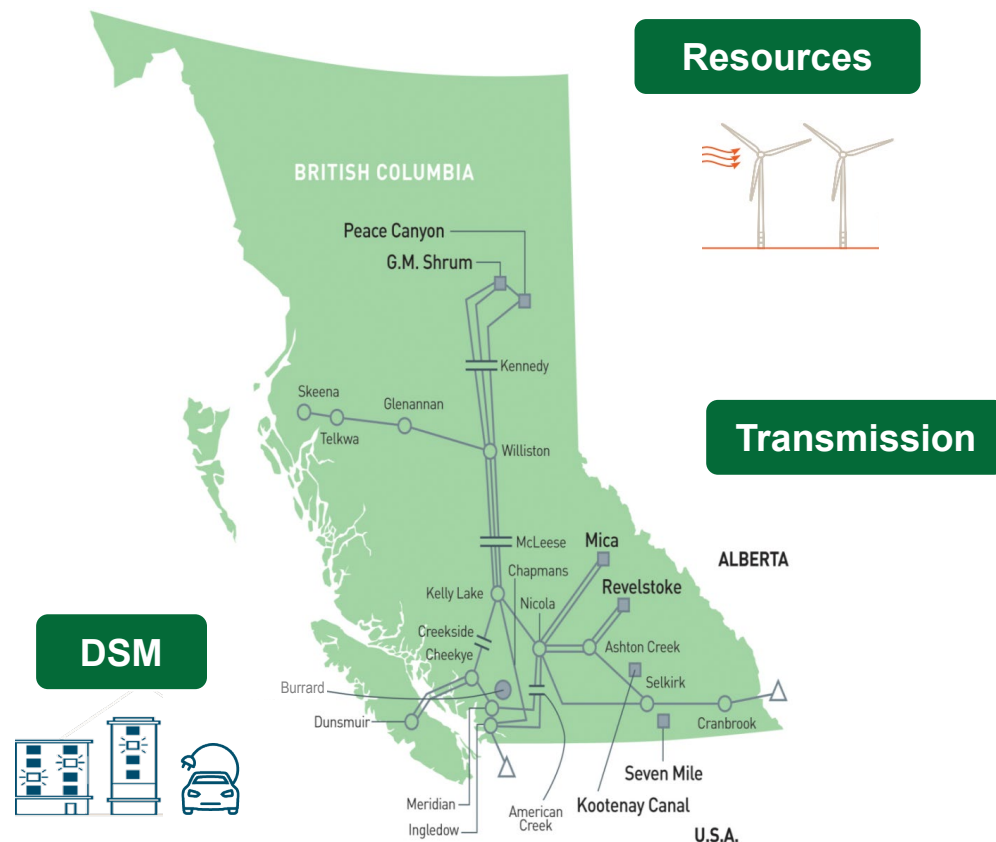
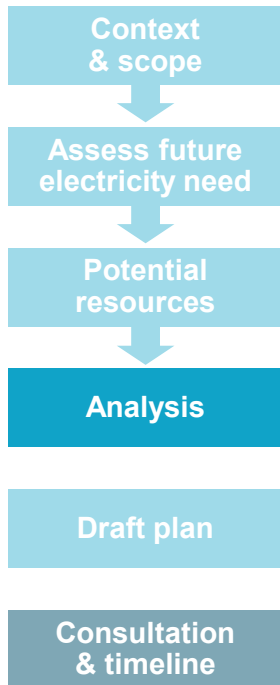
We use a suite of analytical methods to inform plan development



- Structured decision framework to balance and tradeoff planning objectives
- Portfolio analysis
- Explicit consideration of planning uncertainties

# Developing portfolios of resources

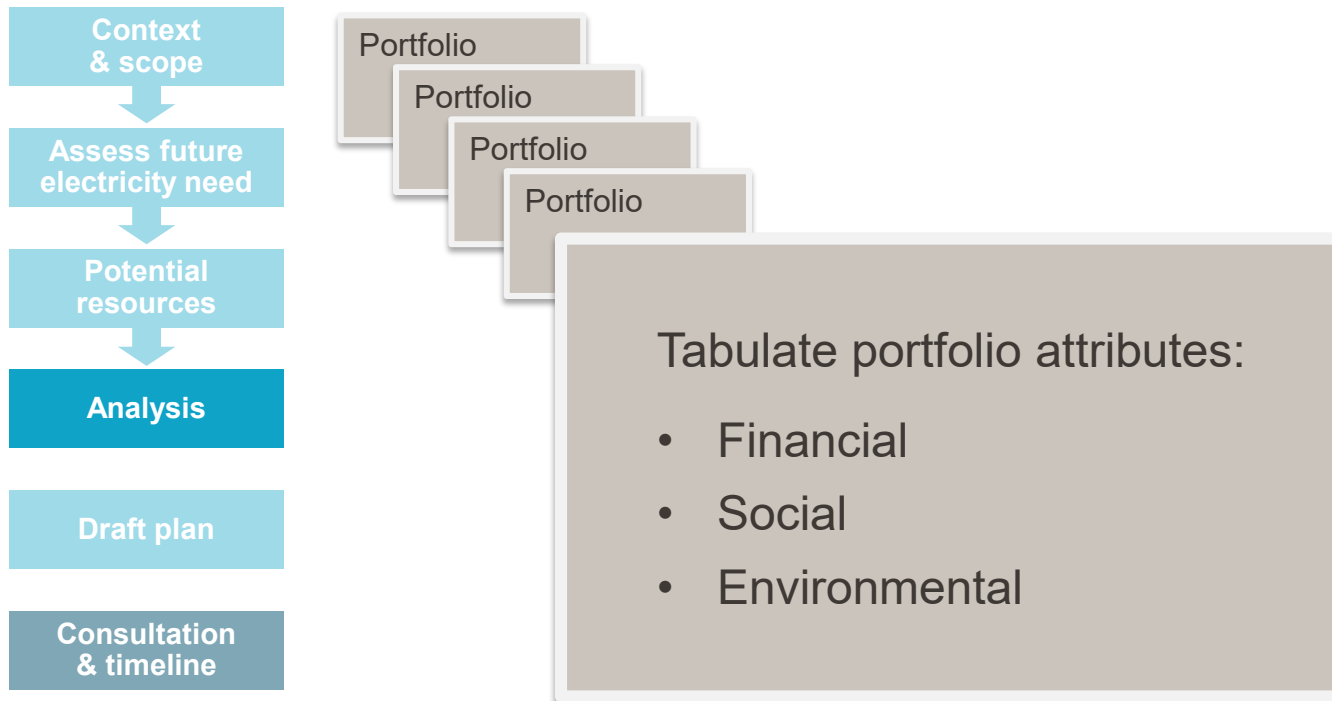
We develop portfolios to provide reliable electricity to customers





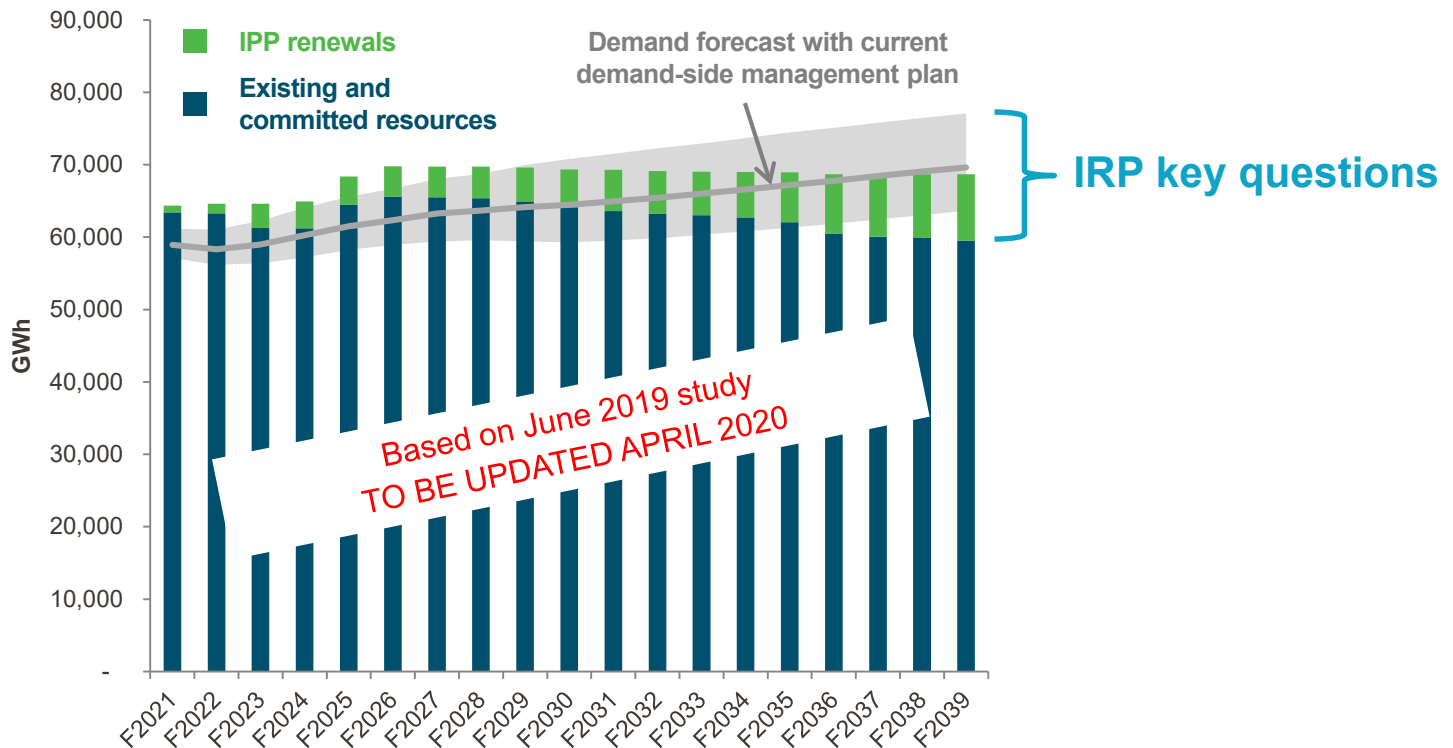
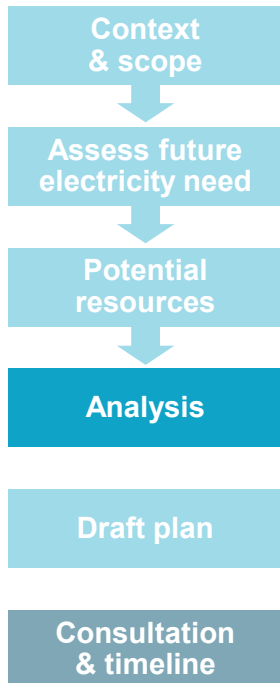
# Comparing portfolios

We evaluate the portfolios against planning objectives



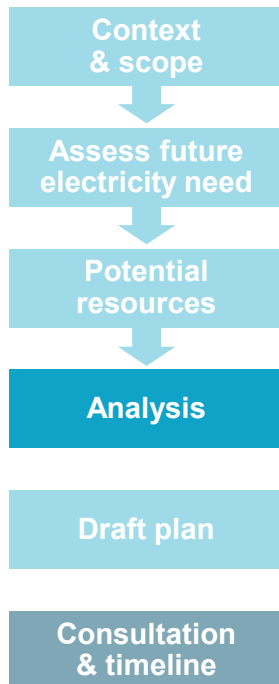
# Looking at June 2019 – system reference case

With Site C coming online, our reference case does not show a need for new energy resources until F2038 and new capacity resources until F2036



# IRP key questions

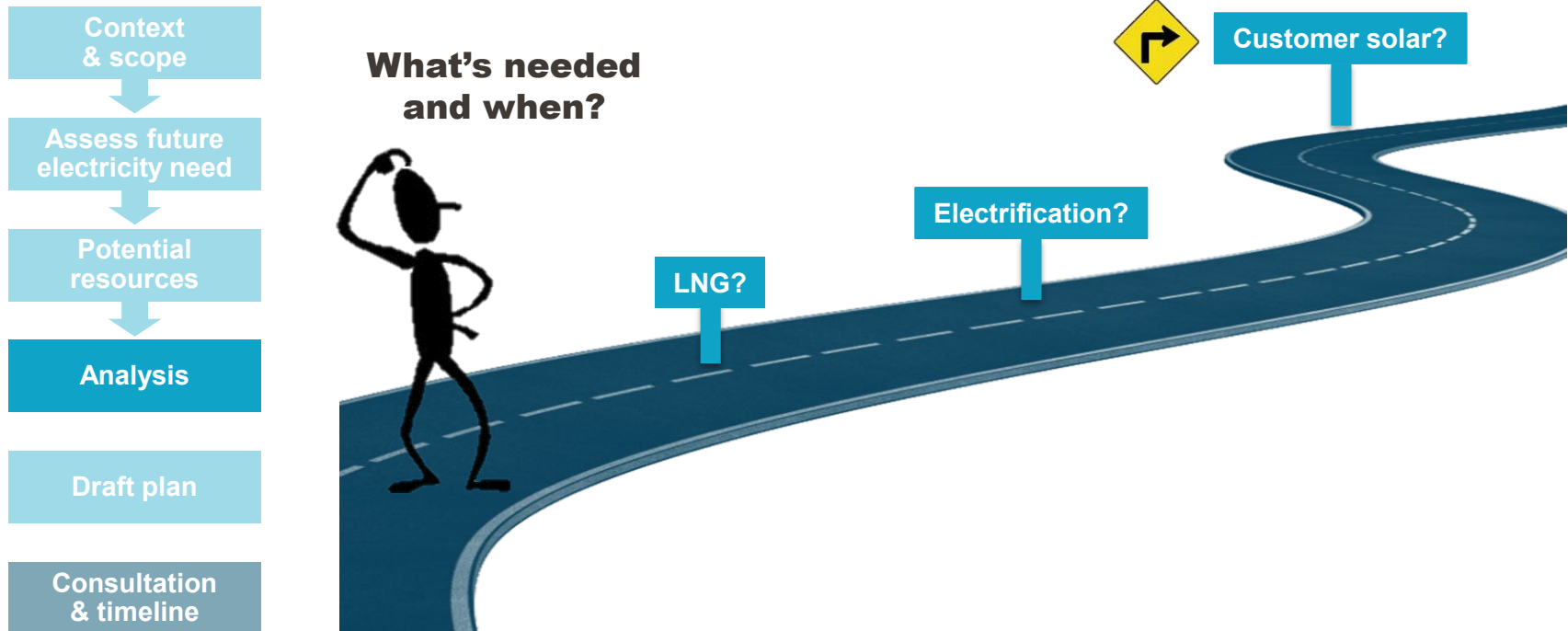
Answers to these questions inform our actions



- How much DSM to pursue – energy efficiency, what is the role of demand response and rate signal?
- What’s the approach for renewing existing electricity purchase agreements?
- What and when is the need for next new resource?
  - Revelstoke Unit 6, pumped storage, batteries (capacity)?
  - Solar, wind (energy)?
  - Transmission?

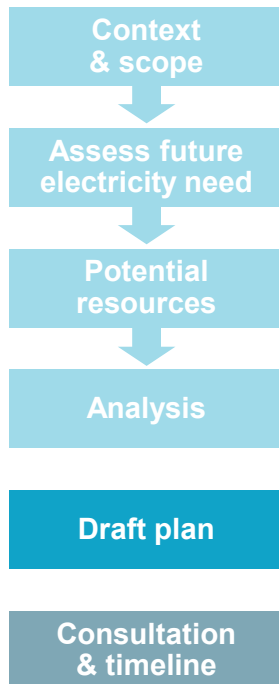
# Dealing with uncertainties

Big challenge for this IRP is preparing for uncertain future



# Develop plan

## Success is a resilient and adaptable plan



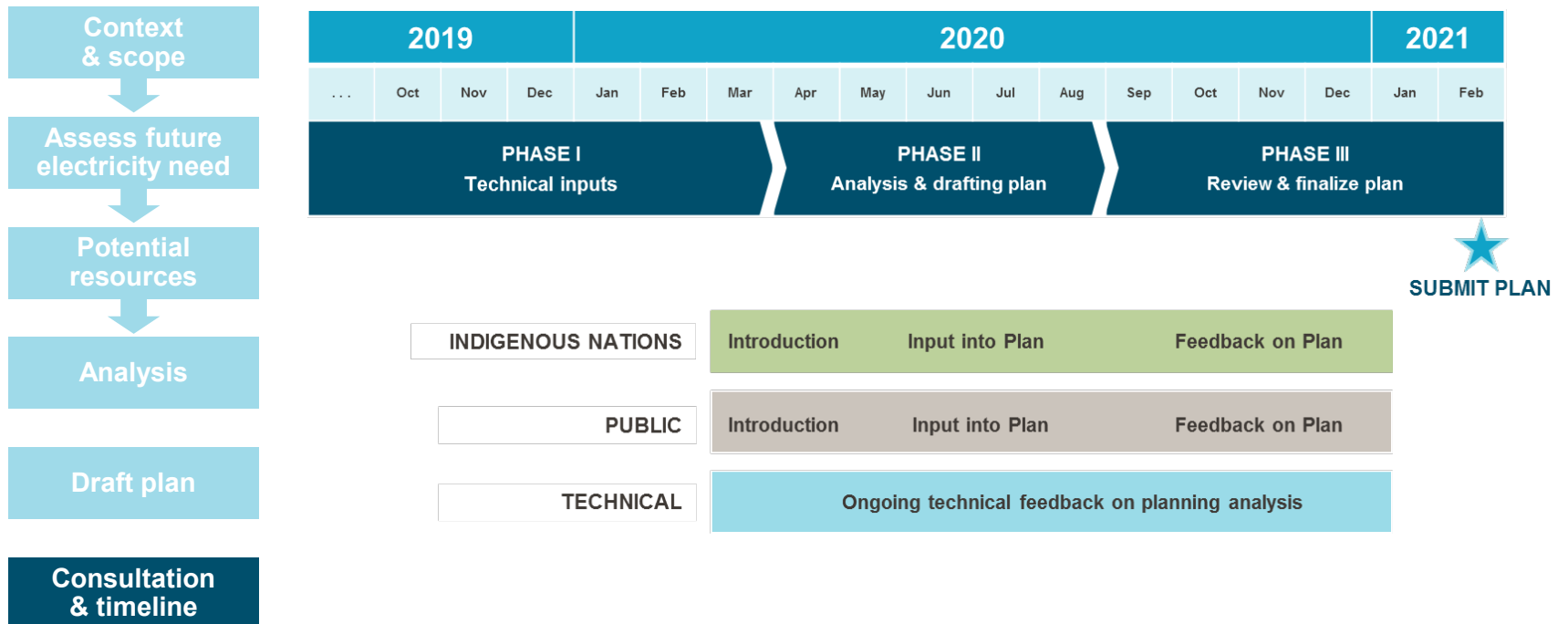
IRP consists of:

- Base Resource Plan to meet reference case
- Contingency Resource Plans to mitigate risks



# Consultation and timeline

BC Hydro will conduct three streams of consultation to gather broad input into the plan

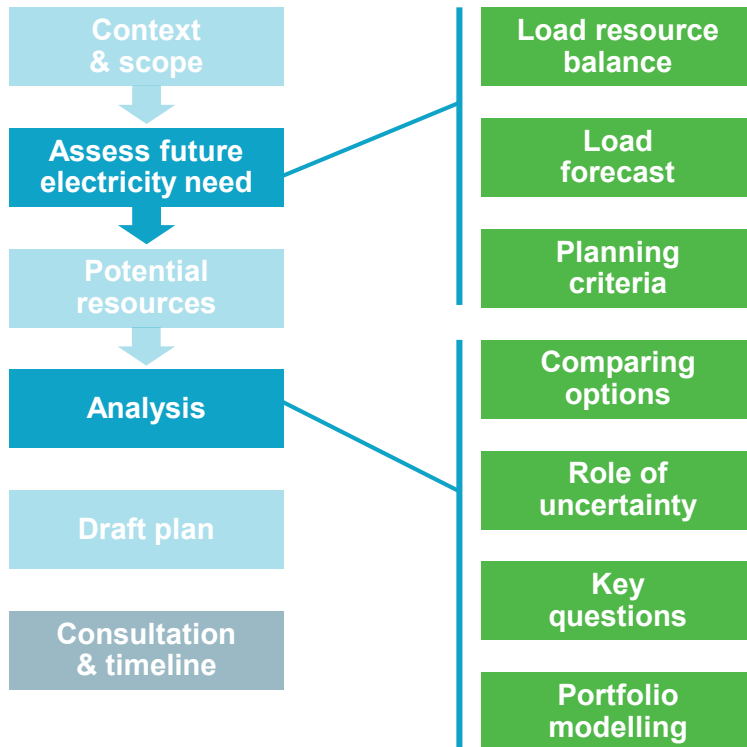


# Decision framework

Basil Stumborg, BC Hydro

# Decision framework

Decision framework is a description of how options will be compared  
– let's explore some aspects in more detail





# A closer look at the decision framework

An objective is to understand the TAC process and schedule and prioritize meeting time activities to focus on key areas of interest

Load resource  
balance

Load  
forecast

Planning  
criteria

Comparing  
options

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

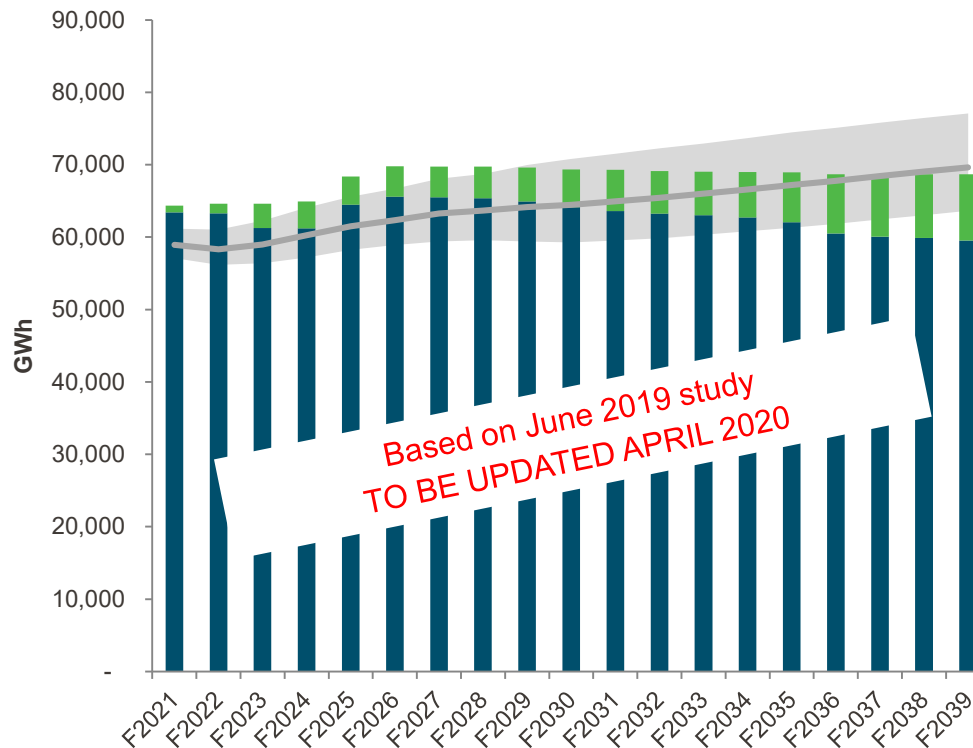
For each topic area (inputs and analysis):

- Introduction
- When we are going to come back with detailed presentations
- Issues we are going to address – including key uncertainties
- Feedback from you – to help us focus future meeting time
  - We can discuss as a group today
  - Send comments afterwards

# Load resource balance (LRB)

Contains the load forecast (net conservation), supply, and planning criteria and assumptions

- Load resource balance
- Load forecast
- Planning criteria
- Comparing options
- Role of uncertainty
- Key questions
- Portfolio modelling



# Load forecast

## A long-term view of provincial electricity demand

Load resource  
balance

Load  
forecast

Planning  
criteria

Comparing  
options

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

The load forecast for energy and capacity

- Results of the April 2020 Load Forecast will be reviewed in detail at the Meeting #2 (mid-April)
- Mechanics will be presented
- Uncertainty will be introduced after that (see later slides)
- BC Hydro team is assuming that results and uncertainties will be TAC's main interest (not mechanics)

# Supply-side resources

## What resources are assumed to be in the supply stack?

Load resource  
balance

Load  
forecast

Planning  
criteria

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uncertainty

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questions

Portfolio  
modelling

Supply-side assumptions – to be presented at Meeting #2 (mid-April)

- Base assumptions of DSM can also be examined
- Starting assumption is that only existing and committed resources contribute

“Gap” will be filled by:

- IPP renewals
- New supply-side resources
- Incremental DSM
- It is assumed these last three topics will be of interest to this committee, and can be explored in Meeting #2

# Planning criteria and assumptions

## Criteria we want to explore with the TAC

Load resource  
balance

Load  
forecast

**Planning  
criteria**

Comparing  
options

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

- Generation planning criteria
- Transmission planning criteria

# How to compare options

## Decision framework will cover multiple objectives and risk

Load resource  
balance

Load  
forecast

Planning  
criteria

**Comparing  
options**

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

- Size and the timing of the future deficit is uncertain
- There are different ways to fill this deficit, with different impacts of interest
- BC Hydro will be transparent about the way it creates and compares options in this IRP by highlighting its decision framework

# Comparing options across multiple objectives

The “best” solution may depend on a balance of competing objectives

Load resource  
balance

Load  
forecast

Planning  
criteria

**Comparing  
options**

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

- BCUC must consider multiple CEA objectives when reviewing the IRP
- Some of these objectives may be in tension with others
- Some of these are forecast with more certainty than others
- IRP will track how different solutions make progress towards or away from these objectives
- Some of these measures will be introduced along with resource options
- Some of these measures will be determined at a portfolio level
- How these objectives are stated and measured will be examined in Meeting #2
- It is assumed that this topic will be of moderate interest to the TAC members

# Role of uncertainty in the LRB

A number of different factors could push up or pull down the LRB

Load resource  
balance

Load  
forecast

Planning  
criteria

Comparing  
options

**Role of  
uncertainty**

Key  
questions

Portfolio  
modelling

## LRB uncertainty

- Incremental changes to factors pushing on load over the long term
- Large, discrete, abrupt changes
  - Will include gov't policy (like CleanBC plan)
  - Will also include larger levels of potential electrification, and LNG growth
- This will be looked at across the system, but also regionally
- Changes to the nature and availability of generation resources
- Uncertain levels of DSM success (for both energy and capacity)
- It is assumed that this will be of great interest to TAC members
- Meeting #2 will canvass TAC for key drivers of uncertainty
- Results will be brought back to Meeting #3

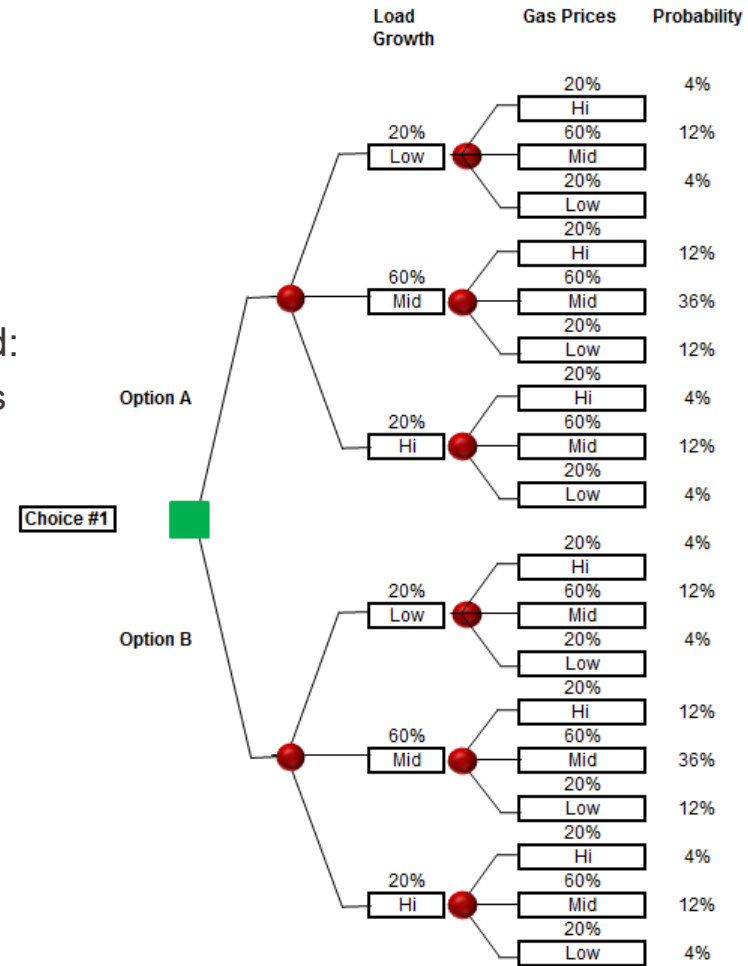


# A way to quantify uncertainty

## Decision trees are a tool to help

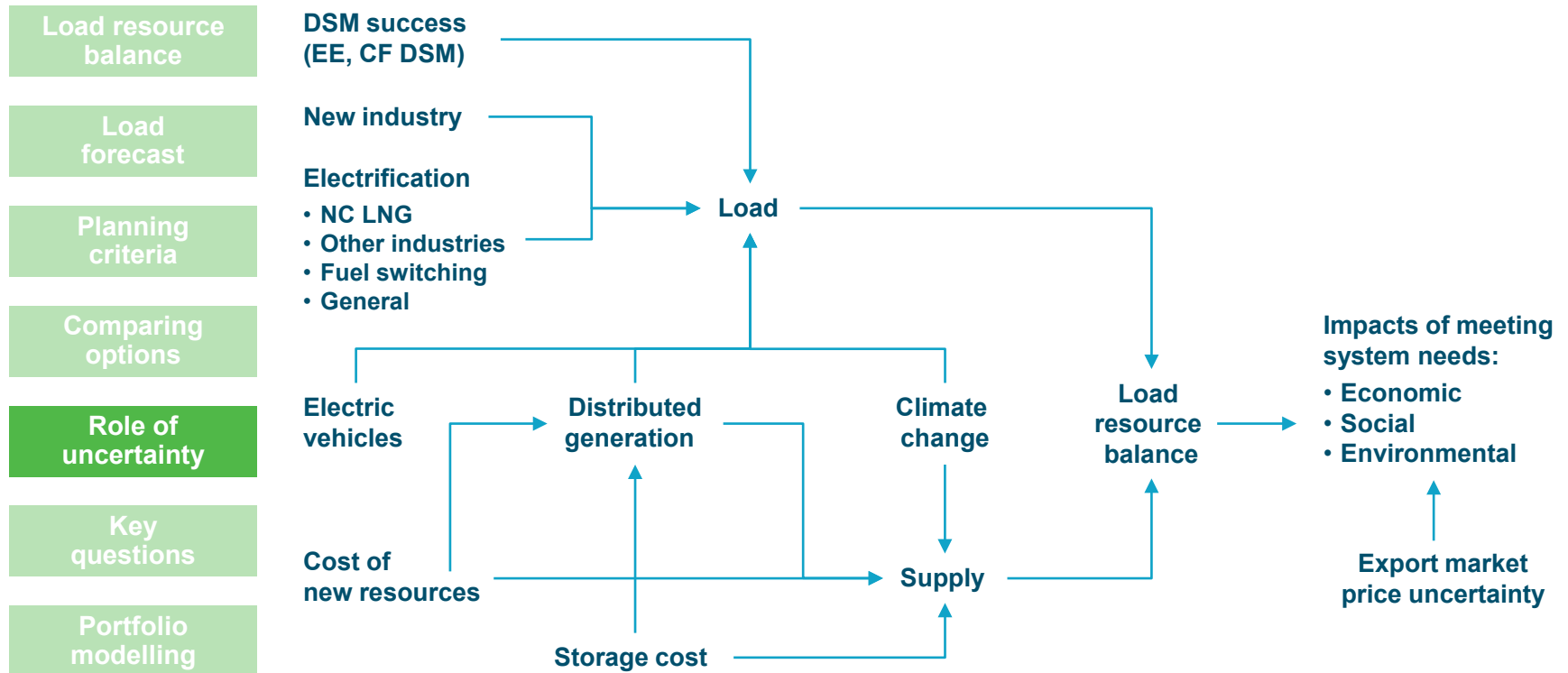
- Load resource balance
- Load forecast
- Planning criteria
- Comparing options
- Role of uncertainty**
- Key questions
- Portfolio modelling

- Uncertainty will be a key element in this IRP
- Each option will need to be evaluated:
  - How it performs when the future is as expected
  - How it will perform when the future surprises us
- Modelling constraints will force us to be judicious with:
  - What uncertainties to explore
  - How to model them
- Goal is to develop a:
  - Base Resource Plan (BRP)
  - Contingency Resource Plan (CRP)



# Types of uncertainties

There are a number of interrelated uncertainties that impact this IRP



# Key questions to be addressed

Precise questions and impacts will be determined by modelling

Load resource  
balance

Load  
forecast

Planning  
criteria

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options

Role of  
uncertainty

**Key  
questions**

Portfolio  
modelling

- What is BC Hydro's near term strategy that balances:
  - preparing for uncertain future load (higher or lower), while
  - minimizing negative impacts of acting now
- This will require thinking through:
  - load growth uncertainty, and its likelihood
  - building more flexible options
- This applies to IPPs and DSM, but also:
  - generation upgrades
  - transmission projects

# Key questions to be addressed

Precise questions and impacts will be determined by modelling

Load resource  
balance

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forecast

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criteria

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options

Role of  
uncertainty

**Key  
questions**

Portfolio  
modelling

- How can BC Hydro prepare for increased electrification?
  - Government has announced its intentions to reduce B.C.'s GHG emissions
  - There is also the possibility of electrifying future LNG development
- What are the load implications of these possible outcomes?
- How quickly do these ramp up?
- What can BC Hydro do to prepare for these increases, while:
  - Preparing for an adequate response, if needed
  - Managing near term negative impacts

# Modelling approaches within the IRP

The way in which impacts of interest will be forecast

Load resource  
balance

Load  
forecast

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criteria

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Role of  
uncertainty

Key  
questions

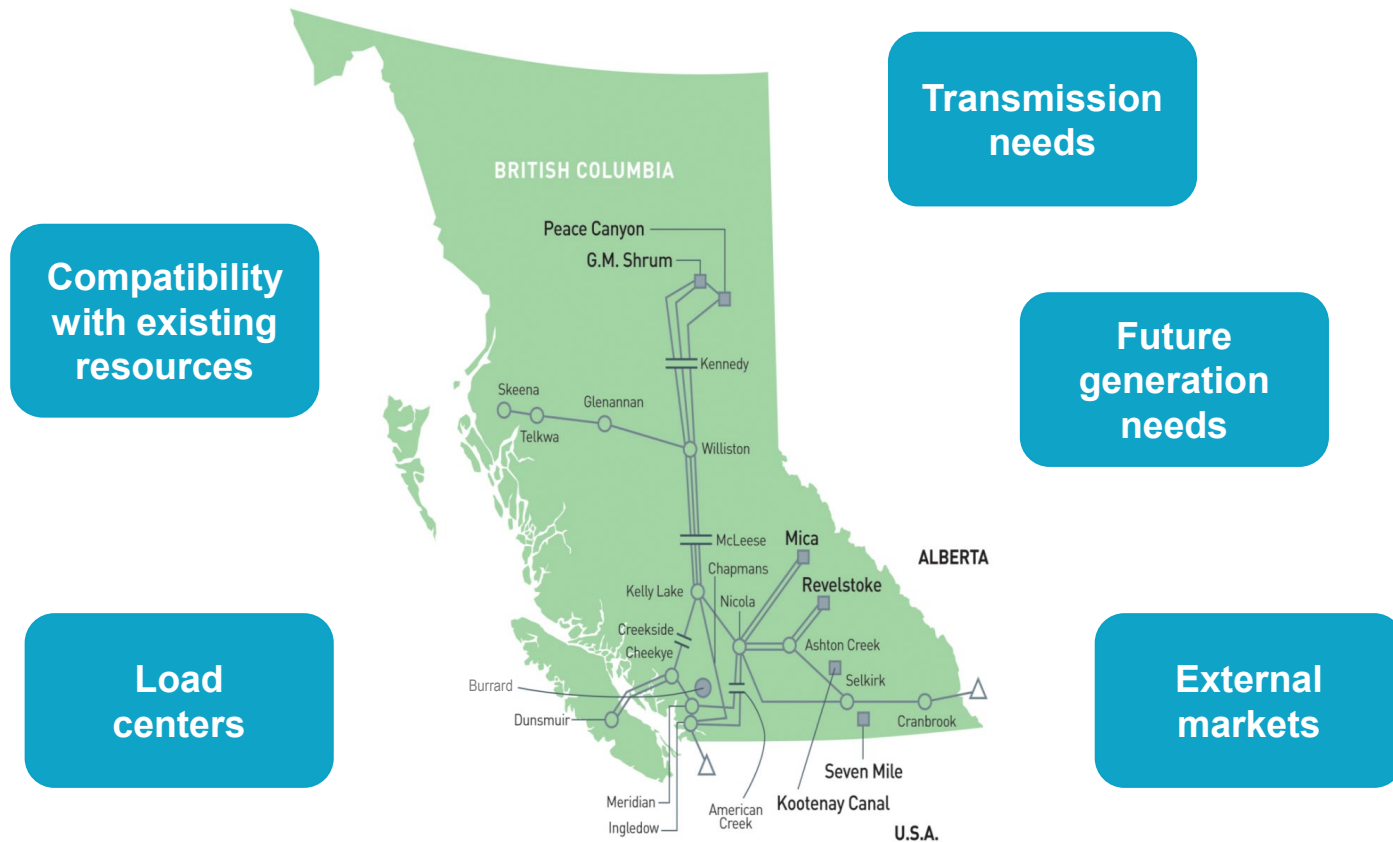
Portfolio  
modelling

Modelling will be done using several models

- Different models will be used for different purposes
- Different models will give different levels of precision when addressing the same question

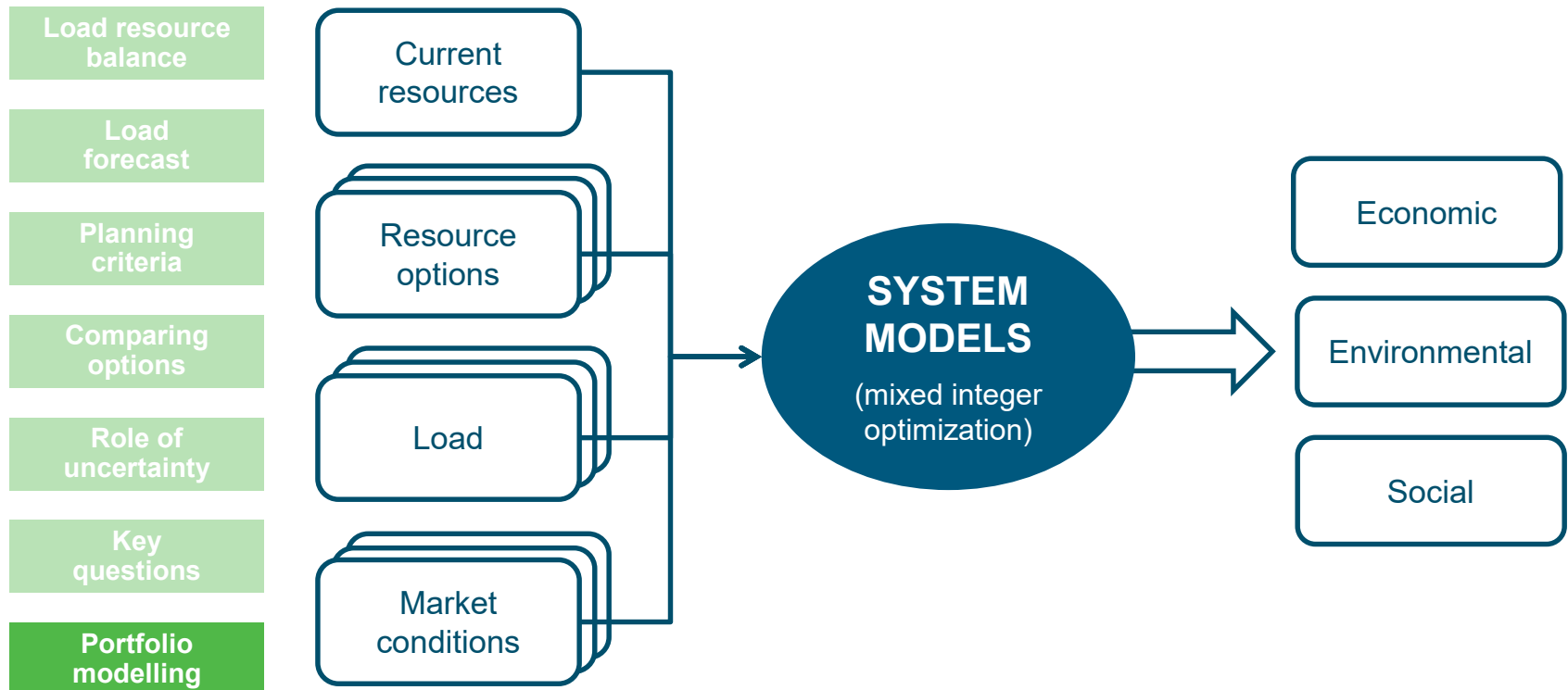
# Modelling resource requirements to serve future load

Analysis looks at future generation options and transmission requirements



# System portfolio modelling

Output is an assessment of the economic and other impacts of changes to our system



# Limitations to comparing options

Limitations exist for identifying both future generation and transmission options

Load resource  
balance

Load  
forecast

Planning  
criteria

**Comparing  
options**

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

- Modelling will give timing and volume of resource need
  - But actual resources (type, location, volume) determined by future resource strategy
  - This limits precise conclusions about regional-specific attributes
- Uncertainty about future generation resources
  - Modelling will indicate broad resource requirements
  - Procurement strategy and outcomes will vary from modelling results
- Transmission uncertainty
  - Wire versus non-wire alternatives will be considered
  - High level need defined rather than project scope, i.e., routing
- This limits the estimation of locational-specific characterization
  - Environmental
  - Social
  - etc.



# Limitations to comparing options

The potential for cumulative effects on environmental and social impacts is of rising importance

Load resource  
balance

Load  
forecast

Planning  
criteria

**Comparing  
options**

Role of  
uncertainty

Key  
questions

Portfolio  
modelling

- BC Hydro is developing a cumulative effects strategy
- IRP may be able to signal where this could be important for accessing future resources
  - Information will be accurate at a regional basis only
- After the IRP, during implementation, this information:
  - Will allow early engagement with those affected
  - Could be part of an early implementation strategy to prepare for future, uncertain loads

# Electrification scenarios

Sanjaya De Zoysa, BC Hydro

# Electrification scenarios

**Broad-based electrification across the province and electrification of future industrial facilities will be tested**

## System-wide electrification scenarios

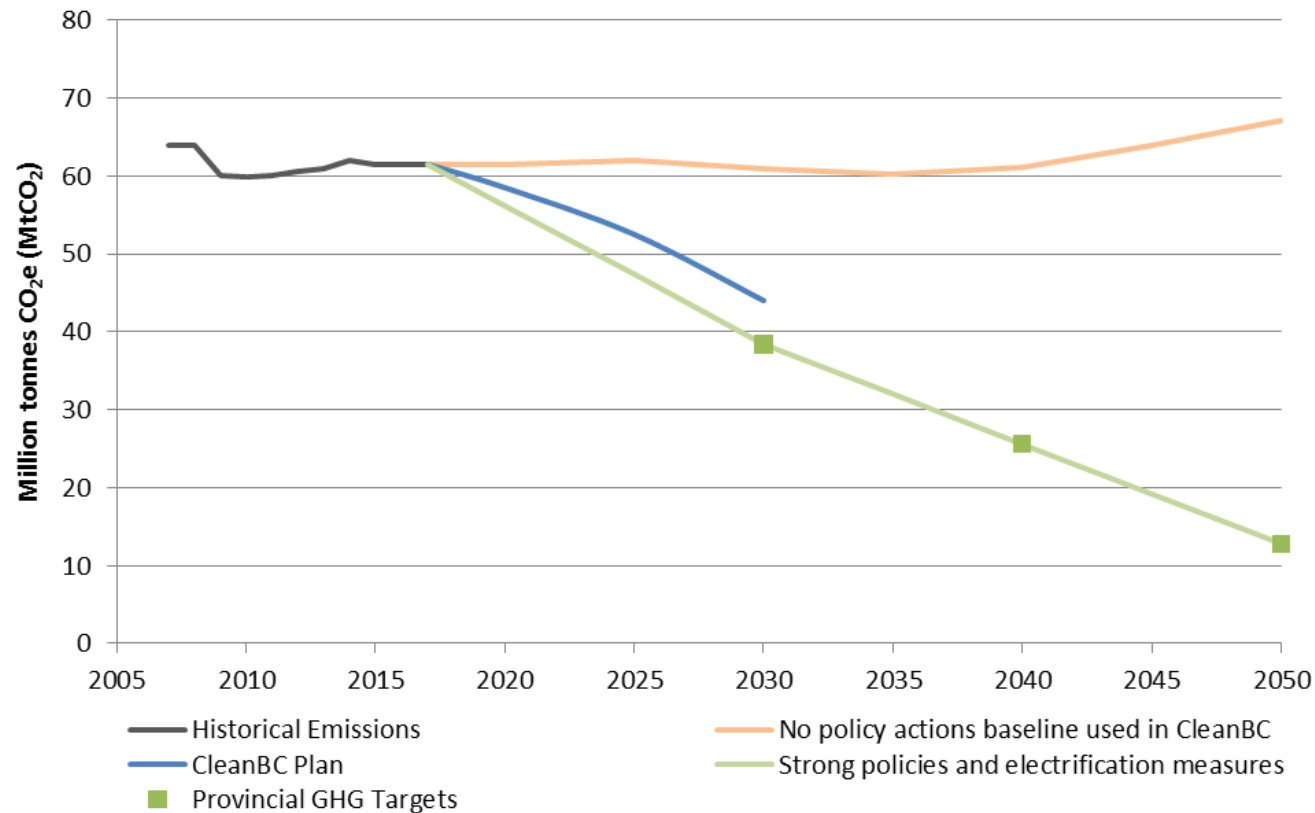
- General electrification of transportation, buildings, and some industry
- Several scenarios being explored

## Industrial electrification scenarios

- LNG electrification in the North Coast and gas extraction in the Peace region

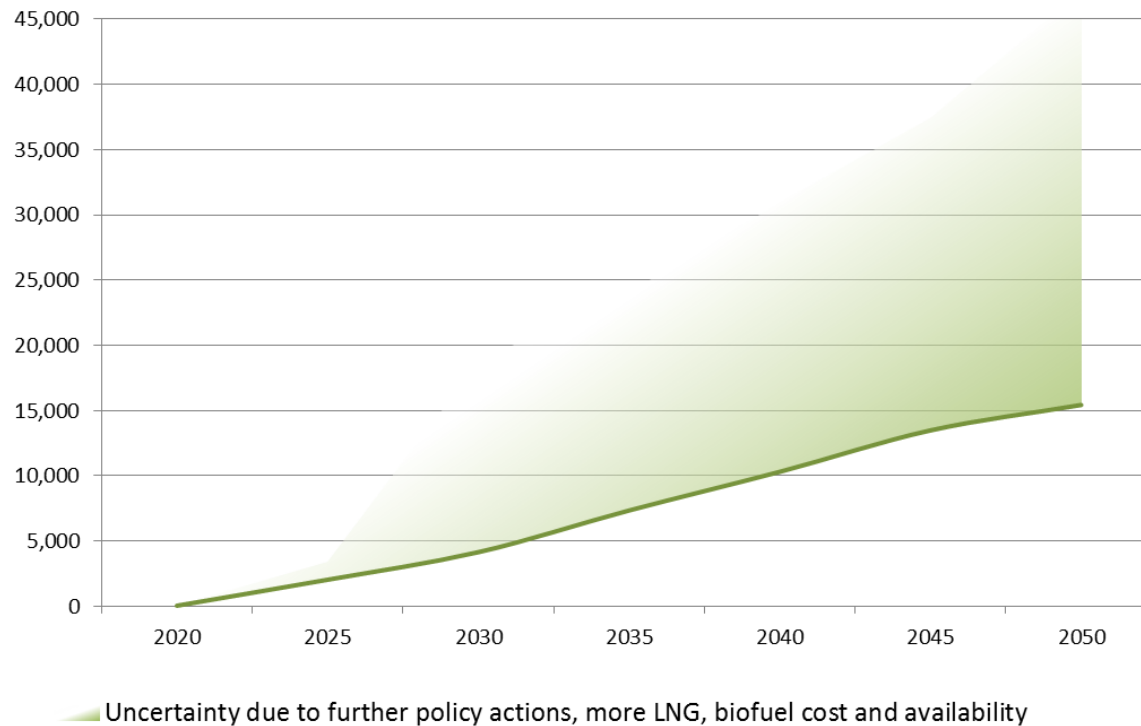
# Provincial GHG reduction targets

Additional GHG reductions are required beyond CleanBC



# Upside to incremental electricity demand

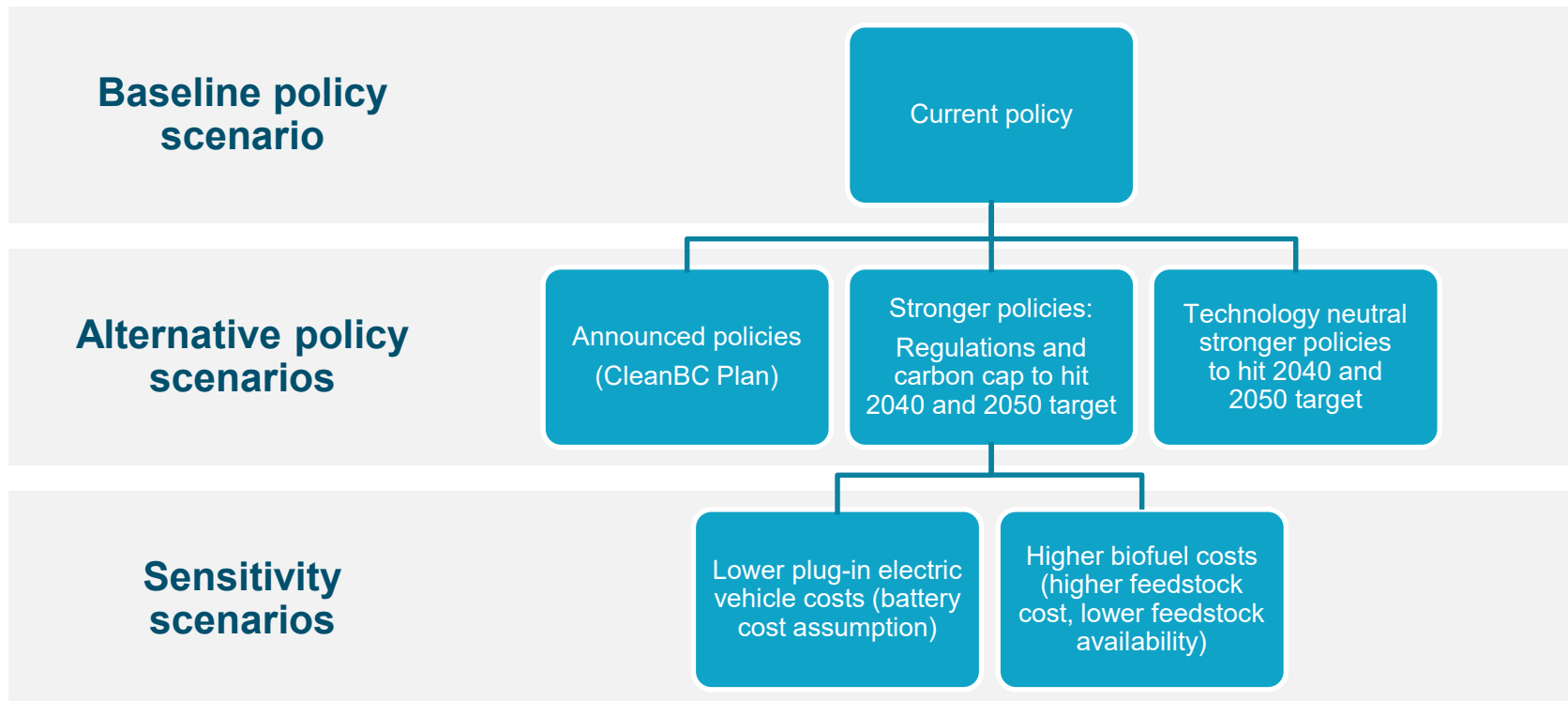
Further policy action and additional LNG could add significant load



— Clean BC Plan actions

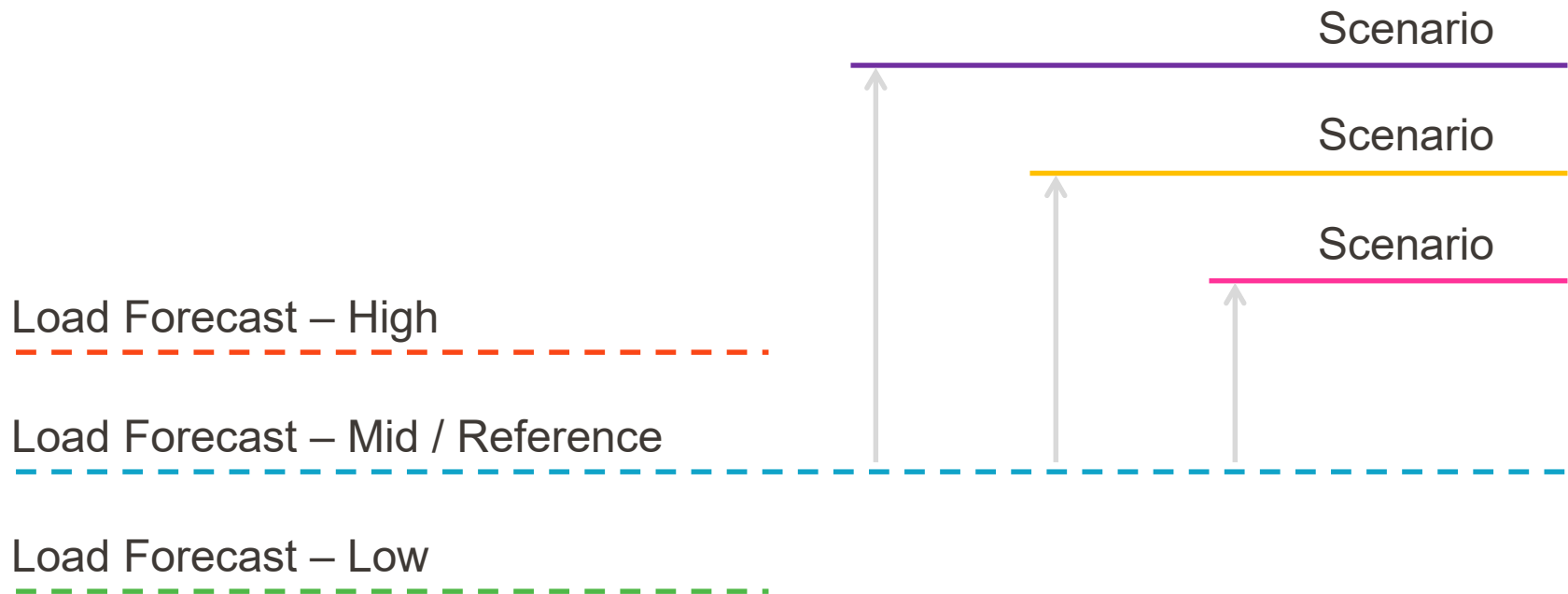
# Electrification scenarios modelled

Scenarios examine uncertainty around future technology and role of biofuels



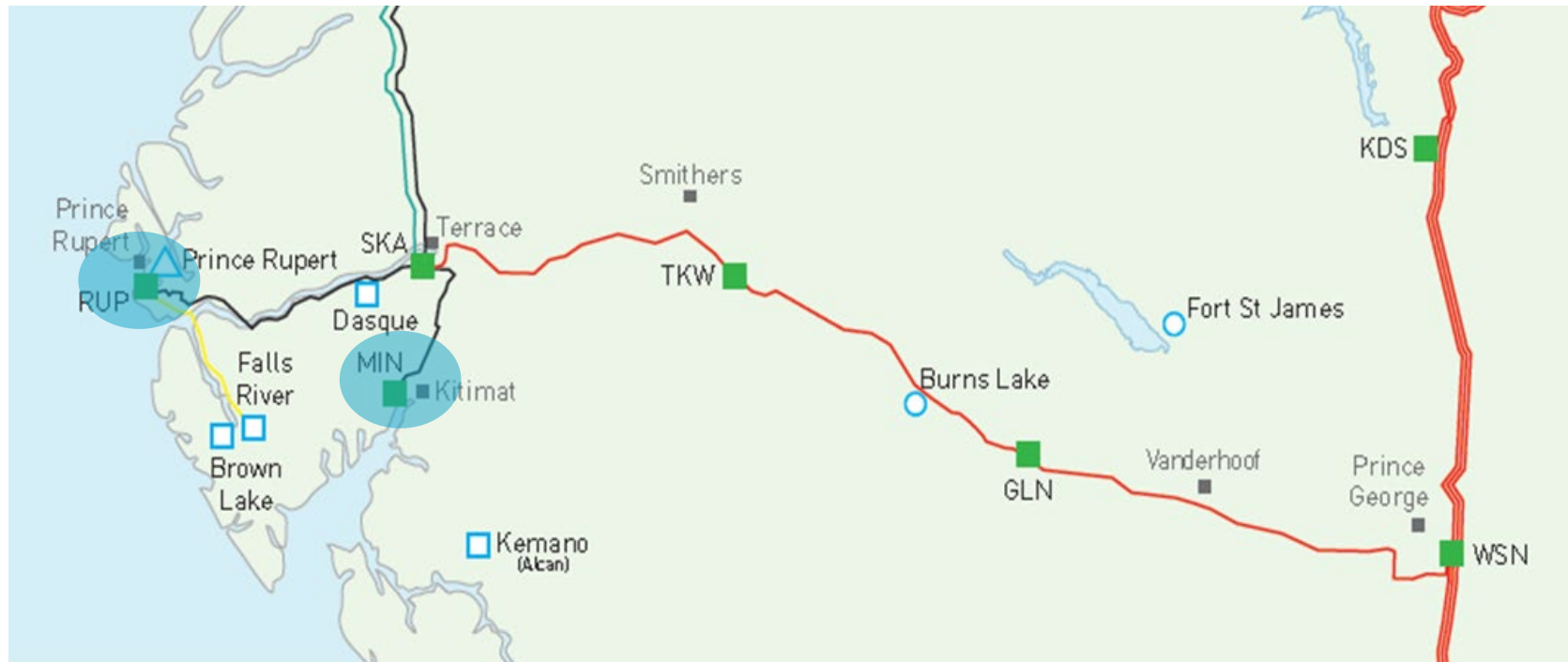
# Incremental electricity demand

Analysis shows incremental demand relative to BC Hydro reference case



# North Coast and Peace Region scenarios

Electrification of future LNG and gas extraction can add significant electricity demand in addition to general electrification





# Feedback on electrification scenarios?

The scenarios will help inform near term actions and longer term strategy

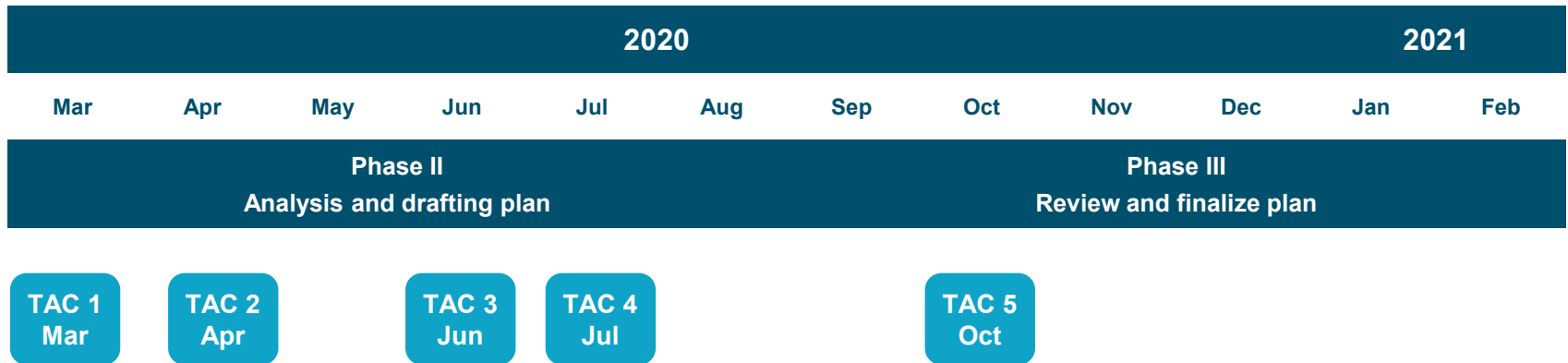
- System-wide and location-specific scenarios provide a range of loads
  - Test requirements for new generation and transmission
  - Test role of DSM - in particular capacity focused DSM
  - Will show location (regionally) and timing needs
  - Will allow BC Hydro to compare against its own ability to deliver
- This should be sufficient for this IRP term
  - Will inform on key question – “how to prepare now for large, sudden, uncertain load increases?”
- Is there something that you think we are missing?

# Session schedule & next steps

Basil Stumborg, BC Hydro

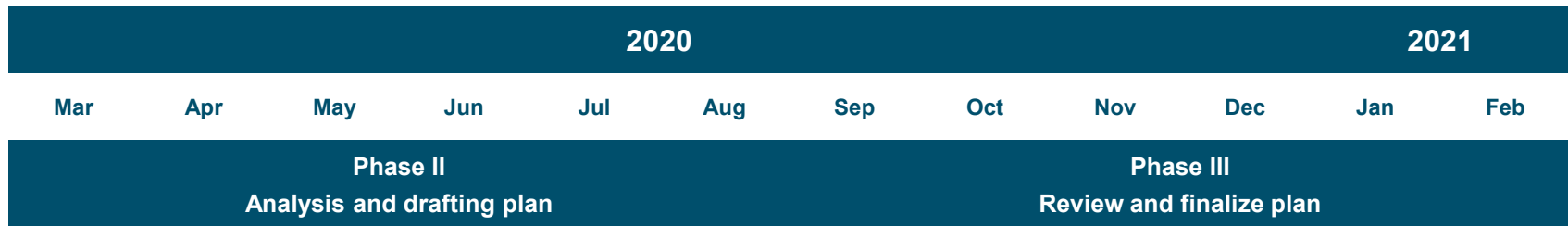
# Technical engagement roadmap

What is the best use of TAC’s time over the next several meetings?



# Technical engagement roadmap

What is the best use of TAC’s time over the next several meetings?



**TAC 1**  
Mar

- Legal scope
- Policy context
- Scope of analysis
- Key questions
- Decision framework
- Electrification scenarios

**TAC 2**  
Apr

- Load forecast (LF) methodology
- LF results
- LF uncertainties
- Load resource balance
- Resource options
- IPP renewals
- DSM options
- Non-financial impacts
- Key questions
- Key uncertainties

**TAC 3**  
Jun

- Preliminary model runs (mid, electrification)
- System needs
- Regional impacts
- Key uncertainties
- Contingency planning

**TAC 4**  
Jul

- Key questions addressed for Base Resource Plan (BRP)
- Tradeoffs considered for BRP
- Key questions addressed for Contingency Resource Plan (CRP)
- Tradeoffs for CRP

**TAC 5**  
Oct

- Draft BRP
- Draft CRP
- Preparatory actions
- Contingent actions
- Signposts, on ramps and off ramps

# High-level workplan for TAC

BC Hydro would like to hear from TAC regarding its level of interest for the various topics raised

Some questions for TAC to start to wind down this day:

1. Given the rough workplan, is there anything missing in the up front steps that you would like to see explored?
2. How would you like BC Hydro and TAC to prioritize information brought back for the next meeting? (dotmocracy exercise)
3. Given the list of topics and the group's prioritization, would you be open to a two-day meeting in mid-April?
4. Review potential dates for mid-April and mid-June now.

# Round table close of session

## Closing thoughts from TAC participants

Given your opening comments and the prioritization discussion:

- Any additional thoughts to share
- Any additional questions
- Any concerns about this process



**BC Hydro**

Power smart