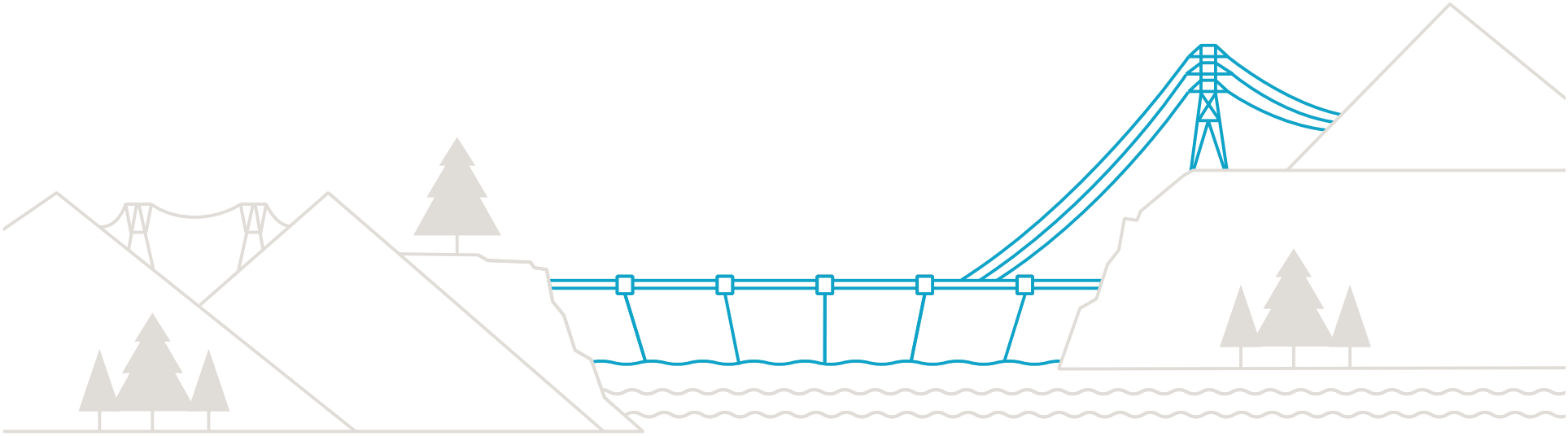
Interconnections Benchmarking Overview



July 25, 2016

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Agenda

- Introduction
- Interconnections Overview
- Benchmarking Background & Process
- Key Findings, Themes & Issues
- Recommendations & Our Plan
- Questions

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Interconnections Overview

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Who is Interconnections?

The face of BC Hydro to interconnection customers.

We…

- Work with large load customers and energy suppliers and BCH owned generation facilities to manage their interconnections to the BC Hydro grid
- Manage interconnection policies, standards, and agreements
- Oversee the interconnection from early discussions with customers to application submission through operation
- Act as “PMs” during early phases of the project

Interconnections is Responsible For

- IPPs : T-IPPs and D-IPPs
- Loads : T-Load and major distribution
- Transmission Line Relocations (“TLRAs”)
- Major Pipeline ROW/Property Assessments
- Telecom/Shared Assets (T-Telecom and D-Telecom)
- Focus Today is T-IPPs and T-Loads
    - Findings and recommendations are relevant to other interconnection streams

Generator Interconnections

For Transmission Generator Connections the Open Access Transmission Tariff is the governing tariff.

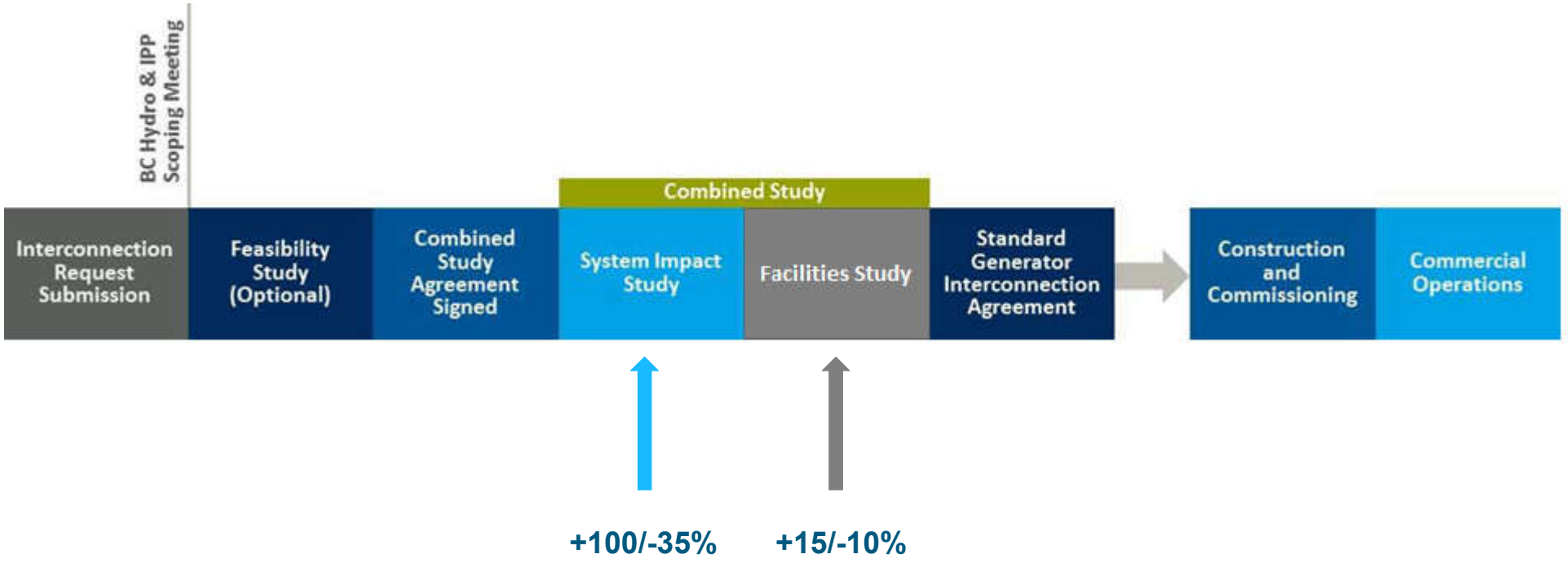
SGIP is Attachment M-1 of the OATT

- Defines end-to-end process
- Defines steps for each study phase
- Prescriptive timelines

The Queue = First-Come First-Serve

The SGIP Process

From first contact to commercial operation.



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Load Interconnections

For Transmission Load connections Tariff Supplement #6 (Facilities Agreement) is the governing tariff.

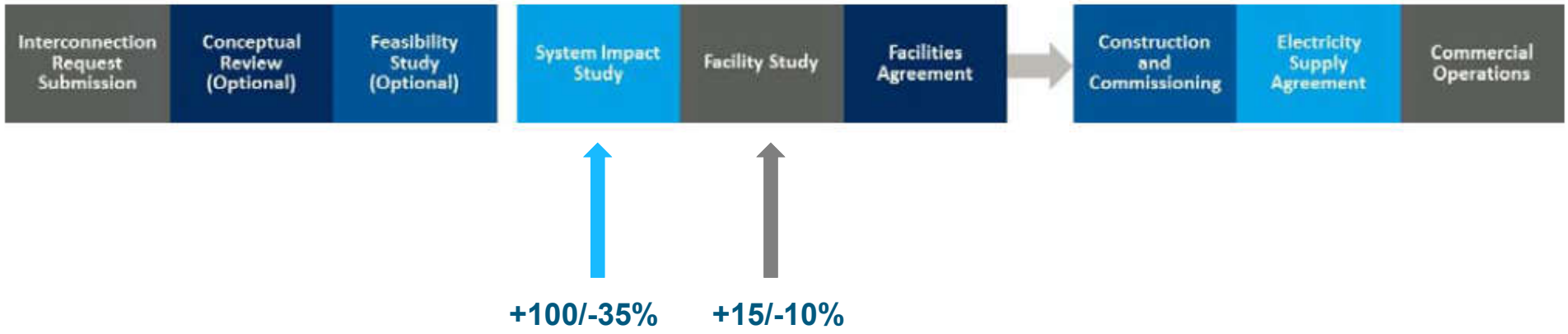
- The tariff defines how costs associated with a new connection are to be treated and what BC Hydro's and the Customers' obligations

Load Interconnections Process is a Business Practice

The Queue = First-Come First-Serve

The Load Interconnections Process

From interconnection request to commercial operation.



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IPP & Load Portfolio Snapshot

Phase	T-Load	T-IPP
Application	19	3
EPA Renewals	0	2
Feasibility or Screening Study	0	4
SIS	5	12
In transition SIS to FS	11	0
Facilities Study	7	8
Implementation	9	16

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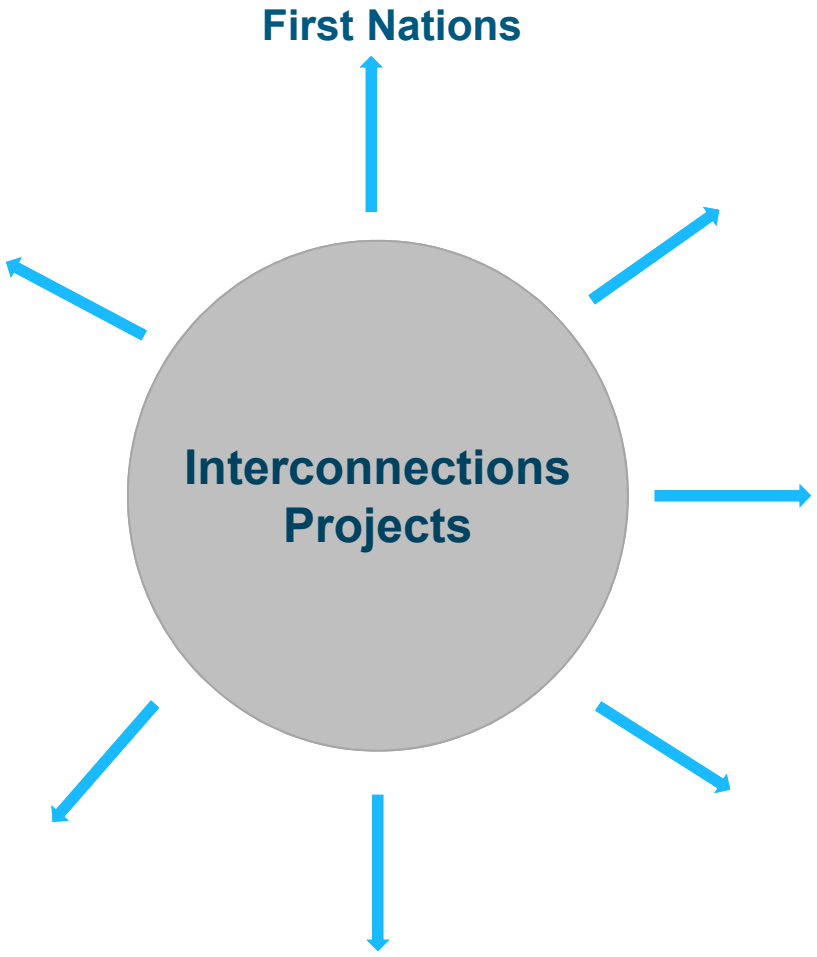
Customer Interconnections

- Interconnecting a customer requires BC Hydro plans, designs, constructs and commissions a capital project in order to connect customers

- This involves extensive coordination of customer requirements and schedules with BC Hydro requirements and schedules to properly take or provide electrical services

Key BCH & External Stakeholders



BC Hydro Departments

- Aboriginal Relations
- Energy Planning
- Energy Procurement
- Engineering
- Finance
- Key Accounts
- Legal
- AIM Planning
- Project Delivery
- Properties
- Real Time Operations
- Regulatory

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Challenges

- Coordination of customer schedule with BCH schedule
- Information availability & changes
- Frequent customer-initiated changes
- Volume of requests vis-à-vis BCH resources (Regional)
- System Capacity/Constraints
- Recent requests involve emerging technology & requirements new to BCH

Benchmarking Background

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Benchmarking Background

Why we did a review.

1. Interconnections Objective, we are committed to:
    - ✓ Customer service
    - ✓ Responding to customer feedback
    - ✓ Continuous improvement

1. Industrial Electricity Policy Review recommendation

2. Informing current and future regulatory applications e.g. Rate Design Application and OATT amendments

Benchmarking Process

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Benchmarking Process

How we did it.

We contracted Black & Veatch (B&V) to complete a:

- ❑ Comprehensive review of our transmission interconnection processes
- ❑ Jurisdictional review & comparison

Benchmarking Process

How we did it.

- B&V interviewed:
  - 9 x Customers
  - 2 x Service Providers
  - Over 20 BCH internal stakeholders
  - 8 x Peer Utilities
- B&V reviewed CEBC paper
- B&V conducted follow-up workshops

Peer Utilities Interviewed

UTILITY	LOCATION	INTERCONNECTION TYPE	
		GENERATOR	LOAD
Alberta Electric System Operator (AESO)	Canada	●	●
Arizona Public Service	USA	●	●
BC Hydro	Canada	●	●
Duquesne Light Company	USA	●	●
Hydro Quebec	Canada	●	●
Northern Indiana Public Service Company	USA	●	●
Nova Scotia Power	Canada	●	●
Ontario Energy Board (Proxy for Hydro One)	Canada	●	●
Southern California Edison	USA	●	●

BCH vs. Peers

Accurate Peer comparison is challenging.

- Data availability and quality
- Political, regulatory and economic environment
- Planning philosophy
- Volume of interconnection work vis-à-vis utilities other capital portfolio
- Presence of ISO in some jurisdictions
- Geography
- Generation and load mix – predominantly hydroelectric
- Government-owned

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BCH vs. Peers

What we heard from 8 of our peers.

- Customer feedback and issues similar to peer utilities
- BC Hydro is in line with peers
- Volume of requests BCH received in last 3 years is unparalleled

Key Findings, Themes & Issues

Key Findings

What we heard.

"The process is well defined"

"BCH is responsive"

"Communication is frequent and effective"

Mixed feedback from customers

"Get to go or no-go decision quicker"

"Studies take too long & cost too much"

"More value for money"

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Key Themes

B&V identified 7 themes from their review.

- Queue MGMT
- Study Phases
- Project Delivery (Implementation)
- Customer Interaction
- External Service Providers (ESPs)
- Information
- Other

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Issues

Common Issues.

- High costs of studies
- Time to complete studies
- Inadequate staffing levels to complete studies
- New project delivery process needs to align with customer-driven projects
- Dependence on PM contractors
- Customer interaction level - responsiveness and effectiveness
- Getting to a ‘go or no-go’ decision faster
- Quality of ESP work vs. BCH work

Queue MGMT	Study Process	IMP	Customer Interaction	ESPs

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Issues

T Load Interconnection Specific Issues.

- Lack of clarity of the interconnections processes
- Lack of clarity in queue management process
- Lack of clarity in TS#6 security / revenue credit formula
- Requested customer information for SISs often not available

Queue MGMT | Study Process | IMP | Customer Interaction | ESPs

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Issues

T Generator Interconnection Specific Issues.

- Time to complete studies greater than OATT timelines
- Requested customer information for Feasibility Studies and SISs often not available
- Limited visibility into existing network stability constraints
- Lack of flexibility in dealing with customer-identified project options
- Applicability of automatic switching requirement if customer is willing to accept lower reliability

Queue MGMT	Study Process	IMP	Customer Interaction	ESPs

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Recommendations &Our Plan

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Recommendations

Common Recommendations.

- Put processes through Work Smart (LEAN principles)
- Develop streamlined SIS and FS processes for small projects
- Engage earlier on technical discussions to get to no quicker
- Dedicated group of PMs to deliver interconnection projects
- Allocate more interconnection work to internal engineering instead of service providers
- Improve transparency and quality of information through website improvements and periodic customer workshops

Queue MGMT | Study Process | IMP | Customer Interaction | ESPs

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Recommendations

T Load Interconnection Recommendations.

- Continue industry and stakeholder engagement through the RDA
- Develop and post business practices and guides
- Revise study templates
- Develop study assumption agreement

Queue MGMT | Study Process | IMP | Customer Interaction | ESPs

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Recommendations

T Generator Interconnection Recommendations.

- Develop optional pre-interconnection study choices for customers
- Evaluate and consider customer election of desired reliability
- Evaluate and consider customer design/construction options (e.g. tap)
- Tighten requirement related to obtaining customer's as-built information
- Amendment to the OATT to align with changes

Queue MGMT | Study Process | IMP | Customer Interaction | ESPs

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Our Plan

- Reviewing and prioritizing key recommendations with the goal of implementing key recommendations by end of March 2017
- Engaging customers and associations to discuss pros/cons of certain recommendations
- Implementing questionnaires to obtain customer feedback for continuous improvement

Smart about power in all we do.

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Questions

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