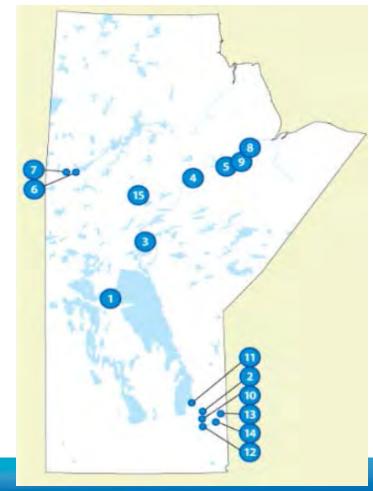
Keeyask Project Overview

- Lorne Midford P. Eng, MSc Vice President, Generation & Wholesale
- Jeff Strongman P. Eng, MBA Keeyask Business Manager
- Dave Bowen P. Eng, MSc– Keeyask Project Director

Manitoba Hydro System

Generation:

• 15 Hydro Generating Stations



Transmission:

- 3 HVDC converter stations
- 18,500 km of transmission lines
- Bipole I & Bipole II
 - 1,800 km HVDC



Keeyask Overview

- Collaborative effort between Manitoba Hydro and 4 Manitoba First Nations working together as the Keeyask Hydropower Limited Partnership (KHLP).
 - Tataskweyak Cree Nation and War Lake First Nation (acting as the Cree Nation Partners);
 - York Factory First Nation; and
 - Fox Lake Cree Nation.
- The Partnership is governed by the Joint Keeyask Development Agreement (JKDA).
 - Long-term revenue opportunity for KCN communities
 - Training, employment and business opportunities during construction.

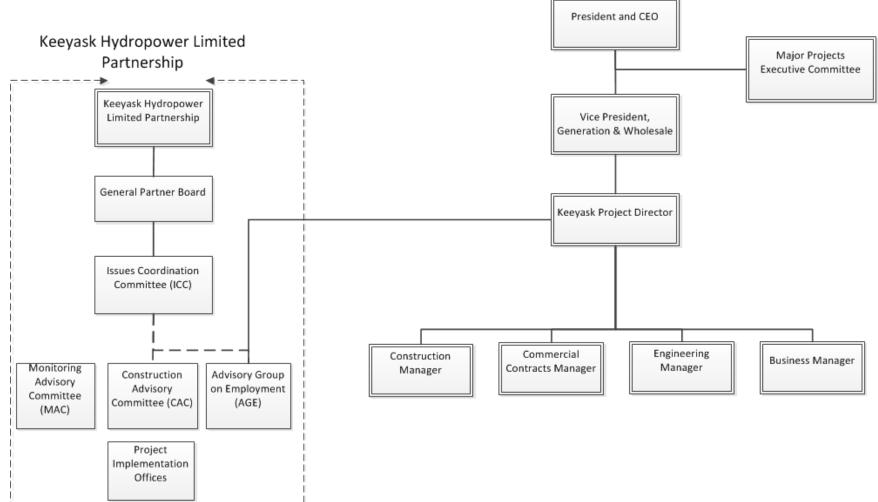
Respecting the Communities

- Incorporating the Cree world view into the project activities
- Face in the rock
- Community Liaison staff
- Involvement from partner communities





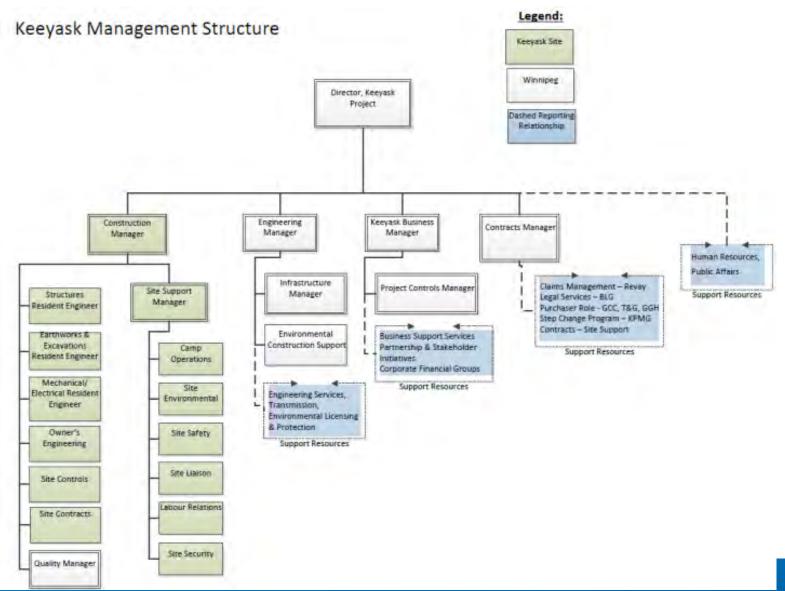
Project Governance Structure



Major Projects Executive Committee

- Established in early 2016.
- Oversees, directs, and make strategic decisions on Manitoba Hydro's major capital projects.
- Membership includes:
 - The President & CEO
 - VP Transmission
 - VP Generation & Wholesale
 - VP HR & Corporate Services
 - VP Indigenous Relations
 - VP Finance & Strategy
- Meeting every 2 weeks (or as required)

Project Execution Team



What are we Building?

A 695-megawatt hydroelectric generating station

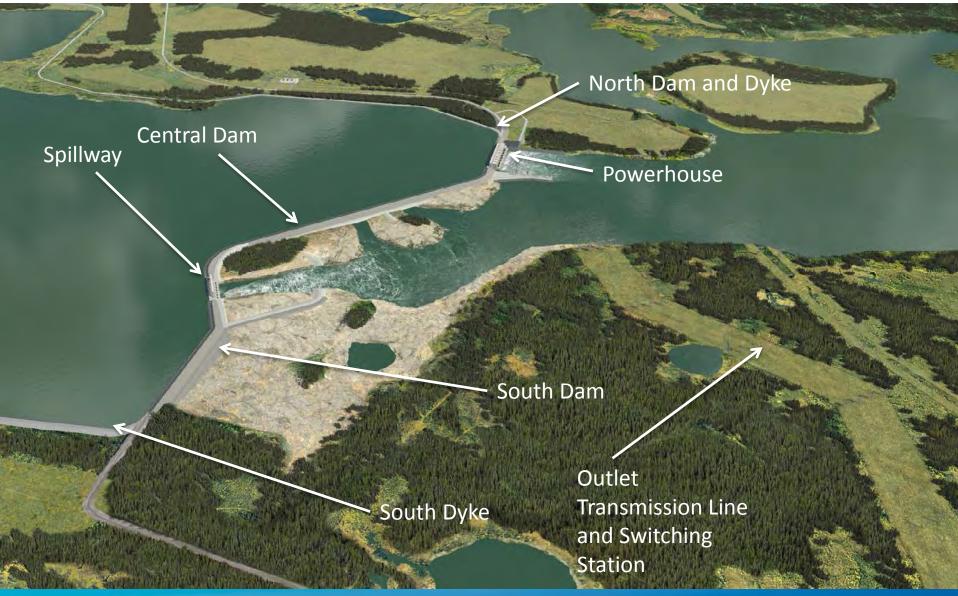
Keeyask Project includes:

- Powerhouse
- Spillway
- Dams & Dykes
- All supporting infrastructure (camp, roads, cofferdams)
- All required transmission facilities

Project Location

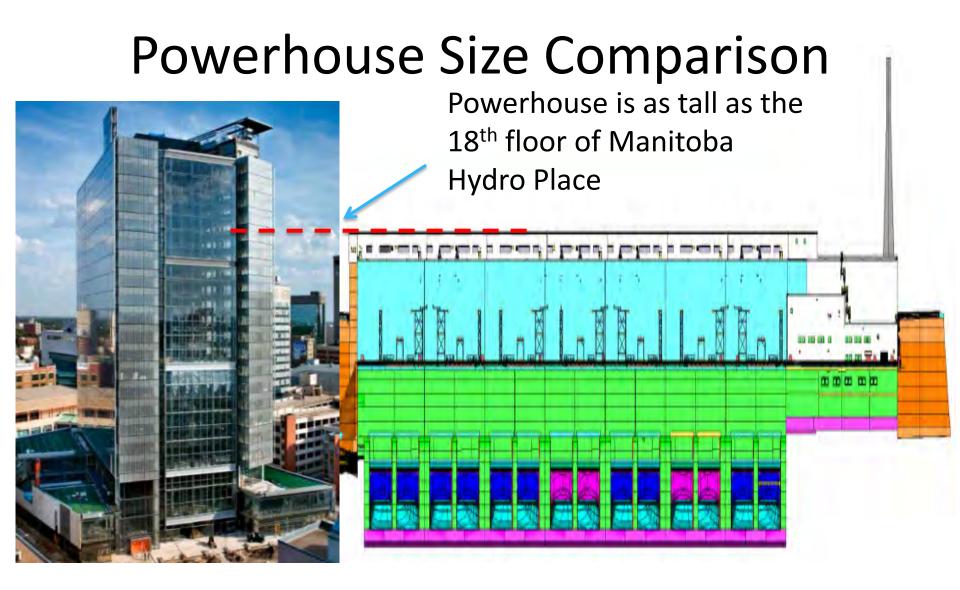


General Arrangement



Powerhouse Rendering

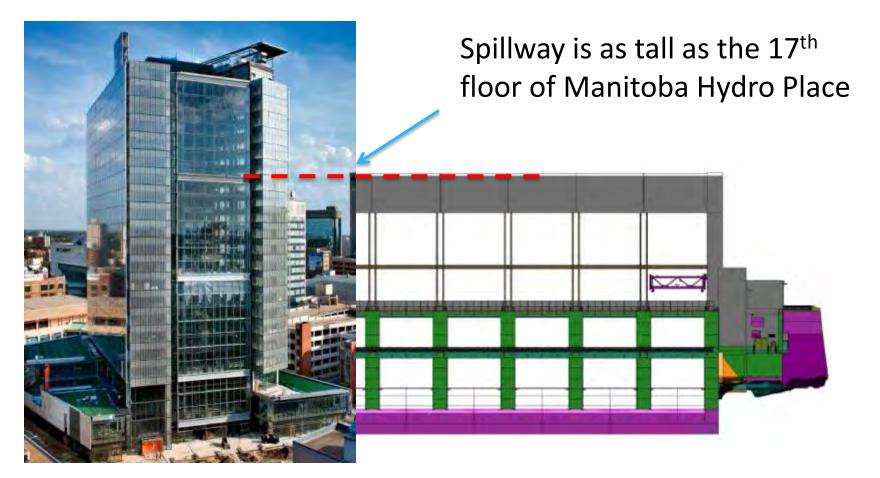




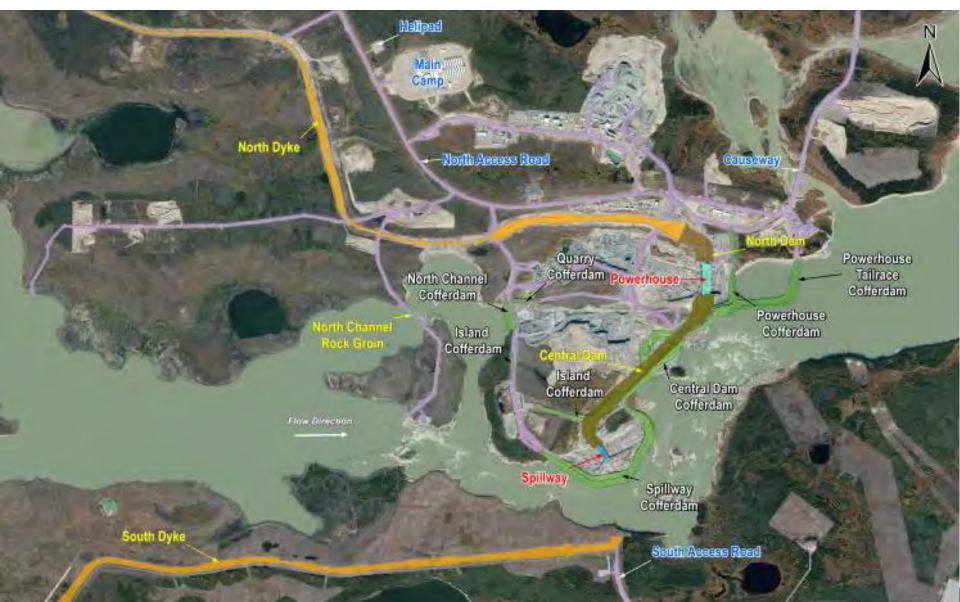
Spillway Rendering



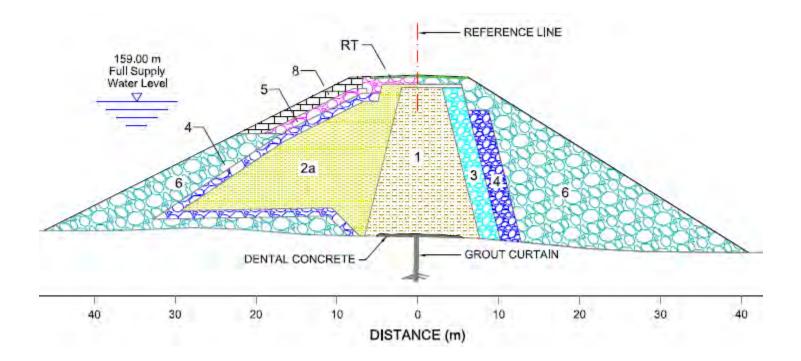
Spillway Size Comparison



River Management Structures

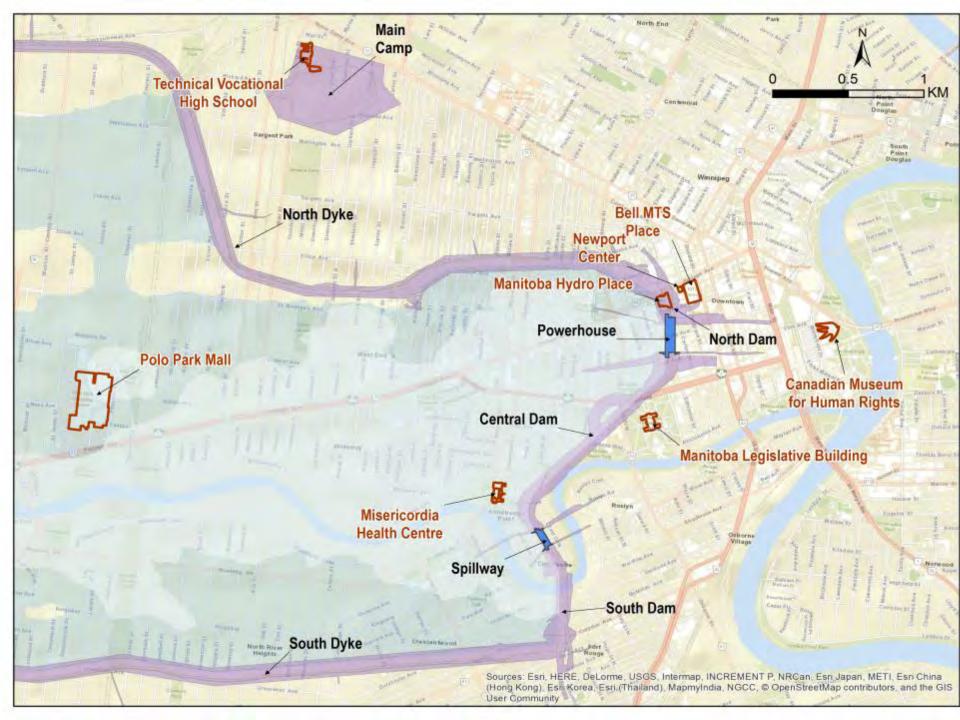


Typical Cross Section of a Dam



Dam and Dyke Construction "Getting off the rock"









Infrastructure



Keeyask Transmission

The Keeyask Transmission Project fulfills two purposes:

- Provide power to the Keeyask site during construction of the GS;
- Facilities required to integrate power generated by Keeyask (when online) into the Manitoba Hydro system.



Lessons learned

- Experience gained from past projects:
 - Early contractor involvement;
 - Contracting model;
 - Third-party reviews;
 - Continuous improvement and rigorous oversight;
 - Project integration;
 - Contract interfaces;

Complex Project Environment

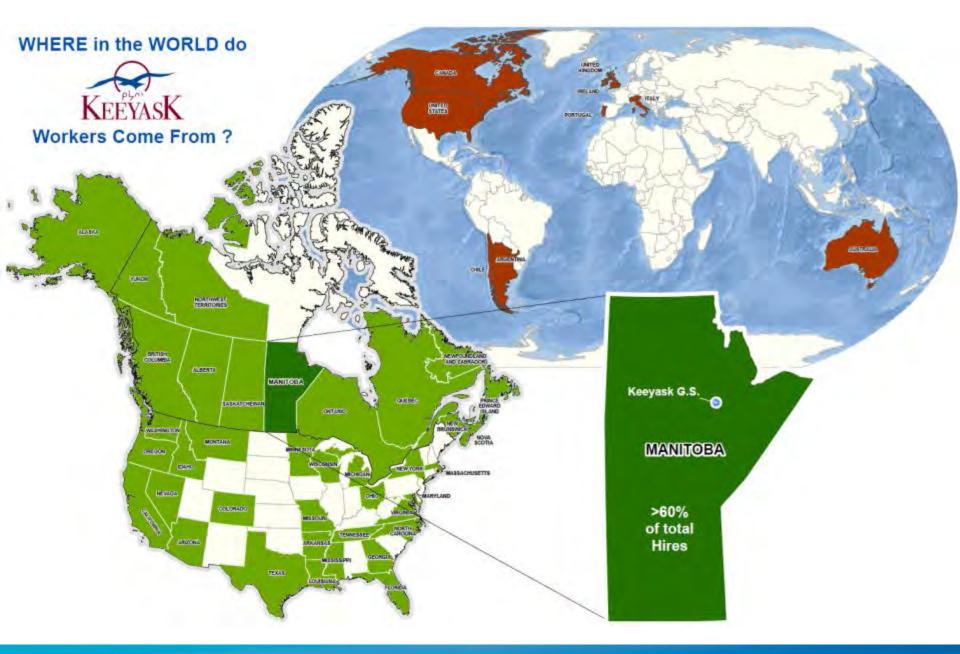


Employment

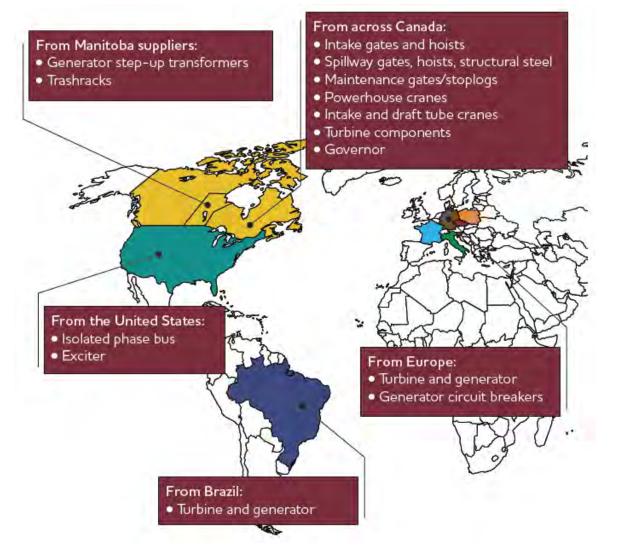
- Employment milestone reached this summer on Keeyask.
 - 2 million person hours worked by KCN members
 - 4 million person hours worked by Indigenous employees
- 73% of total hires are Manitobans.







Global Supply Chain



Keeyask Project Safety

- Strong safety culture
- Over 15 million person hours worked
- Better than industry standards
- GCC has gone over a year without a lost time incident
- MH and all our contractors will continue to focus on our goal of zero injuries

Delivery Strategy

- Contracting model for each scope of work.
- Considers market capacity
- Risk allocation

Types of Contracts

- Cost-reimbursable
- Target price
- Fixed price
- Unit price

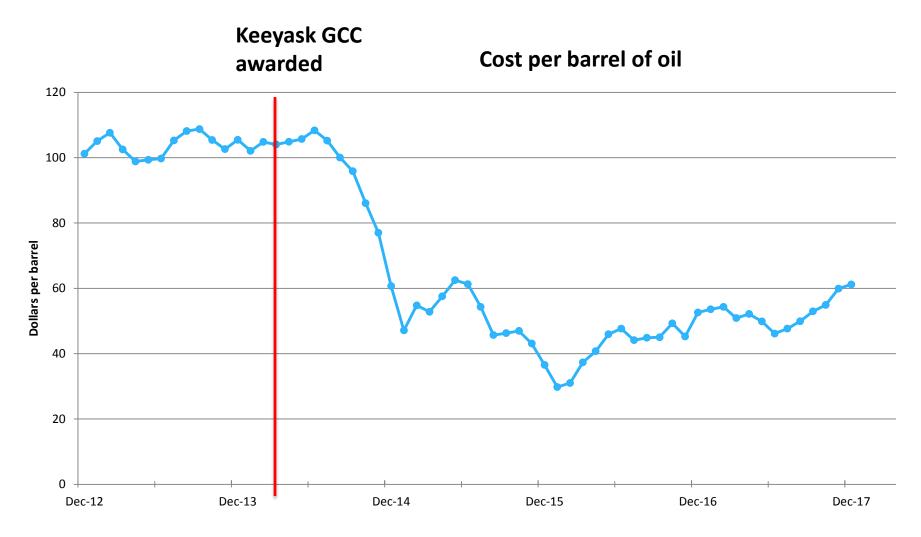
Major Contract Types

Contract	Contractor	Contract Model
General Civil Works	BBE Hydro Constructors	Target Price
Camp Operation Services*	Fox, York & Sodexo JV	Cost Reimbursable
Main Camp	Britco	Fixed Price
Turbines & Generators	Voith Hydro	Fixed Price
Engineering – Final Design	Hatch	Cost Reimbursable with Cap
Maintenance Services*	Maintenance Services JV	Cost Reimbursable
South Access Road*	Amisk Construction	Unit Price
Reservoir Clearing*	Amisk Construction	Unit Price
Spillway GGH	Canmec Industriel	Fixed Price
Intake GGH	Canmec Industriel	Fixed Price
Security Services*	Fox, York and Sodexo JV	Cost-reimbursable
Directly Negotiated Contract (DNC) with KCN businesses		Contract Complete

General Civil Contract

- General Civil Contract awarded to BBE in 2014.
- Largest contract on the project and includes:
 - Cofferdams,
 - Rock excavation,
 - Concrete structures,
 - Earthworks structures,
 - Electrical and mechanical work.

Keeyask GCC Tendered in 'Hot' Market



GCC Procurement

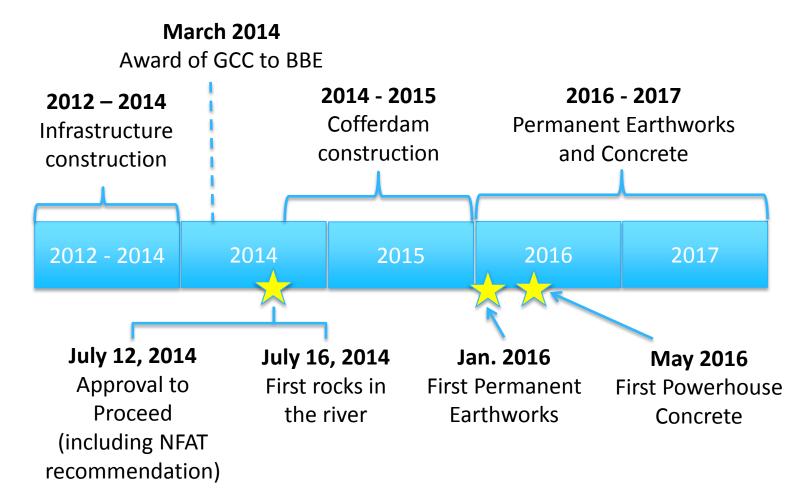




General Civil Contract

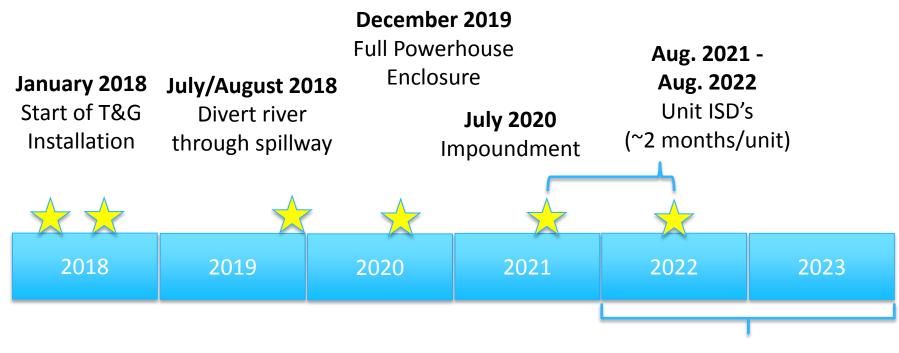
- Target price contract where the contractor is reimbursed for actual costs.
- Contractor has profit at risk.
- If the project cost is over the target the contractor loses a proportional amount of his profit margin and overhead.
- If the cost is under the target, the contractor shares a portion of the savings and gets his predetermined profit and overhead set out in the contract.

Construction Milestones Achieved





Future Construction Milestones

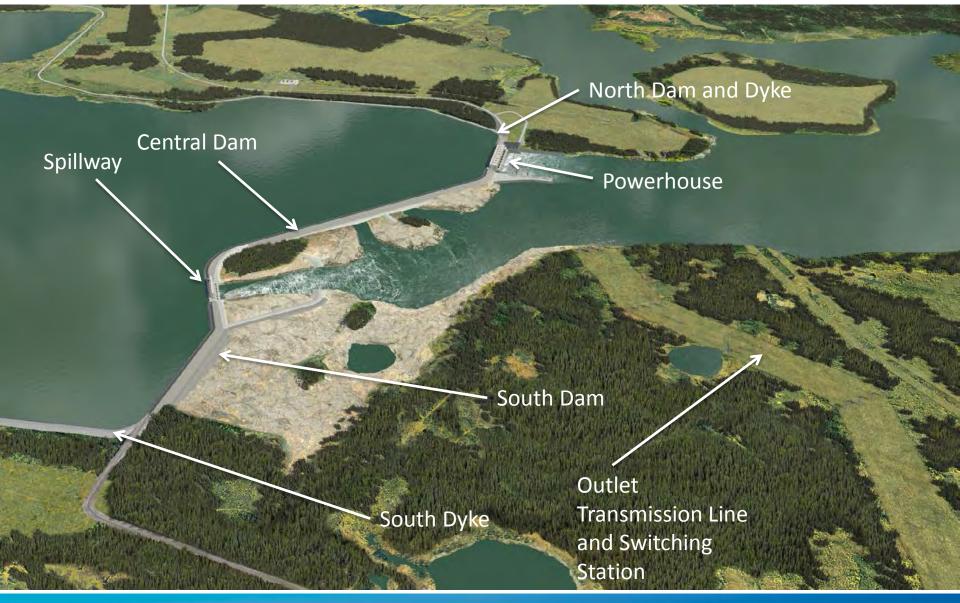


February 2017 Control Budget = \$8.7B Unit 1 ISD = Aug. 2021



2022 - 2023 Infrastructure decommissioning & environmental rehabilitation.

General Arrangement



Powerhouse Rendering





Powerhouse Construction

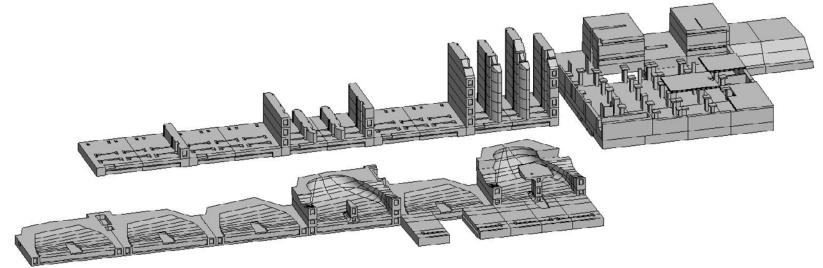


2016 Powerhouse Construction



Powerhouse Complex





2017 Powerhouse Complex



2017 Powerhouse Complex



Powerhouse – Current Status



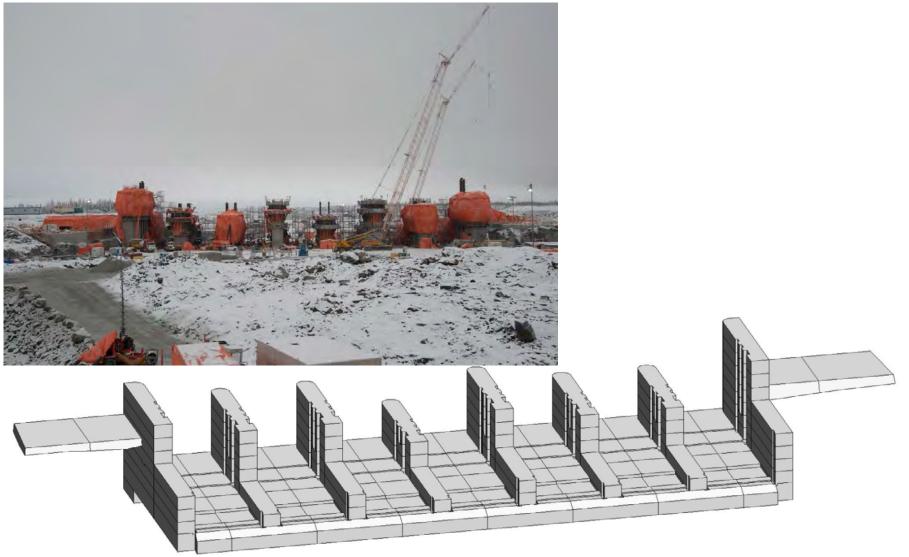
Spillway Rendering



2016 Spillway Construction



End of 2016 Spillway



2017 Spillway



Spillway - Current Status



January 11, 2018

North Dyke

---- North Dam

Powerhouse Complex

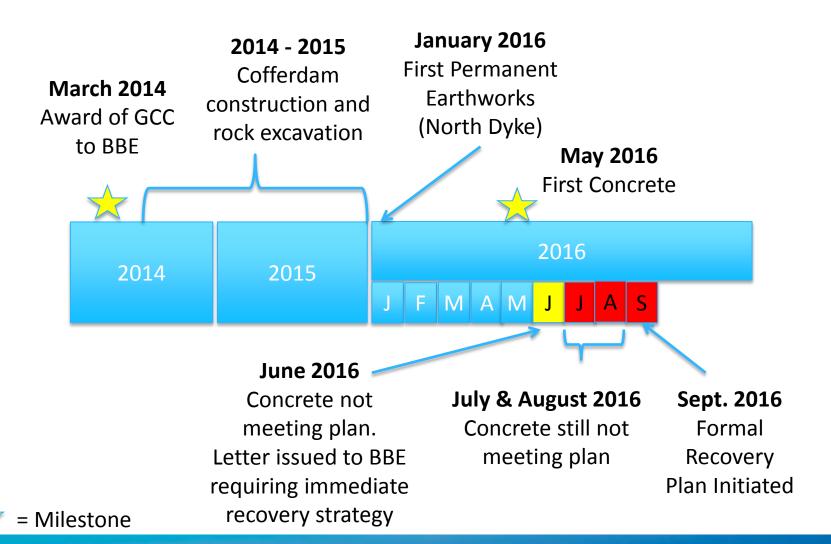
Central Dam



Construction Update Video

2 minutes, 30 seconds

Timeline of 2016 Challenges



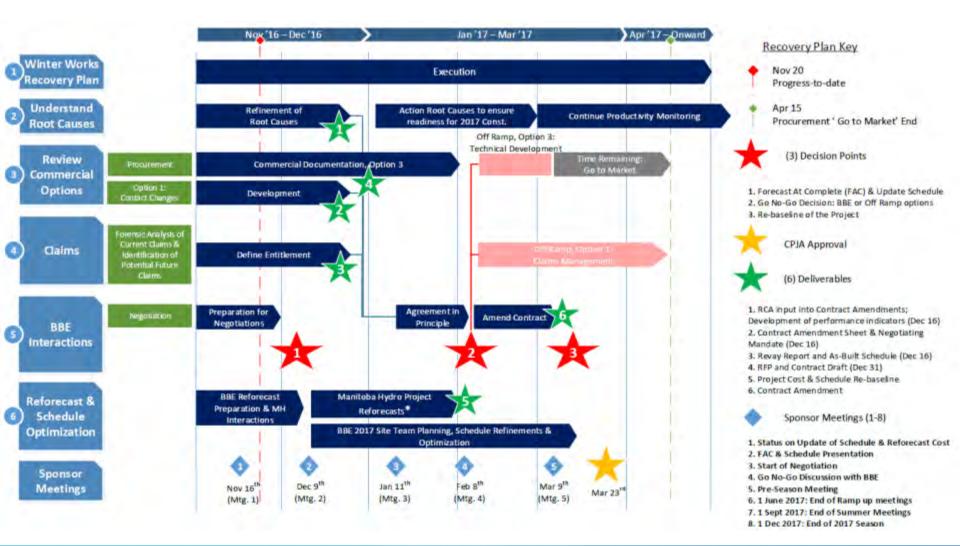
2016 Recovery Plan

- A call to action for BBE's project team, Executive Sponsors and CEOs.
- The development of a plan for the continuation of concrete through severe winter months.
- Identifying root causes of performance issues
- Initiating activities to reforecast the cost and schedule for the project.
- Undertaking analysis around Contractor's claims.
- Supplementing the commercial expertise of the Manitoba Hydro team.

2016 Challenges

- In 2016 the GCC only achieved 41% of the concrete plan and 65% of the earthworks plan.
- Main contributing factors were:
 - Aggressive concrete production assumptions by Contractor
 - Slower than planned progress in ramp-up on site, and
 - Actual experience with geotechnical and geological conditions.
- Schedule rapidly changed from having a 6 month advancement opportunity to a potential 2+ year delay.

Recovery Plan Implementation



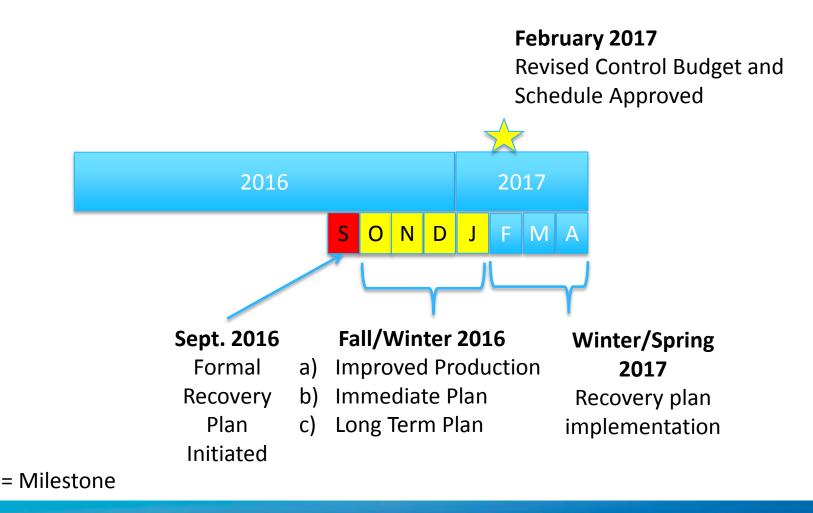
Commercial Options

- Manitoba Hydro undertook a thorough process to evaluate alternatives for and impacts to the General Civil Contract.
- The process included input from industry experts including:
 - KPMG Recovery Plan support.
 - Revay Claims valuation and management.
 - Borden Ladner Gervais LLP (BLG) Legal support.
 - Validation Estimating Contingency development.

Evaluation Outcome

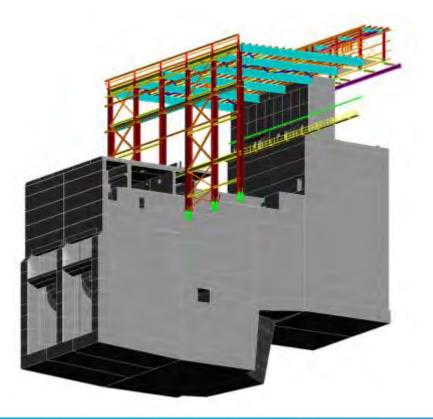
- The review demonstrated that the best course of action was to amend the existing contract with BBE.
- All other alternatives introduced significant additional risks as well as guaranteed impacts to cost and schedule that were greater than the selected option of amending the contract with BBE.

Timeline of Recovery Plan

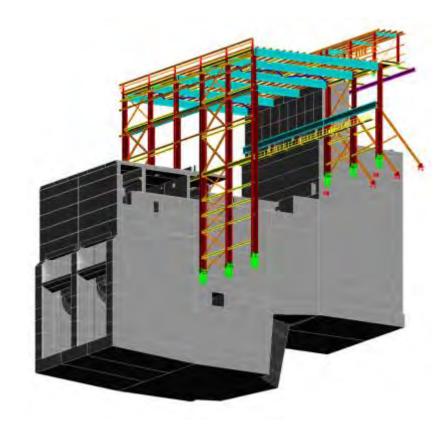


Column Extenders

Previous Design – No Column Extenders



New Design – With Column Extenders



Contract Amendment Achieved

- Manitoba Hydro and BBE were able to achieve mutual agreement that was required to amend the contract.
 - The negotiation required 'gives and takes' from both parties.
- Lowered the overall cost and schedule risk for Manitoba Hydro and allowed BBE an opportunity to re-establish a reasonable profit level.
- The terms of the agreement aligned the interests of both parties to deliver a "Best for Project" approach.

Features of the Amendment

- The details of the amendment to the contract are formalized in Amending Agreement #7 between Manitoba Hydro and BBE.
- Key features of the amendment include:
 - Contractor claims "wiped clean";
 - Schedule and cost incentive pool provides incentive for BBE to earn profit and MH to minimize Project cost and schedule;
 - General Administration & Overhead (GA&O) capped at target price;
 - Narrowed ability for future claims;
 - Liquidated damages.

Establishing a New Control Budget

Dualant in Couries Cost	Ovisional	Third Dants Decomposition ded		
Project in Service Cost	Original	Third Party Recommended		
(Billions \$)	Control Budget	Contingency		
Base Estimate Including				
Spent, Costs to Go, Interest				
and Escalation				
Delay (months)	-	11		
First Unit In-Service	Nov-19	Oct-20		
Total Base Estimate	6.2	7.8		
Contingency		P50	P75	P90
Additional Delay (months)	-	10	14	18
First Unit In-Service	Nov-19	Aug-21	Dec-21	Apr-22
Estimated Contingency	0.307	0.578	0.914	1.246
Additional Interest &				
Escalation on Contingency	-	0.339	0.464	0.588
Project Estimate				
(with Contingency)	6.5	8.7	9.1	9.6

Note: Interest and escalation are reasonable approximations; full financial-model calculations will be incorporated into control budget.

Keeyask Budget Summary

(From PUB MFR 122)

Keeyask Budget Summary (in Billions \$)

ltem #	Item	NFAT Approved	Current Approved	Variance
		Budget (2014\$)	Budget (2016\$)	
		CPJA #4	CPJA #4	
1.1	Generating Station	4.046	5.948	1.902
1.2	Generation Outlet Transmission	0.164	0.202	0.038
	(GOT)			
1.3	Escalation @ CPI	0.244	0.249	0.005
1.4	Interest (including Interest on	1.343	1.749	0.406
	Equity)			
1.5	Contingency	0.307	0.578	0.271
1.6	Labour Management Reserve	0.304	0.000	-0.304
1.7	Escalation Management Reserve	0.088	0.000	-0.088
1.8	Total	6.496 B	8.726	2.230
1.9	First in-service Date	Nov-2019	Aug-2021	21 months.

2017 Performance

	2017 Actual Quantities (m ³ rounded)	% Improvement over 2016
Concrete	86,000	~12%
Earthworks	1,030,000	~90%

- There was a significant improvement in performance over 2016 which occurred in both concrete and earthworks.
- Actual quantities were less than planned.
- However, key milestones were achieved in 2017 which maintain the schedule for the shortest duration.

2017 Key Milestones

Milestone	Date	Status
Completion of the Spillway concrete and handoff of the Spillway to the Gates, Guides and Hoists Contractor (Canmec).	November 2017	Completed on schedule
Installation of the Powerhouse Cranes in the Service Bay.	November 2017	Completed on Schedule
Enclosure of Powerhouse Units 1 and Service Bay	December 2017	Completed on Schedule
Enclosure of Powerhouse Units to allow for the start of turbine and generator work.	February 2018	On track
Significant progress on dams and dykes required to divert the river through the Spillway in July/August 2018.	July/August 2018	On track for river diversion

Milestone - Spillway Concrete Complete

October 2017

Milestone - Powerhouse Crane Installation Complete



Milestone - Enclosure of Service Bay and Unit 1

December 15, 2017

Milestone - Earthworks on Track for River Diversion in Summer 2018



2018 Plan

Improved performance by the GCC is required to meet control budget (\$8.7B) and a first unit ISD 10 months in advance of control schedule.

Main contributing factors will include:

- 2018 winter concrete and south dyke work;
- Continuing to learn from past experiences;
- Earthwork foundation preparation is now complete for 2018 work;
- Cold eyes review; and
- MH and BBE leads continuing to drive improvement;

2018 Key Risks

- With 4+ years of construction ahead there are still significant risks that have the potential to jeopardize meeting the control budget and schedule.
 - This risk is typical for projects of this scale and complexity.
- The top risks include:
 - Execution/productivity rates of the GCC;
 - Loss of site access/work stoppages;
 - Unexpected geotechnical/geological conditions at the South Dam/Dyke;
 - Unseasonable weather

Current Forecast at Completion

- Manitoba Hydro is currently forecasting the following cost and schedule outcomes for the Keeyask Project:
 - Cost A final project cost on or below the control budget of \$8.7 B.
 - Schedule A first unit in-service date in advance of the control schedule of August 2021.
 - All seven units are forecasted to be within control schedule dates.

Key Messages

- Manitoba Hydro is capable of successfully delivering the Keeyask Project and has effective governance.
 - Manitoba Hydro will continue to leverage third party expertise as required.
- Amending the contract with BBE was the best path forward with least impact to cost and schedule.
- The necessary milestones were achieved in 2017 to maintain the shortest duration schedule.
- Plans continue to be developed to cause a 10% improvement going forward to achieve our control budget.

Summary

- Hydro has a number of capital projects underway at varying levels of completion
- We are managing the risks
- We are incorporating lessons learned across the projects as we move forward
- There is a strong team in place supported by external expertise
- MH is open and transparent, gave MGF access and answered any question they had
- We want the Panel, intervenors and public to know where we are, what challenges we face, and how we address them

Bipole III Transmission Reliability Project Overview

Manitoba Hydro



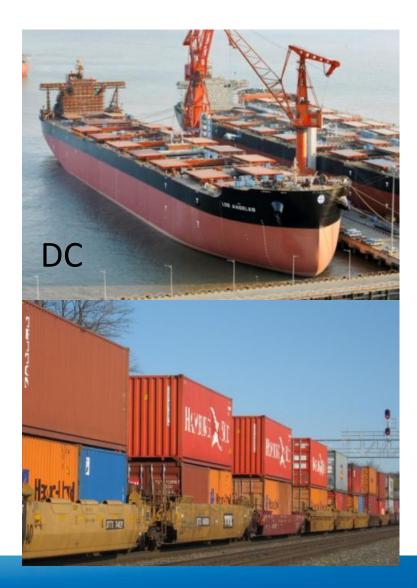
Presentation Outline

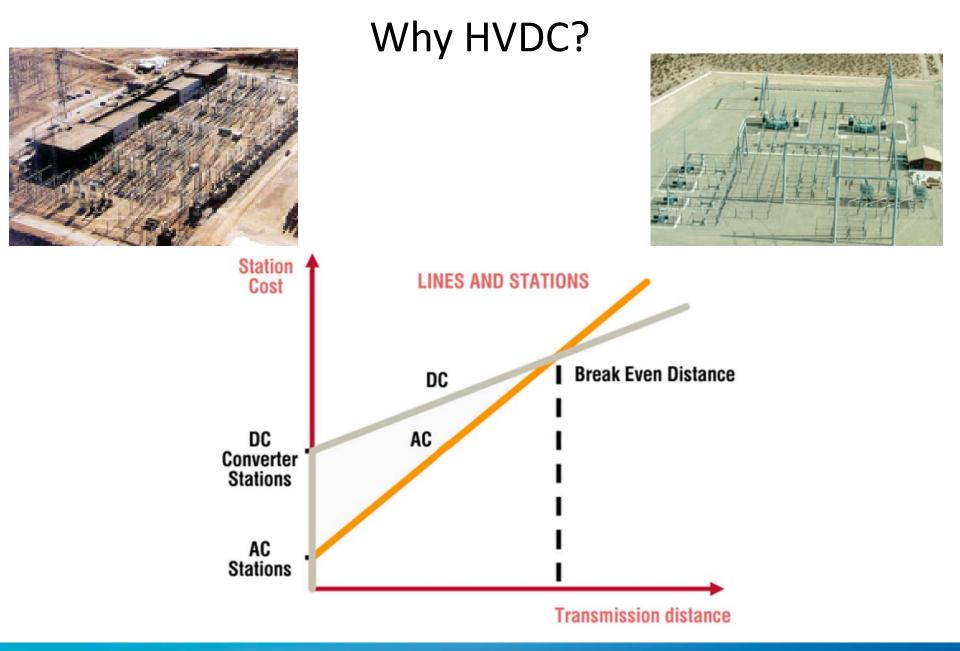
- What is HVDC
- Existing HVDC system
- Bipole III overview
- Bipole III status update
- Remaining risks
- Video

Why HVDC?

"Bulk" transmission





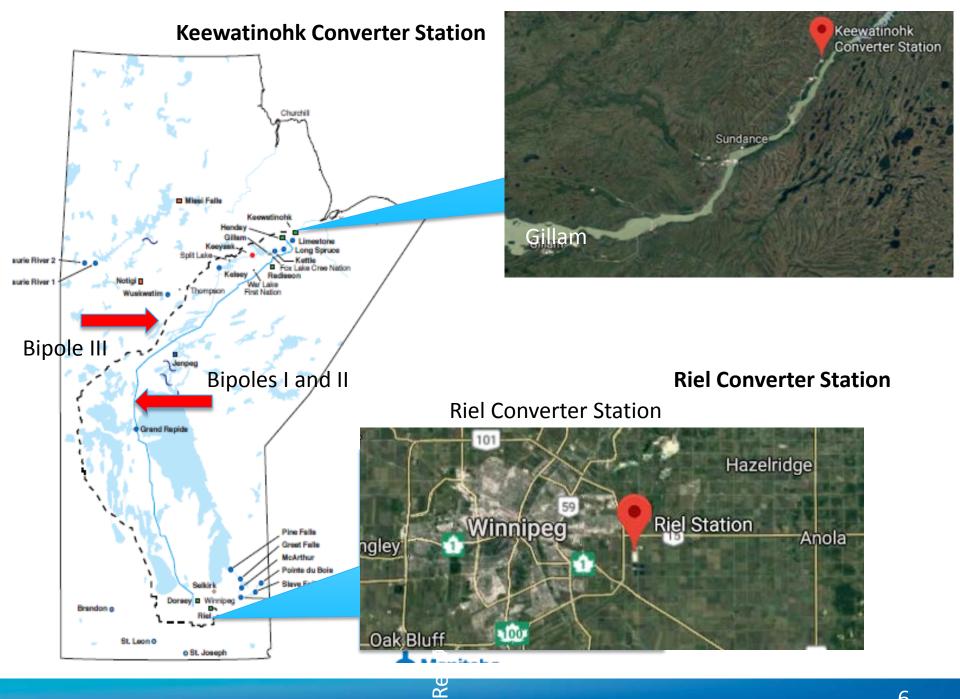


The Existing Bipole I and II System





- Link to 70% of the Province's generating capacity
- Bipole I and II HVDC lines constructed on the same Right-of-way (same corridor)
- 900km overhead lines, difficult terrain and access in the north
- Terminated at a common station – Dorsey (inverter)



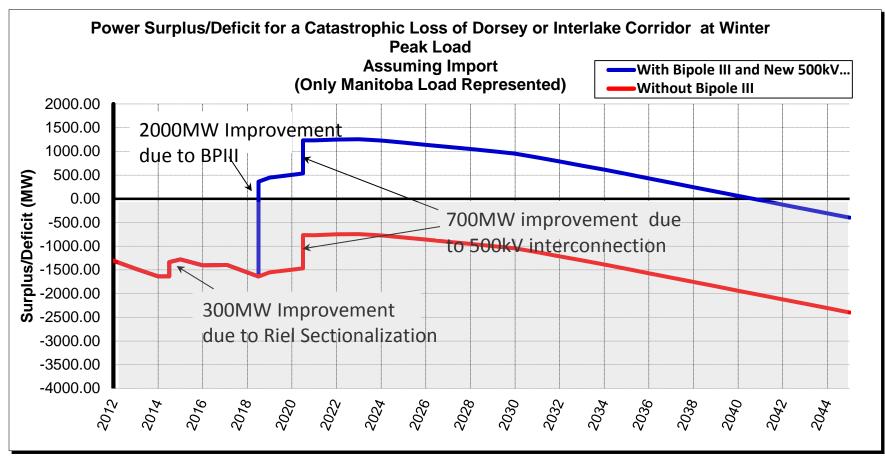
Reliability Risk – Dorsey Converter Station



Elie F5 tornado Approximately 40 km from Dorsey

- Dorsey is currently single terminus point for HVDC system
- Significant weather events (tornados, etc.) in the vicinity of Dorsey in the past
- A loss at Dorsey could mean loss of connection to northern generation for up to 3 years.

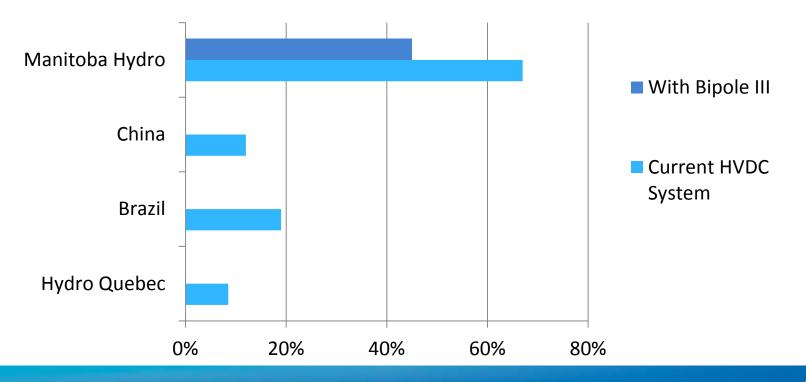
Supply Deficit



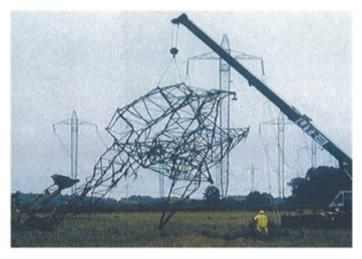
- Supply deficit of approx. 700MW for Bipole I/II line loss in winter of 2020 vs. 1,300MW surplus with Bipole III.
- Rotating blackouts for about 140,000 homes (5kW per household), even with new 500kV import line

Maximum Percentage Power through a Single Facility

- Manitoba has highest percentage of power concentrated in a single facility for a major network in the world.
- "Too many eggs in one basket"



Bipole III Overview



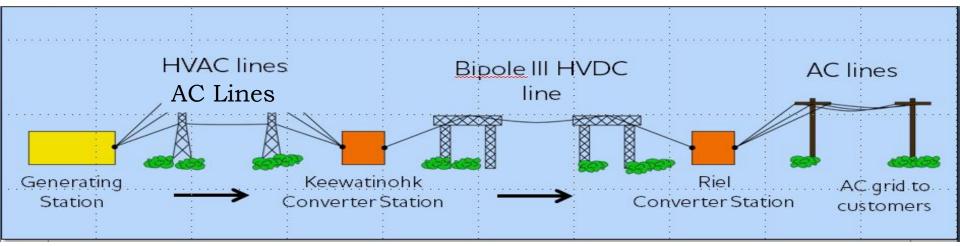


1997 wind events near Dorsey

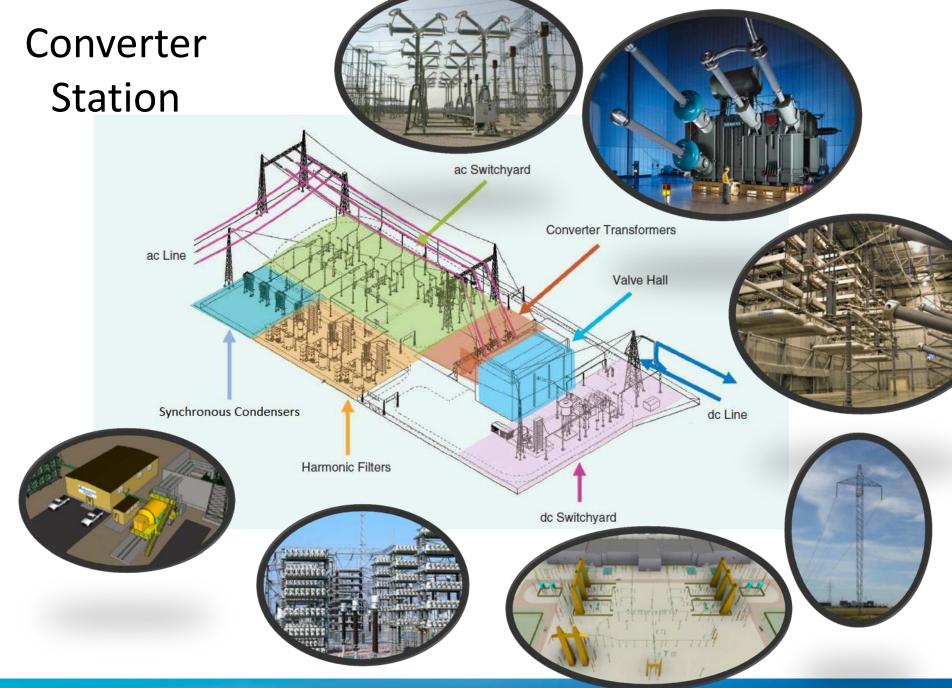
Increase reliability

- Second corridor for northern generation
- Supply deficit of 700MW with loss of Bipole 1 & 2 (~140,000 homes)
- Additional conversion facility
- Increased capacity
 - Increase of 2,000MW
 - Keeyask or associated power sale requires the transmission capacity of Bipole III

Bipole III Overview



- 230kV Collector Lines (5) to connect existing system to new Keewatinohk Converter station
- 2 HVDC Converter Stations
 - Keewatinohk Converter Station 80 Km North East of Gillam Manitoba
 - Riel Converter Station just East of Winnipeg
- 500kV HVDC Transmission Line (1384 km)
- Keewatinohk 600 person Construction Camp
- Tie into the southern transmission system



Transmission Line

Bipole III-500kV HVDC

- 500kV HVDC Transmission line
- 3,076 towers starting from Keewatinohk to Riel
- 1,388km length (actual constructed length)

Collector Lines-230kV AC

- Five AC collector lines to transfer all AC power from the Henday and Long Spruce stations to Keewatinohk
- Total length of 165km and 384 towers.

Keewatinohk Converter Station

Riel Converter Station



Bipole III Transmission Line

SCOPE HISTORY OF BIPOLE III





- Complete project re-estimate
- Based on updated line routing and environmental act Licence requirements
- Updated land acquisition costs

- LCC HVDC technology based on vendor pricing
- Includes Synchronous Condensers
- Includes costs for the Community Development Initiative (CDI)

SCOPE HISTORY OF BIPOLE III



- Actual transmission line construction unit rates (market rates)
- Updated transmission line material costs
- Southern route change

- Actual land acquisition
- Increase contingency

Bipole III Status

- Converter station construction is 91% complete
- Transmission line construction is 84% complete
- Budget is 79% spent and is on target

In Service Date July 2018

- 6 months of work left to test and energize thousands of components
 - The remaining risks are more an impact to schedule, not budget

Keewatinohk CS Current Status

- HVDC equipment has been installed at site
- AC Switchyard construction is complete and energization is well underway
- Construction on Auxiliary Buildings is complete



Riel CS Current Status

- HVDC equipment has been installed at site
- AC Switchyard expansion is complete and has been commissioned
- Three Synchronous Condenser units are onsite and under installation. One Synchronous Condenser unit remains to arrive at Riel

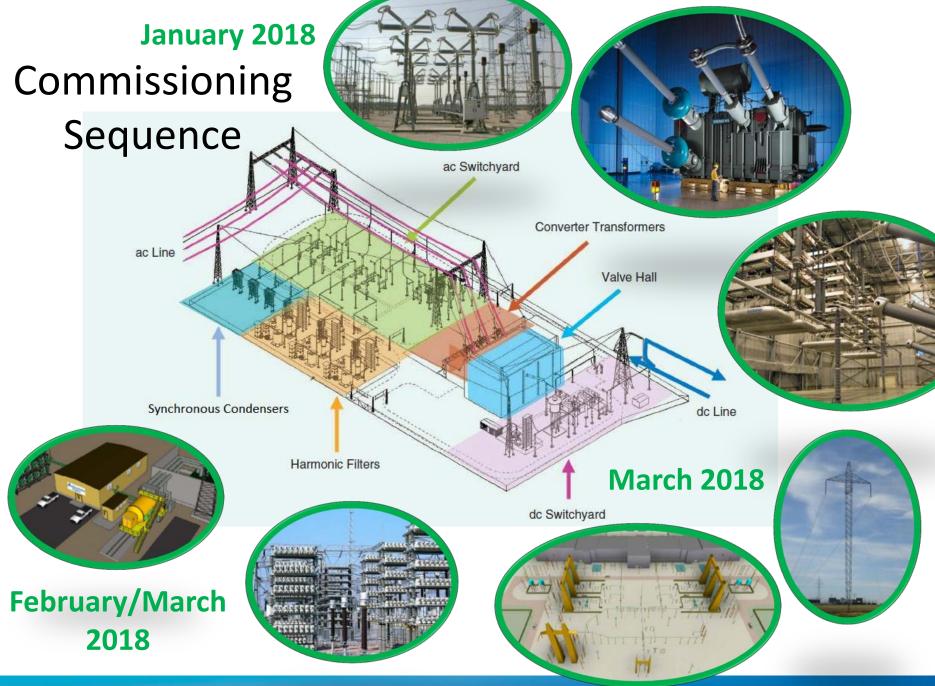


Transmission Line Current Status



- Tower anchor and foundation installation is at 99%
- Tower erection is at 84%
- Stringing is at 45%
- Transmission line construction will be complete March 2018

As of January 1, 2018



Bipole III Commissioning

- Quality assurance to ensure manufacturing of equipment meets technical specifications prior to being placed inservice
- Equipment is tested in the factory to ensure technical compliance prior to being shipped to site
- Subsystems are verified on-site prior to being connected to the Manitoba Hydro network
- Energized system testing is conducted to integrate the Bipole III HVDC system to the existing network

Integrating Bipole III into the Existing System

- Integrating a state of the art digitally controlled Bipole into a system that was designed in the 60s and 70s
- Simulated the operation of Bipole III at the factory level with over 2000 tests
- Equipment and sub systems tests over 500 equipment tests and 450 subsystem tests
- System testing approximately 250 tests
- Trial operation 30 days

Remaining Schedule Risks

- Transmission Line
 - Contractor performance
 - Weather
- Converter Stations
 - Synchronous condenser transformer delay
- Commissioning
 - 6 months of work remain to test and energize thousands of components

<u>Bipole III Video – 3 minutes</u>

Conclusion

- Construction is on schedule to be in service July 2018
- Budget is tracking to the control budget of \$5.04 Billion
- Will be an asset in operation for the upcoming fiscal year
- Capital costs will begin depreciation this year

Great Northern Transmission Line Project

David Cormie, Director

Wholesale Power and Operations

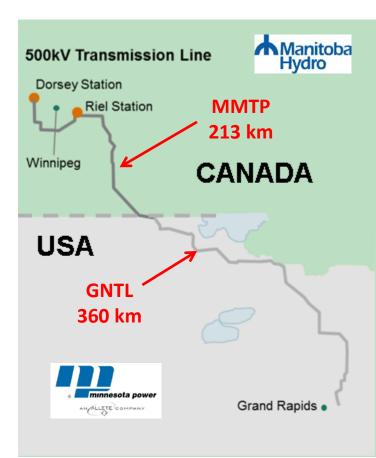


Connecting Manitoba and Minnesota



500 kV Manitoba – U.S. Interconnection

- MH Development Plan
 - Keeyask
 - New major interconnection
 - Export sales
 - Minnesota Power
 - Wisconsin Public Service
 - Northern States Power
 - SaskPower (subsequent)
- In Manitoba
 - Minnesota Transmission Project (MMTP)
- In Minnesota
 - Great Northern Transmission Line (GNTL)
- Capital cost is approximately \$1 billion



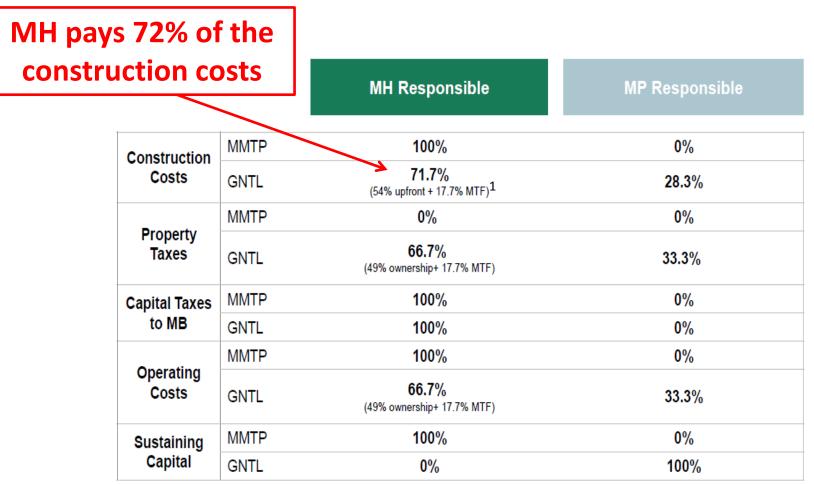
U.S. Interconnection Objectives

• Import

- Increase import capability by 100% or 700 MW
- Improve energy security, emergency response and system reliability
- Reduce import costs
- Improve market prices
- Export
 - Increase export capability by 50% or 900 MW
 - Increase export market prices
 - Improve bi-lateral market access with
 Wisconsin utilities by 600%



The 40 year MP Transmission Deal



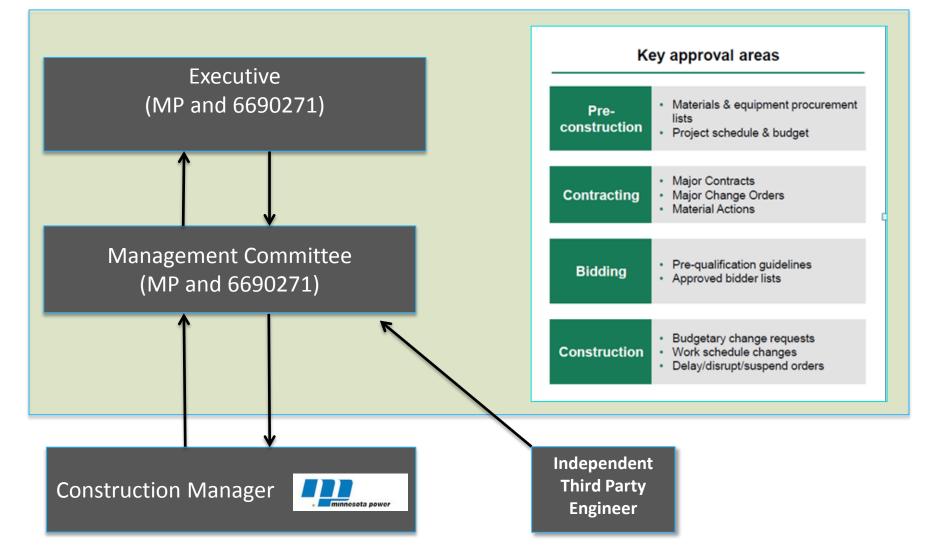
Note 1. MTF is the Monthly Must Take Fee established in Section 2.6 133 MW Energy Sale Agreement for MH use of 133 MW of MP capacity. Ownership costs on 500 MW of capacity are established through a Service Fee defined in Article 6 of the Operation and Maintenance Agreement



6690271's Role is to Protect Manitoba Hydro

- Responsible for MH's interests in the Great Northern Transmission Line
- GNTL Facilities Construction Agreement (FCA)
 - Between 6690271, Minnesota Power and MISO
- GNTL Construction Management Agreement (CMA)
 - Between 6690271 and Minnesota Power
 - Appoints Minnesota Power as Construction Manager
 - Establishes governance structure for the construction project
 - 669 has consultation and veto rights
 - Provides for an independent oversight engineer

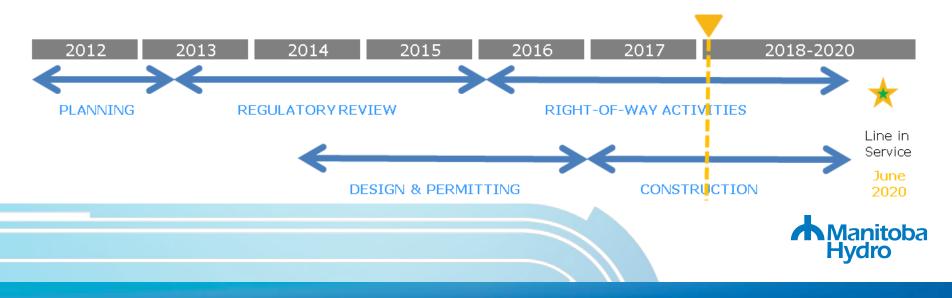
GNTL Governance



GNTL Schedule and Budget

- GNTL is on schedule for June 1, 2020
- GNTL is on budget
 - 10% spent to December 1, 2017
- MH expects GNTL to be under budget





Manitoba – Saskatchewan 230 kV Transmission Project

David Cormie, Director Wholesale Power and Operations



Saskatchewan System Power Sale Agreement

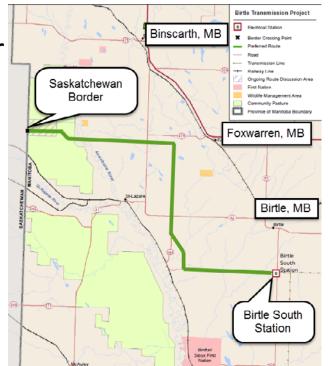
- 100 MW of capacity and firm energy
- Term is June 1, 2020 to May 31, 2040
- Existing firm export transfer capability is insufficient
- Studies indicate the need for another line
 - If project is delayed use of interim firm service, to the extent it is available, will be used
- "Both power contract and transmission line project remain economic^{1"}



Note 1. Daymark Energy Advisors Independent Expert Consultant Report SaskPower Contract-Economic Review, dated DECEMBER 15, 2017, page 24

Birtle Transmission Project

- 230kV AC transmission line
 - Length 46 km
 - Birtle Station to Saskatchewan Border
 - ISD June 2021
 - Class 2 Regulatory Approval
- 2015 Approved Budget \$57M





Major Capital Projects Summary

- Keeyask G.S.
 - On budget and schedule for ISD of August 2021
 - Several opportunities to reset for rate setting purposes if necessary
- BiPole III
 - On schedule and budget for ISD July 2018
 - Will impact 2018/19 financial results
- MMTP
 - On budget
 - Projected ISD June 2020
- GNTL
 - Budget is likely high but it is early
 - On schedule for ISD June 2020
- Birtle Transmission
 - Budget is under review
 - On schedule for ISD June 2021









Manitoba Minnesota Transmission Project (MMTP)





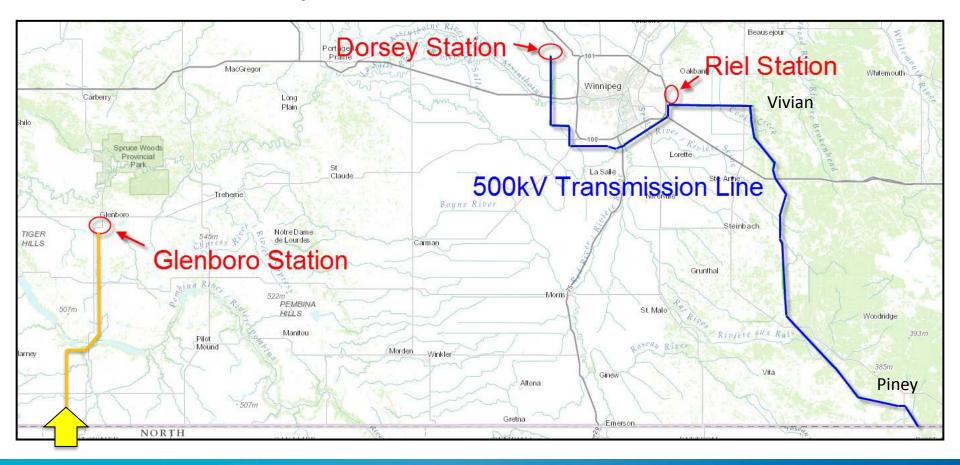
Project Overview

- MMTP Control Budget: \$453 M
- Projected In Service Date of June 2020

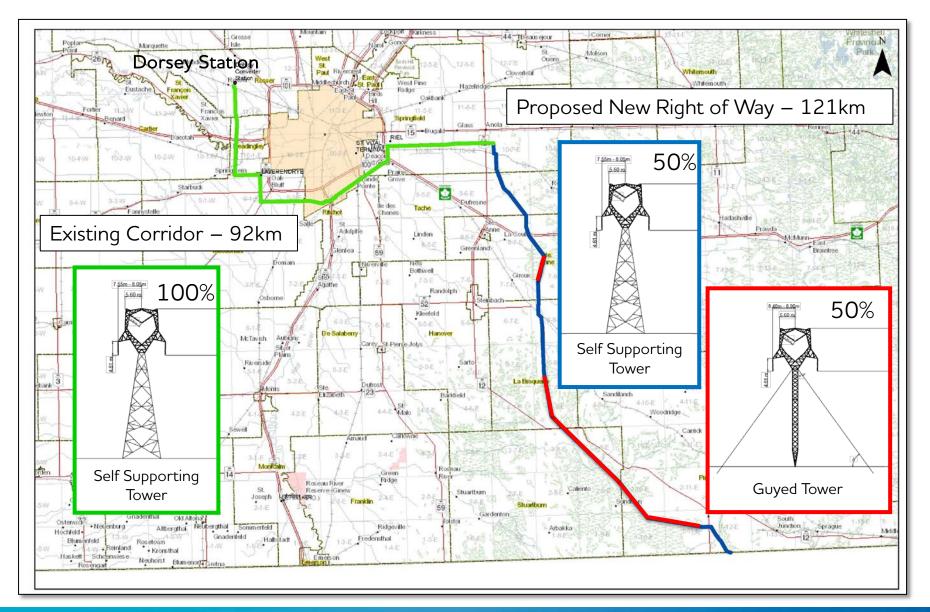


Project Overview

• MMTP Components



MMTP – Transmission Line Overview

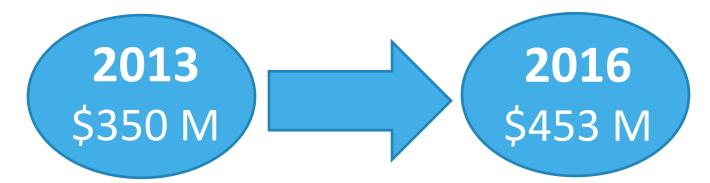


Project Execution Plan

- Internal Resources:
 ✓ Project Management
 ✓ Design
 ✓ Construction
 - Construction
 Management
- External Contracts:
 - ✓ Material Supply
 - ✓ Transmission line Construction
 - Majority of station construction



Budget Changes



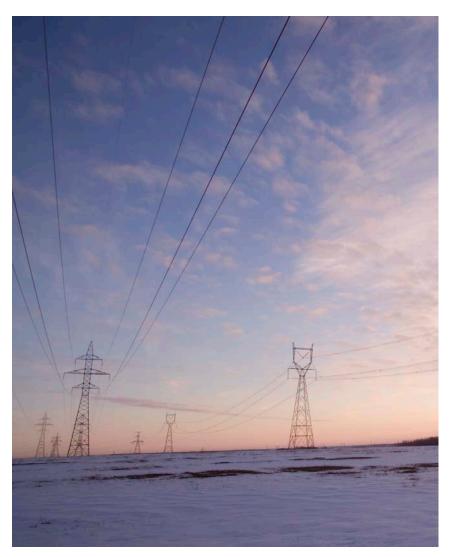
Scope Finalization Items

- Increase in self supporting towers due to route selection
- Adding a 2nd Phase Shifting Transformer at Glenboro
- Biosecurity and Environmental Monitoring
 Market Conditions Pricing
 - Transmission Line Construction

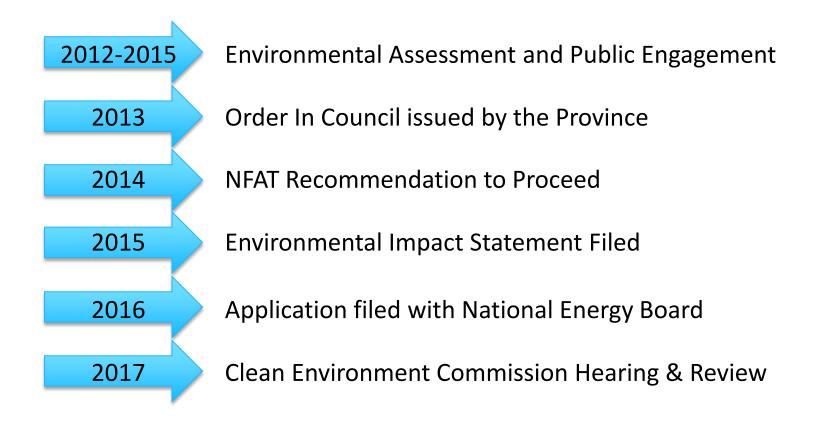
Contingency

Lessons Learned

- Routing Methodologies
- Indigenous Engagement
- Biosecurity
- Contracting Models
- Construction Methods



Project Progress



Project Progress





Thank You