Need For and Alternatives To Selection of Development Plans for NFAT

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Resource Development Goals

- Provide exceptional customer service
- Protect the environment in everything that we do
- Strengthen working relationships with Aboriginal peoples
- Profitable exports
- Promote cost effective energy conservation & innovation
- Integration of sustainability principles
- Local aboriginal & non-aboriginal communities support project as overall net benefit
- Undertake planning, public consultation, public review & regulatory activities to have the option to construct projects at early opportunity for export & Manitoba load

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Resource Planning Process

- Develop a menu of resource options
  - Characteristics
  - Capital, operating costs
- Develop inputs
  - Load forecasts
  - Interest, escalation, exchange rates
  - Electricity export market prices
  - Cost of fuel - natural gas, coal (in Manitoba)
  - GHG premiums (in Manitoba)
- Compare options – decision criteria
- Make a decision
  - Stages of development
  - Iterative

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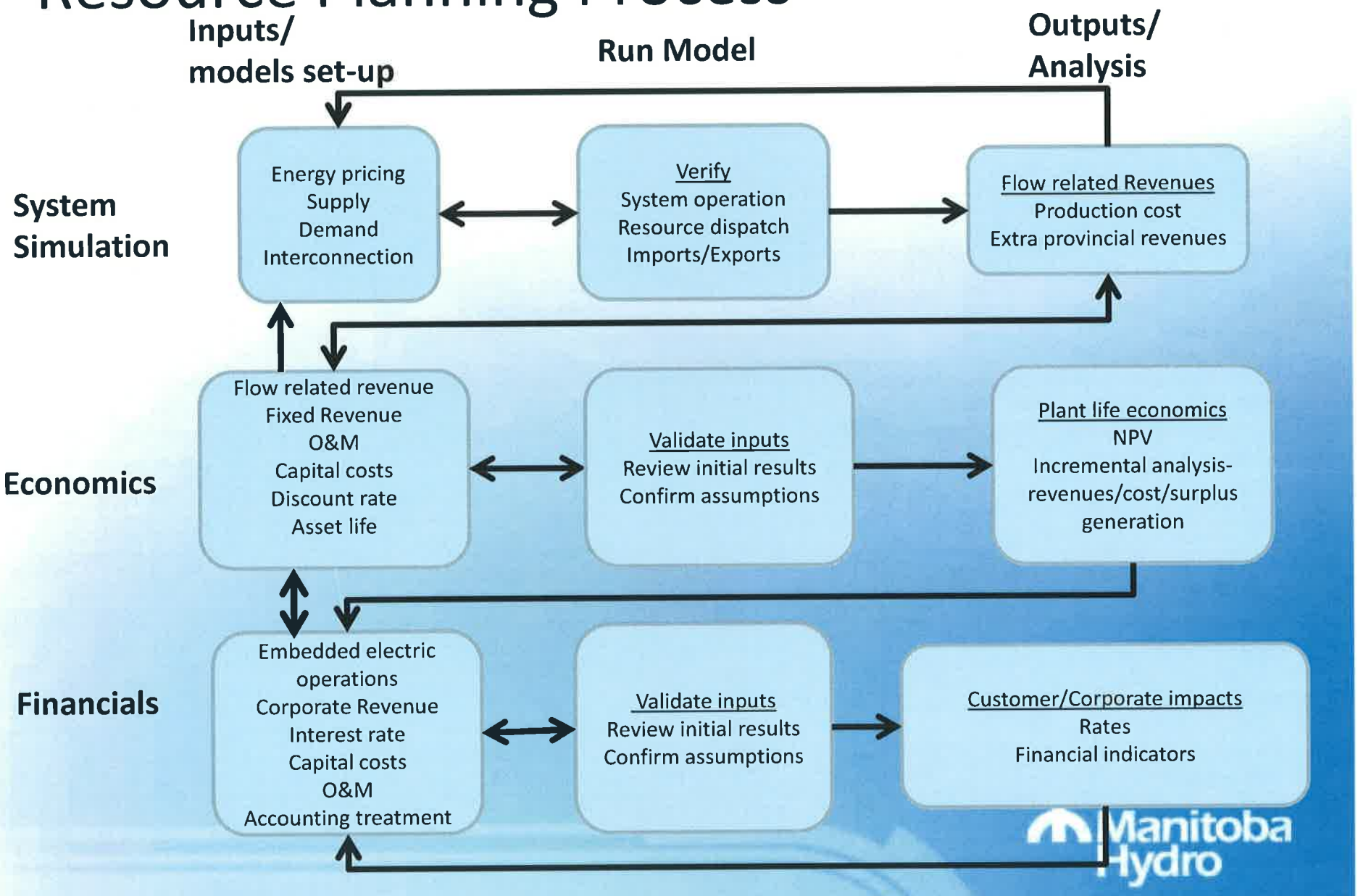
Resource Planning Process



Screening Consideration – Technical and Economic

Technical

- Maturity of Technology
- Technical Challenges in Manitoba
- Ease of Integration into System
- Intermittency
- Seasonality

Economic

- Manitoba Delivered Fuel Costs
- Typical Project Levelized Unit Energy Costs ($/MW.h)

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Screening Consideration - Environmental and Socio-economic and Policy

Environmental Effects

- Water Quality Impacts
- Hazardous Air Pollutants
- Greenhouse Gas Emissions
- Land Use Impacts
- Wildlife Species of Interest

Socio-economic & Policy

- Regulatory Constraints
- Social Acceptability
- Proximity to Load Centre

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Resource Technologies Screened

- Additional DSM
- Hydro with storage
- Run of river hydro
- On shore wind
- In lake wind
- Photovoltaic (utility plant scale)
- Solar thermal
- Enhanced geothermal
- Simple cycle gas turbine
- Combined cycle gas turbine
- Conventional pulverized coal
- Integrated gasification combined cycle
- Nuclear power
- Agricultural crop residue
- Wood based fuel
- Imports

The appendices contain a greater variety of technologies

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7 Resource Technologies Selected by Screening for Development Plans

- Additional Demand Side Management
- Hydro - with Storage
- Hydro - Run-of-River
- Wind - On-Shore
- Simple Cycle Gas Turbines (SCGT)
- Combined Cycle Gas Turbines (CCGT)
- Imports

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2012-13 Development Plan Groups

- Plans meet energy & capacity criteria to meet Manitoba load growth & existing exports/imports
- Four groups of plans:
  - **No New Interconnections**
  - **New 250 MW Interconnection**

    (MP 250 MW, NSP 125 MW extension)
  - **New 750 MW Interconnection with no WPS Sale**

    (MP 250 MW, NSP 125 MW extension)
  - **New 750 MW Interconnection with WPS sale**

    (MP 250 MW, WPS 300 MW, NSP 125 MW extension)

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2012-13 Plans: No New Interconnections

1) All Gas – Combined & Simple Cycle Gas Turbines starting 2022

- Lowest capital cost plan, reference point for evaluations
- Test natural gas generation benefits

2) Wind/Gas- Wind 2022 supported by Simple Cycle Gas starting 2025

- Test wind generation benefits

3) Wind/Conawapa 26 - Wind 2022, Conawapa 2026

- Test wind vs. gas (when only energy required not capacity)
- Test Conawapa

4 & 5) Gas/Conawapa 26 – Single Cycle Gas 2022 or Combined Cycle Gas 2022, Conawapa 2026

- Test Conawapa

6) Keeyask 22/Gas – Keeyask 2022, Combined & Simple Cycle Gas

- Test Keeyask

7) Keeyask 22/Conawapa 29 – Keeyask 2022, Conawapa 2029

- Test Keeyask

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250MW Interconnection
MP 250MW, NSP 125 MW expansion

These plans test 250MW Interconnection & sale combination

8) Keeyask 19/Gas 24 – Keeyask 2019, Combined & Simple Cycle Gas starting in 2024

- Test Gas vs. Conawapa assuming 250 MW interconnection

9) Keeyask 19/Conawapa 25 – Keeyask 2019, Conawapa 2025

- Test Conawapa vs. Gas assuming 250 MW interconnection

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750MW Interconnection
MP 250MW, NSP 125 Expansion

These plans test 750MW Interconnection & sale combination (No WPS Sale)

10) Keeyask 19 Gas – Keeyask 2019, Combined & Single Cycle Gas starting 2031

- Test Gas vs. Conawapa

11) Keeyask 19 Conawapa 31 – Keeyask 2019, imports 2025, Conawapa 2031

- Test Conawapa vs. Gas

NOTE: no plans with Conawapa 2025 for 750MW tie and no WPS

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750MW Interconnection(WPS 300MW, MP 250MW, NSP 125 Expansion)

These plans test 750MW Interconnection & sale combination (With WPS Sale)

12) Preferred Plan

Keeyask 19 Conawapa 25 – Keeyask 2019, Conawapa 2025

- Test Conawapa vs. Gas

13) Keeyask 19 Gas – Keeyask 2019, Combined & Single Cycle Gas starting 2025

- Test Gas vs. Conawapa

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Risk Management through flexible Development Decision Pathways

Representative of decisions that are next step in Manitoba's electricity future

1) **Natural Gas Generation Pathway**

- Gas 2023 only for domestic load. Later gas generation or hydro (or other)

2) **Keeyask, No New Interconnection, No New Export Pathway**

- Keeyask 2023 only for domestic load. Later Conawapa or natural gas

3) **Keeyask, 250MW Interconnection, Small Export Pathway**

- Keeyask 2019, 250MW interconnection, MP Sale, 125MW NSP extension but not WPS sale.
- Plan on Conawapa 2026 but can defer or switch to gas up to 2018

4) **Keeyask, 750MW Interconnection, Large Export Pathway**

- Keeyask 2019, 750MW interconnection, MP Sale, 125MW NSP extension but not WPS sale.
- Plan on Conawapa 2026 but can defer to 2033 or switch to gas up to 2018

5) **Keeyask, 750MW Interconnection, Large Export Pathway**

Preferred Plan Pathway)

- Keeyask 2019, 750MW interconnection, MP Sale, 125MW NSP extension & WPS sale.
- Plan on Conawapa 2026 but can defer or switch to gas up to 2018

NOTE: WPS Sale still under negotiation; pathways 4&5 may evolve slightly

Multi Account Benefit Cost Analysis

- Overall socio-economic benefit of the preferred and alternative plans will be assessed by examining their advantages and disadvantages in terms of the following accounts:
  - Market valuation
  - Manitoba Hydro ratepayer
  - Manitoba Government
  - Manitoba economy
  - Environment
  - Social
  - Risk
  - Manitoba electricity user reliability & energy security

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Historical Resource Plans

Power Resource Plan	Generating Station (MW)	In Service Date	Exports & Notes
1990	Conawapa 1230 MW	2000	1000MW to Ontario starting in 2000 plus interconnection
	Wuskwatim 340 MW	2007	300 MW NSP/UPA Diversity Exchange
	Birthday (or Gull) 540 MW	2011	
	Manasan 195 MW	2014	
	First Rapids 225 MW	2015	
1993	Wuskwatim 340 MW	2010	Ontario cancel sale due to major Recession. Ontario reimburses MH for Conawapa costs.
	CCCT 200 MW	2014	
	CCCT 200 MW	2016	
	Gull 840 MW	2018	
	Manasan 195 MW	2024	
	First Rapids 225 MW	2027	

Power Resource Plan	Generating station (MW)	In Service Date	Exports & Notes
1995	Wuskwatim 340 MW	2011	Birthday & Gull projects redesigned to reduce environmental impacts ultimately move to one project & reduce total development from 1,150 MW to 695 MW
	CCCT 200 MW	2016	
	Notigi 88 MW	2017	
	CCCT 200 MW	2018	
	Gull 610 MW	2019	
1997	Wuskwatim 280 MW	2016	Wuskwatim starts being redesigned to reduce environmental impacts, reduced from 340 MW to 200 MW
	Notigi - 88 MW	2018	
	SCCT 163 MW	2019	
1999	Wuskwatim 206 MW	2014	
	Conawapa 1230 MW	2018	
2000	Brandon 260 MW SCCT	2002	AIPs for Aboriginal Partnerships for Wuskwatim & Keeyask
	Wuskwatim 200 MW	2019	
	Gull 630 MW	2025	

Power Resource Plan	Generating station (MW)	In Service Date	Exports & Notes
2003	Wind 100 MW	2005	Early 2000s were period of intensive Wind generation field investigations and price discovery.
	wind 50 MW each year for 3 years	2006 to 09	
	Wuskwatim - 200 MW	2009	
	Gull 620 MW	2022	
2004	Wind 100 MW	2005	
	wind 50 MW each year for 3 years	2006 to 09	
	Wuskwatim - 200 MW	2009	
	Conawapa 1250 MW	2022	
2006	wind 100 MW	2005	Ultimately about 250MW wind generation developed In Manitoba by 2013. Larger amounts uneconomic.
	wind 150 MW	2009	
	wind 150 MW	2010	
	Wuskwatim 200 MW	2012	
	Conawapa 1250 MW	2021	

Power Resource Plan	Generating station (Mw)	In Service Date	Exports	Notes
2008	Wuskwatim - 200 MW	2012	NSP 375 + 125	
	Keeyask - 695 MW	2018	MP 250	MOUs with MP & WPS
	Conawapa 1485 MW	2022	WPS 500	
2010	Keeyask - 695 MW	2019	MP 250 & NSP 125	Conawapa deferred- load forecast & development schedule.
	Conawapa 1485 MW	2023	WPS 500	NSP 375, 350 Diversity and 125 signed 2010.
2011	Keeyask- 695 MW	2019	MP 250 & NSP 125	MP 250 PPA signed & approved by MPUC
	Conawapa 1485 MW	2024	WPS 500	
2012	Keeyask- 695 MW	2019	MP250 & NSP 125	
	Conawapa 1485 MW	2025	WPS 300	WPS Reduces to 300 MW

Questions?

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