Stakeholder Session
Update on Long-Term Transmission Plan
Review of Input Assumptions

June 23, 2010

Meeting Agenda

- Update of 2011 Long-term Transmission System Plan development
- Load Forecast (FC2009)
- Generation baseline and scenarios
- Next steps / Consultation
- Loss Factors

Today, Review input assumptions

Fall, Review Draft Tx. Options

Spring, finalize Plan

Long Term Transmission Plan 2011

- Plan to be update of 2009
  - Blueprint for Transmission Plan System
- Document will meet mandate as outlined in the *Transmission Regulation*
- Plan will build on compliance filing for transmission
  - Alberta Reliability Standards
- Baseline generation scenario will be used
- Other scenarios will be used to stress test transmission

Critical Transmission Infrastructure Assumptions

- 4 designated lines consistent with legislative framework and built into plan
- CTI Supports
  - Market / FEOC
  - Opportunity for investment (generation / load)
  - Renewables
  - Reliability / transmission backbone
  - Economic development
- Development of Milestones for CTI stages to be examined

Guiding Principles

- The Transmission Plan will address requirements of T-Reg / PES:
  - Improving transmission system reliability by identifying enhancements required to remove potential overloads, voltage violations and stability issues
  - Providing a robust competitive market by identifying enhancements that provide access for new generation identified in the generation scenarios to:
    - Allow in merit generation can operate 100% of the time under normal operating conditions and 95% of the time under abnormal operating conditions
    - Facilitate integration of generation from zones of renewable and low emission generation
  - Improving transmission system efficiency by selecting a preferred alternative that reduces overall transmission costs including the cost of losses
  - Improving operational flexibility by ensuring the recommended alternative meets the needs of the operation group
  - Maintaining options for long term development by assessing various scenarios

Consultation

- Feedback on:
  - All assumptions
    - Load forecast, policy assumptions, generation scenarios
  - Methodology
  - Transmission Planning objectives and scope
- Next steps and timing discussed at end.

Future Demand and Energy Outlook (2009 – 2029)

LaRhonda Papworth
Supervisor, Long Term Load Forecasting

Future Demand and Energy Outlook (2009 – 2029) “FC2009”

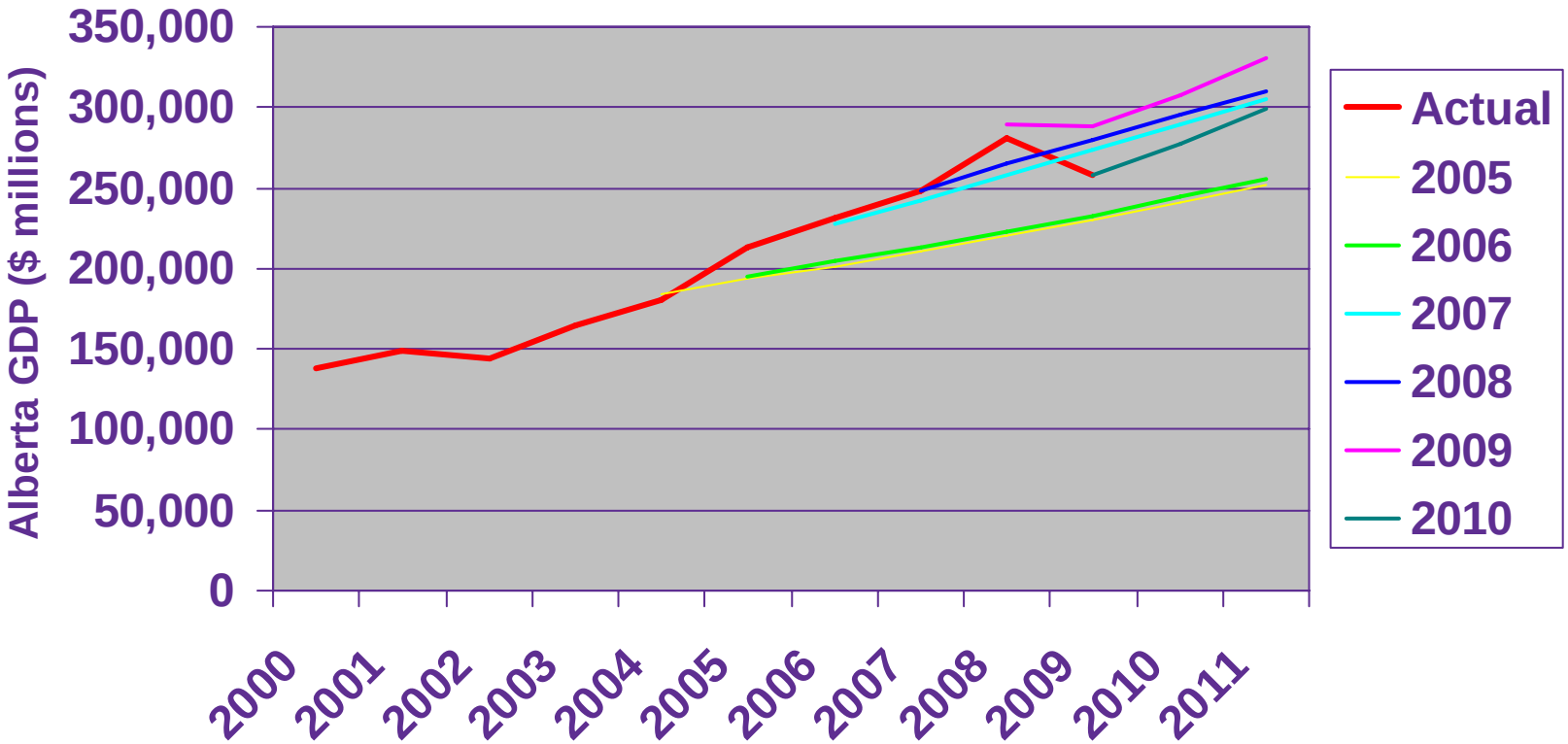
- FC2009 Review
  - Dates
  - Feedback
- FC2009 Models and Development
  - System
  - By customer sector
- Update FC2010
- Future Load Scenarios
- Feedback

FC2009 Input Assumptions

- Alberta Economy*
  - GDP
    - Strong growth to 2019 based on strong economic inputs from oilsands – 2.7%
    - Slight decrease in growth rate for 2nd 10 years – 2.3%
  - Population
    - Growth from 2008 to 2019 – 1.5%
    - Growth from 2019 to 2029 – 1.2%
- Oilsands Production
  based on CAPP June 2009
  - Bitumen production increase
    - 2008 1.3 million bpd
    - 2019 2.9 million bpd
    - 2029 3.9 million bpd
  - Upgrading production increase
    - 2008 0.6 million bpd
    - 2019 1.1 million bpd
    - 2029 1.4 million bpd

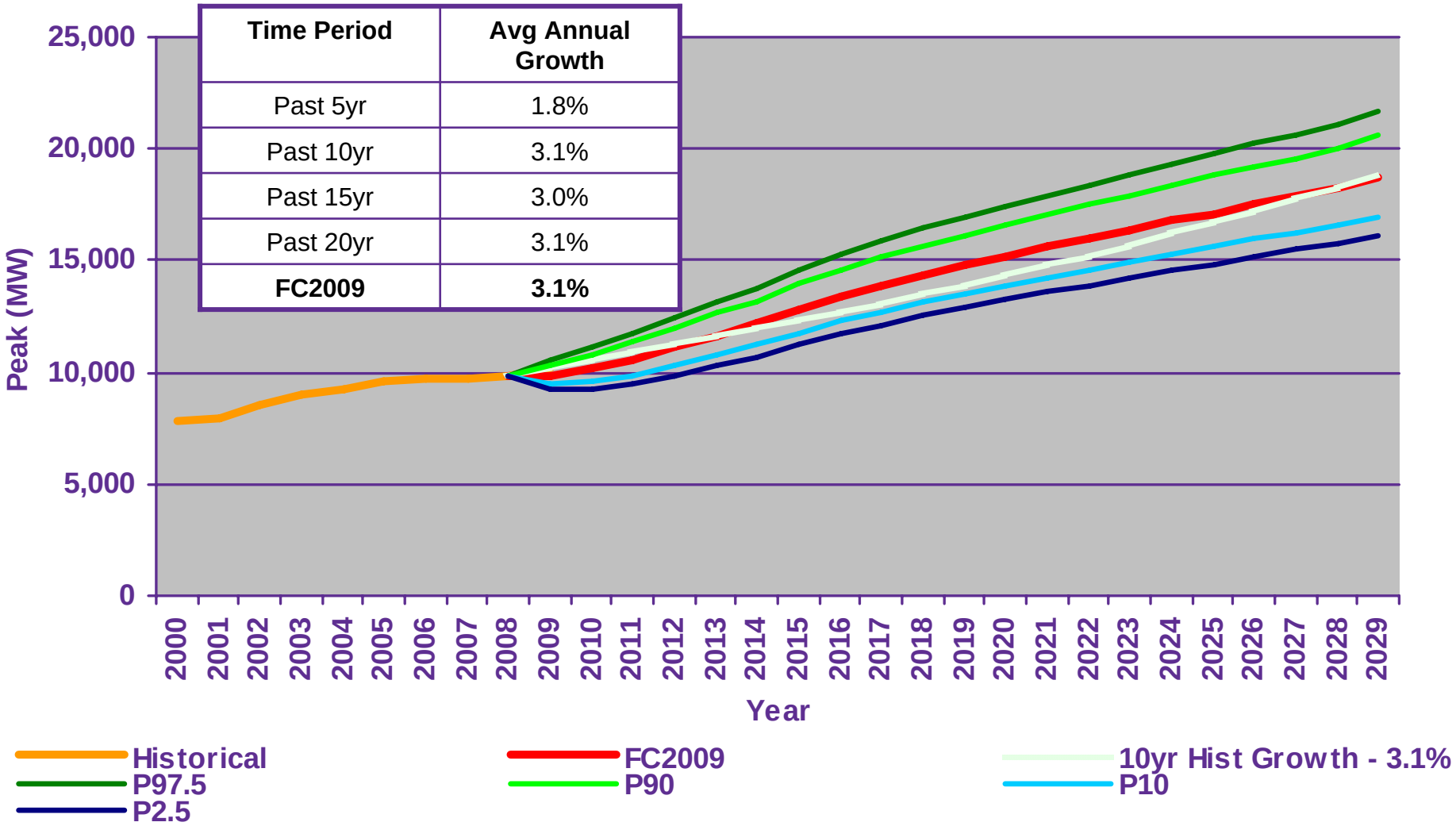
*based on Conference Board of Canada's 2009 Long-Term Provincial Forecast

Conference Board Nominal Alberta GDP Comparison

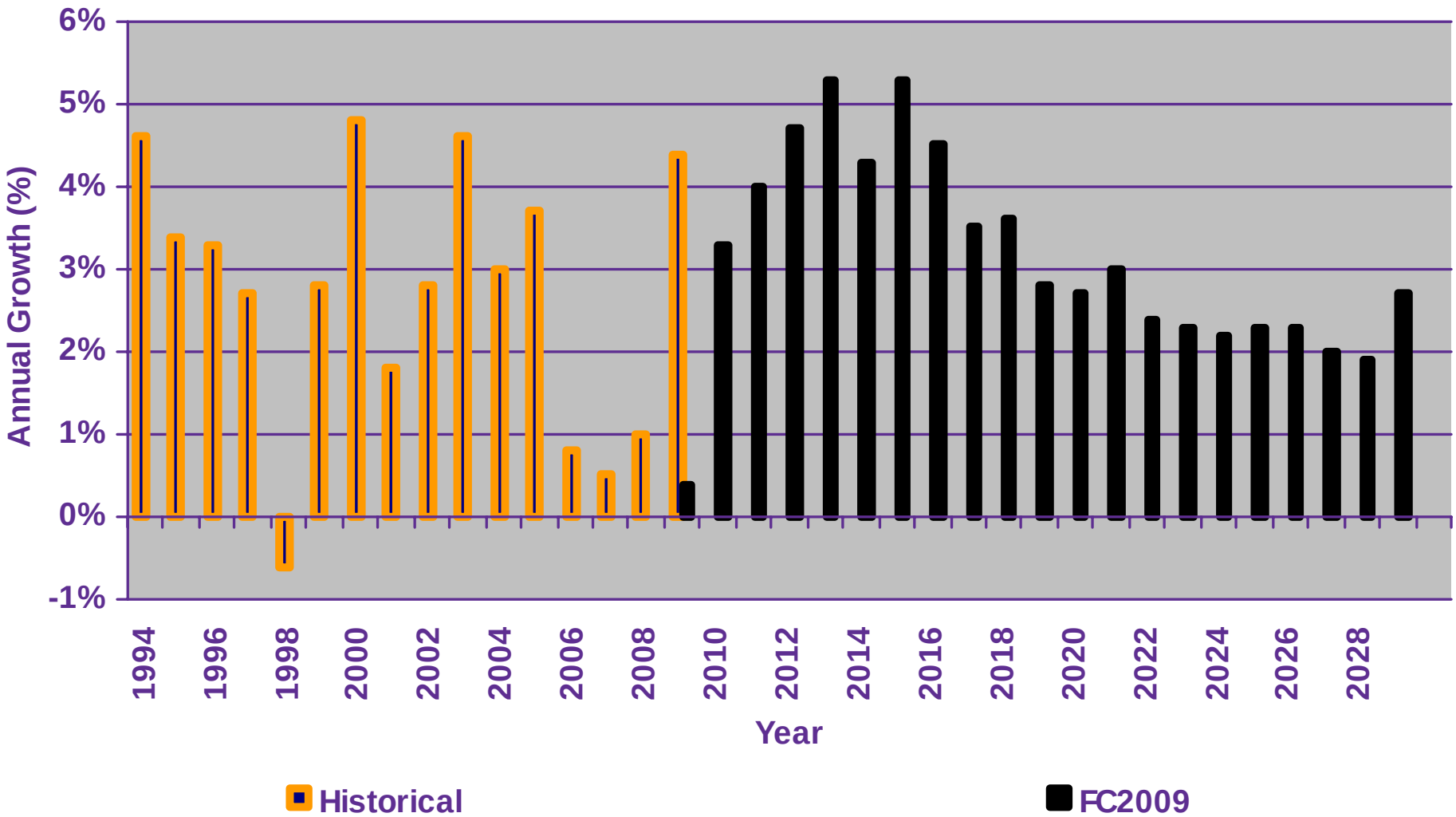


FC2009 – Alberta Internal Load (AIL) Peak Results

Time Period	Avg Annual Growth
Past 5yr	1.8%
Past 10yr	3.1%
Past 15yr	3.0%
Past 20yr	3.1%
FC2009	**3.1%**

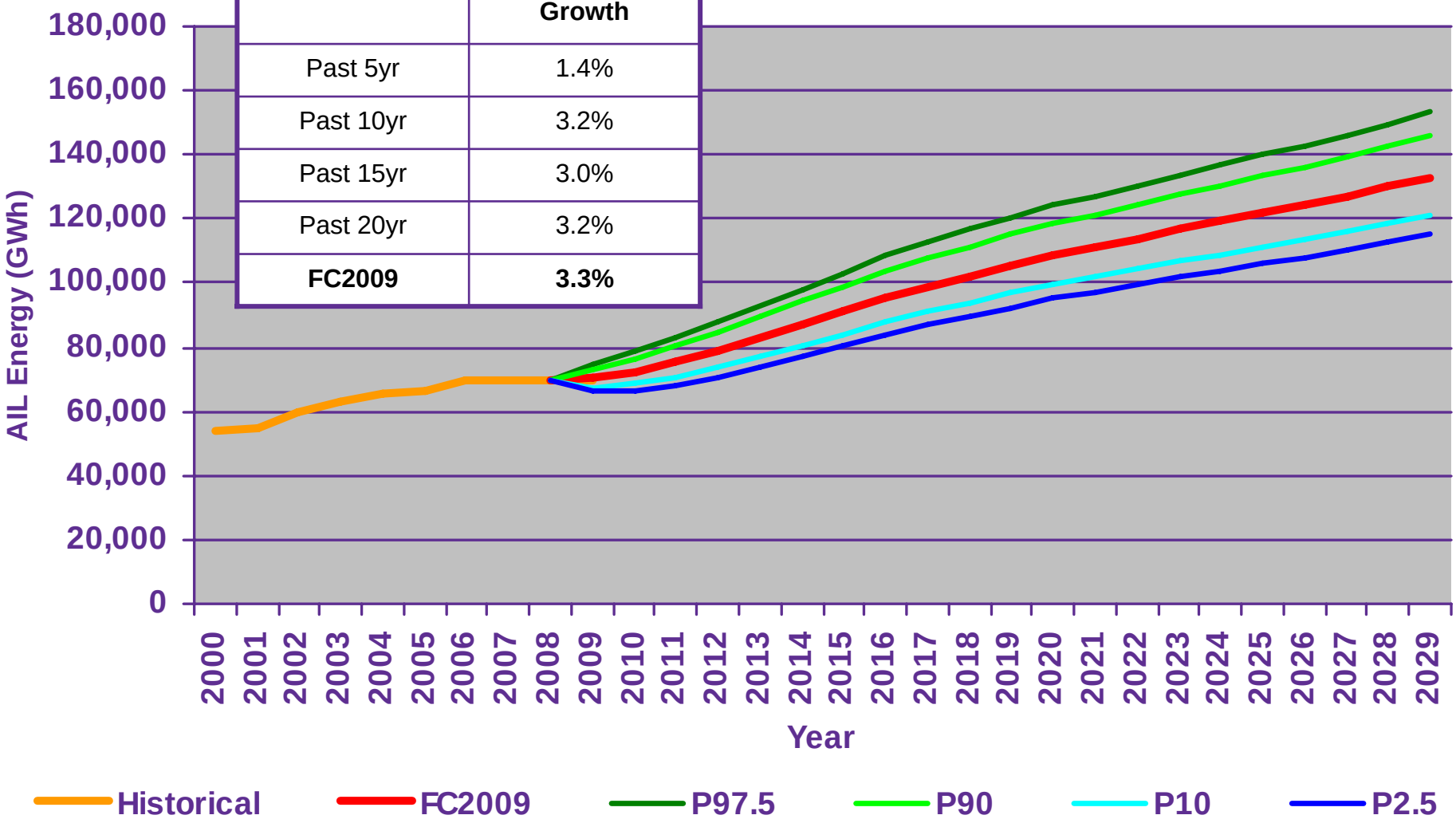


FC2009 – Alberta Internal Load (AIL) Peak Growth Comparison

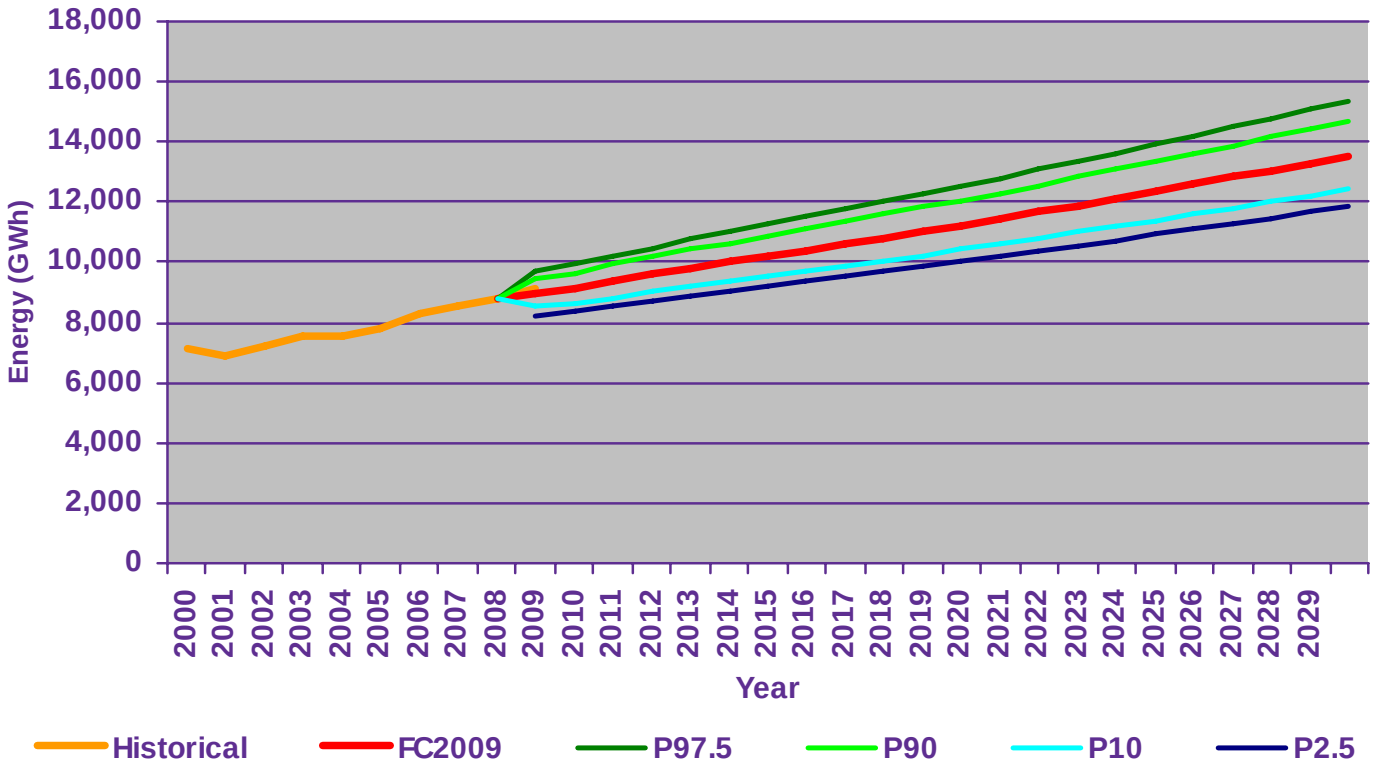


FC2009 – Alberta Internal Load (AIL) Energy

Time Period	Avg Annual Growth
Past 5yr	1.4%
Past 10yr	3.2%
Past 15yr	3.0%
Past 20yr	3.2%
FC2009	**3.3%**



FC2009 – Residential Sector



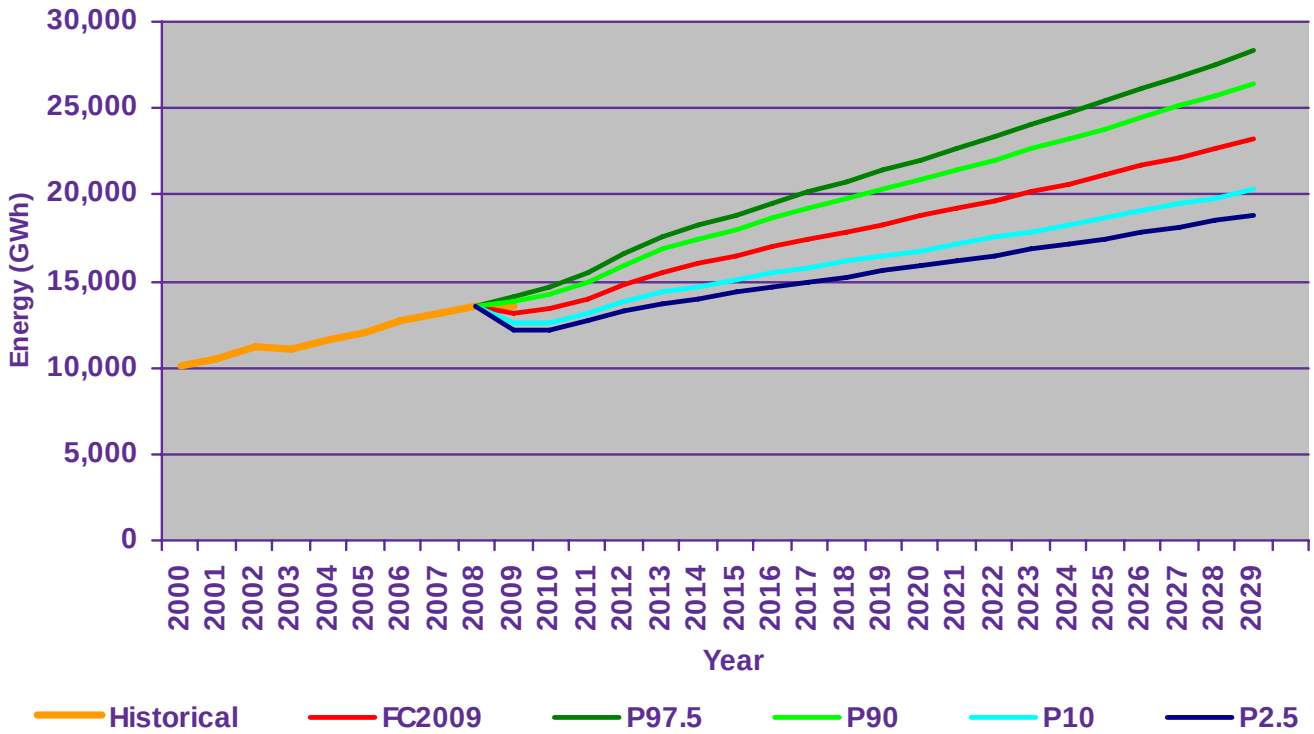
Model

$$RES_t = \beta_0 + \beta_1(POP_t) + \beta_2(INCOMECAP_t) + \beta_3(CDD_t) + \beta_4(HDD_t)$$

Topic of Interest

- Recent trend in increasing residential use per capita given focus on micro generation and demand side management (DSM)

FC2009 – Commercial Sector



Model

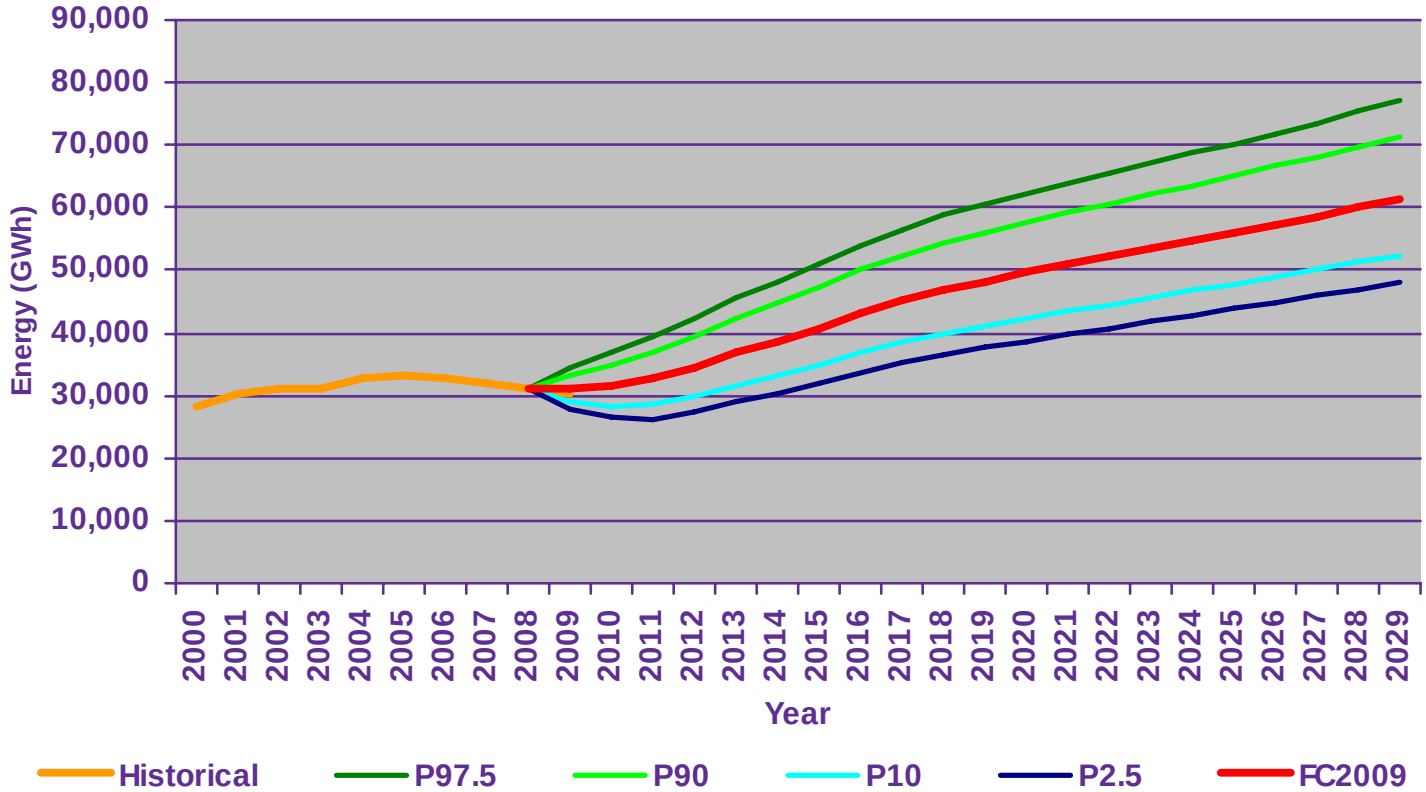
$$COM_t = \beta_0 + \beta_1(ABGDP_t) + \beta_2(Dummy_t^{\dagger}) + \beta_3(COM_{t-1}) + \beta_4(CDD_t) + \beta_5(HDD_t)$$

Topic of Interest

- Strong model and correlation to Alberta GDP
- Emergence of load served by distributed generation (DG)

†**Note** - binary variable to control for customer reclassification between Commercial and Industrial

FC2009 – Industrial (w/o Oilsands) Sector



Model

$$IND_t = \beta_0 + \beta_1(MINGDP_t) + \beta_2(Dummy_t^{\dagger}) + \beta_3(IND_{t-1})$$

Topic of Interest

- Future growth in industrial sector?

†**Note** - binary variable to control for customer reclassification between Commercial and Industrial

FC2009 – Oilsands Sector

Model

$$OILSANDS = PROD_{MINING} * INTENSITY_{MINING} + PROD_{IN-SITU} * INTENSITY_{IN-SITU} + PROD_{UPGRADE} * INTENSITY_{UPGRADE}$$

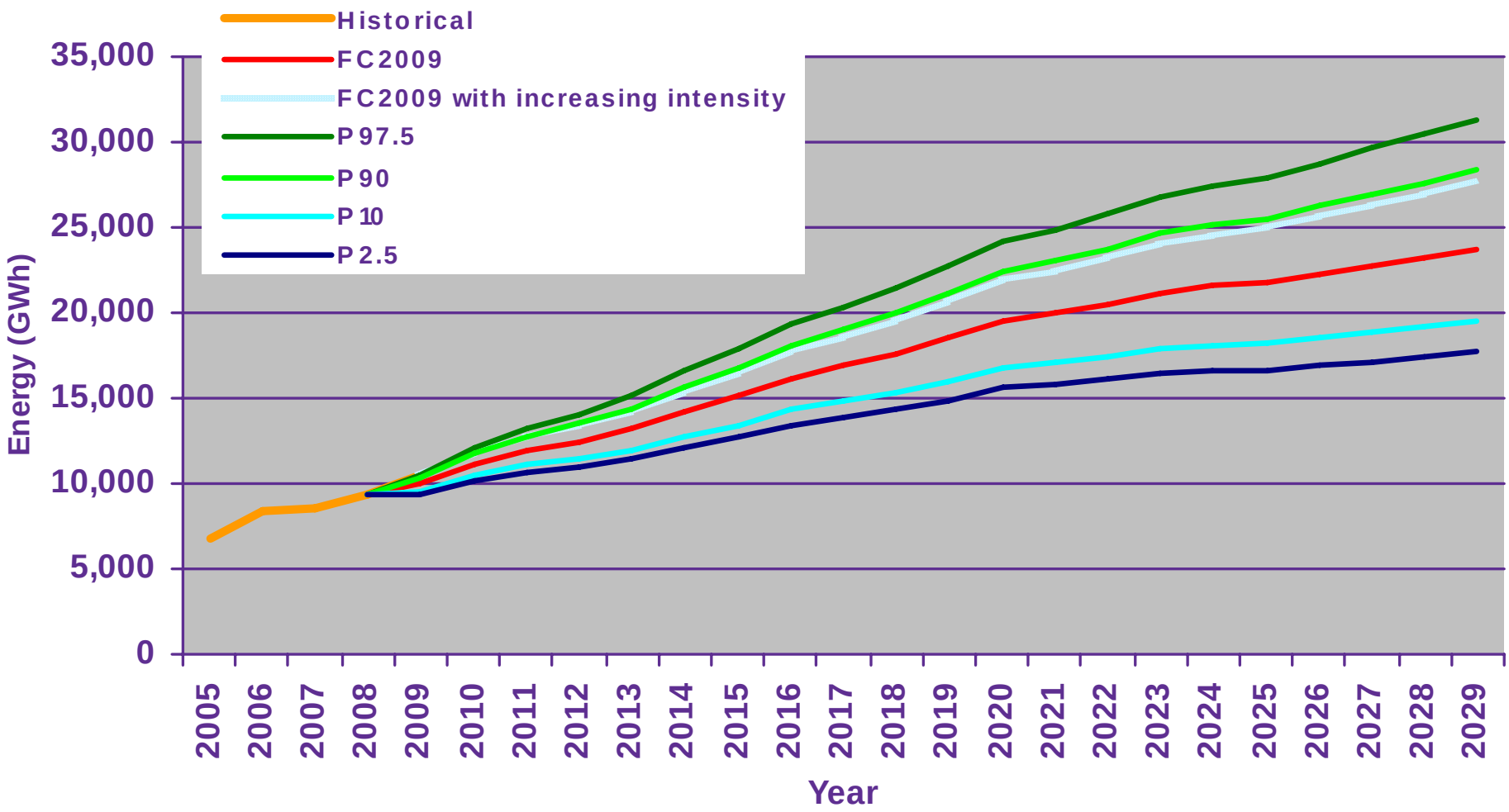
Topics of Interest:

- kWh/barrel intensity in-situ held constant at 2008 level 12.1 kWh/barrel
- In-situ management of electricity intensity

  Growing at 1% per year can add 275 MW by 2019 and 500 MW by 2029 to forecasted AIL Peak

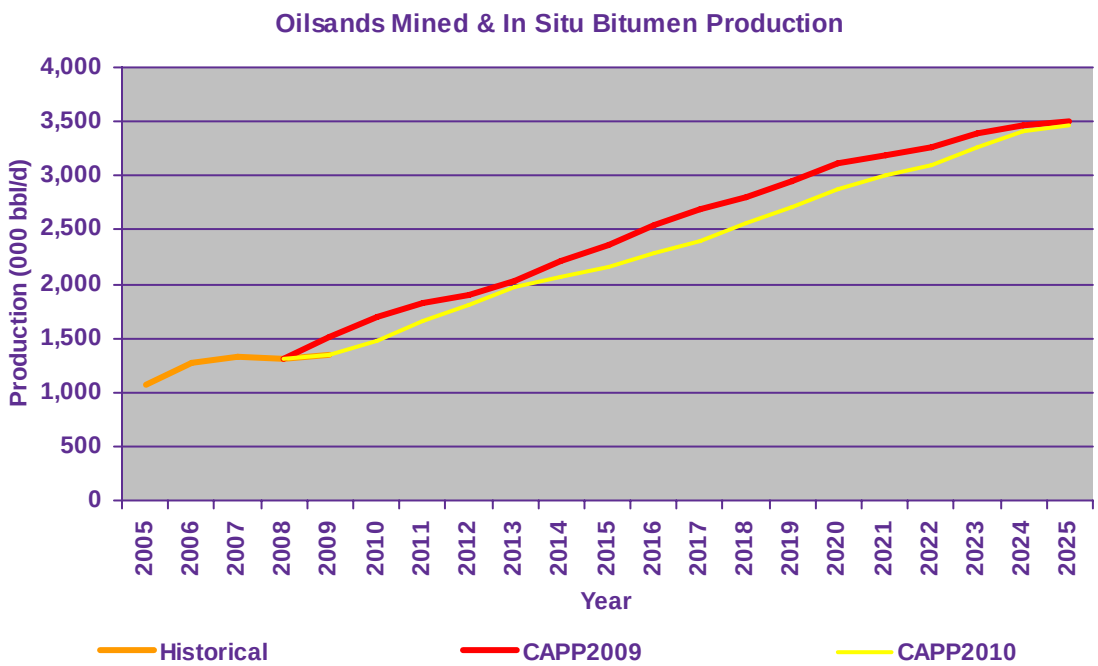
- New technology and/or policies leading to different extraction fuel sources

FC2009 – Oilsands Sector (cont'd)

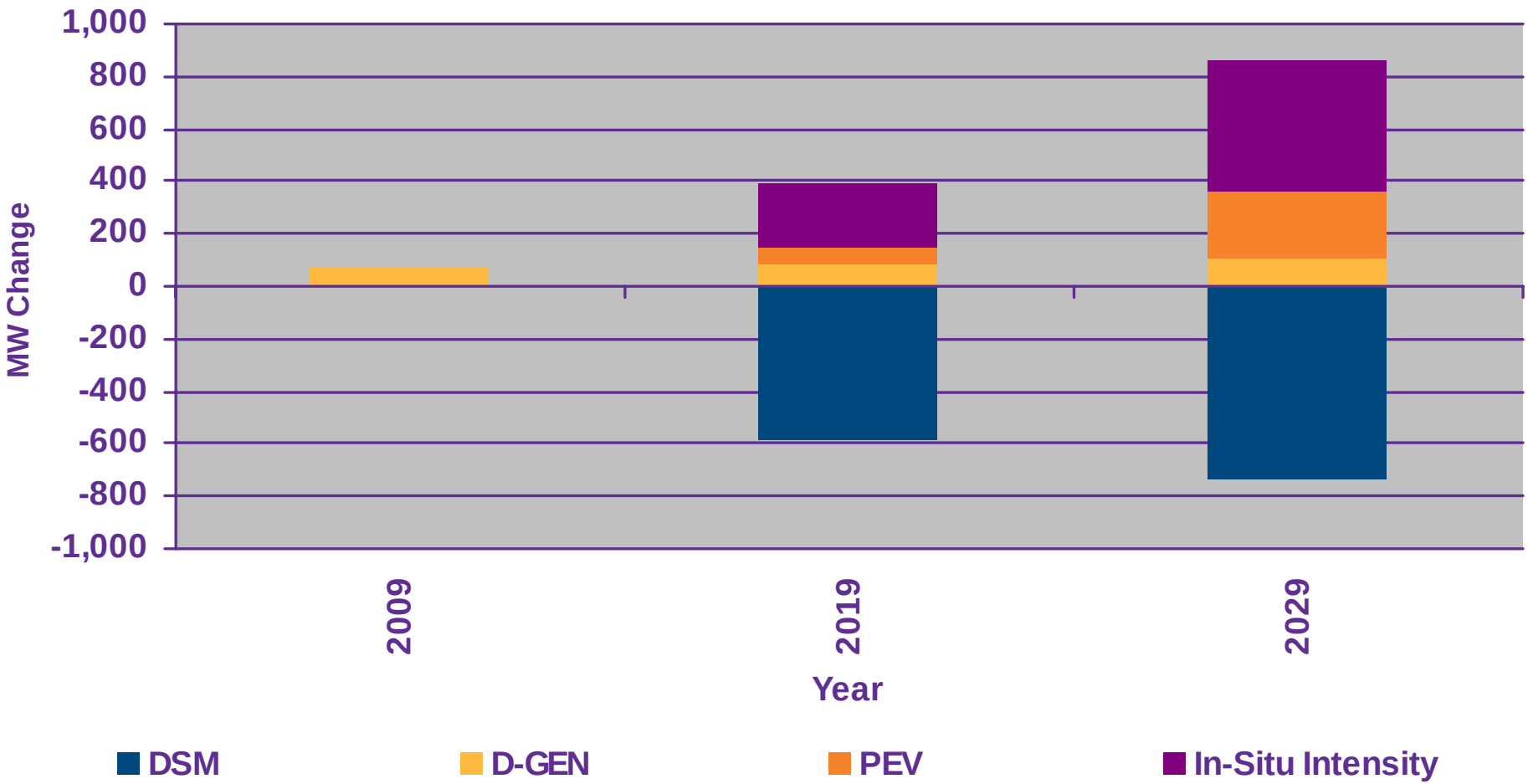


FC2009 compare to FC2010 Input Assumptions

	FC2009 Inputs	FC2010 Inputs
Alberta GDP 2009 – 2019 2019 - 2029	 2.7% 2.3%	 3.4% 2.2%
Alberta Population 2009 – 2019 2019 - 2029	 1.5% 1.2%	 1.6% 1.2%
Bitumen production 2008 2009 2019 2029	‘000 bpd 1.3 1.5 2.9 3.9	‘000 bpd 1.3 1.5 3.0 4.3
Upgrading production 2008 2009 2019 2029	‘000 bpd 0.6 0.7 1.1 1.4	‘000 bpd 0.6 0.7 1.0 1.4



Future Changes in Load Behaviour



CERA Scenarios and Provincial Energy Strategy Summary

Barreling Ahead 	Clean Energy Production ↓ Wiser Energy Use ↓ Sustained Economic Prosperity ↑
New Social Order 	Clean Energy Production ↑ Wiser Energy Use ↑ Sustained Economic Prosperity →
Deep Freeze 	Clean Energy Production → Wiser Energy Use → Sustained Economic Prosperity ↓
Others?	

Questions ?

Generation Baseline & Scenarios (2009 – 2029)

Nicole LeBlanc
Manager, Environment & Technology

Overview

Update Long Term Plan generation scenarios based on new information

- Methodology
- Uncertainties & assumptions
- Generation baseline & scenarios

Methodology – Baseline & Scenarios

- Gather data on resources, technologies, development plans, policy developments, uncertainties to generation development
- Create Alberta scenarios that capture major uncertainties (Environment and Technology)
- Determine the future supply gap
- Create mixes of generation to fill the supply gap that are :
  - Reasonable & defendable
  - Consider the major uncertainties
  - Test of the transmission system
- Validate that the generation additions meet load adequately and create market prices that support the generation development

Assumptions

Markets:

- The wholesale market continues to support generation development to a level that meets load reliably and creates competitive prices – use 10% effective reserve margin as proxy

Transmission:

- Transmission is unconstrained, and not a constraint to generation development

Load:

- Alberta economy and load grows as forecasted by FC2009

Other:

- Prior to 2020 large energy storage, large hydro or nuclear will not be developed
- NOx and SOx constraints based on existing CASA framework

Key uncertainties impacting generation development in Alberta

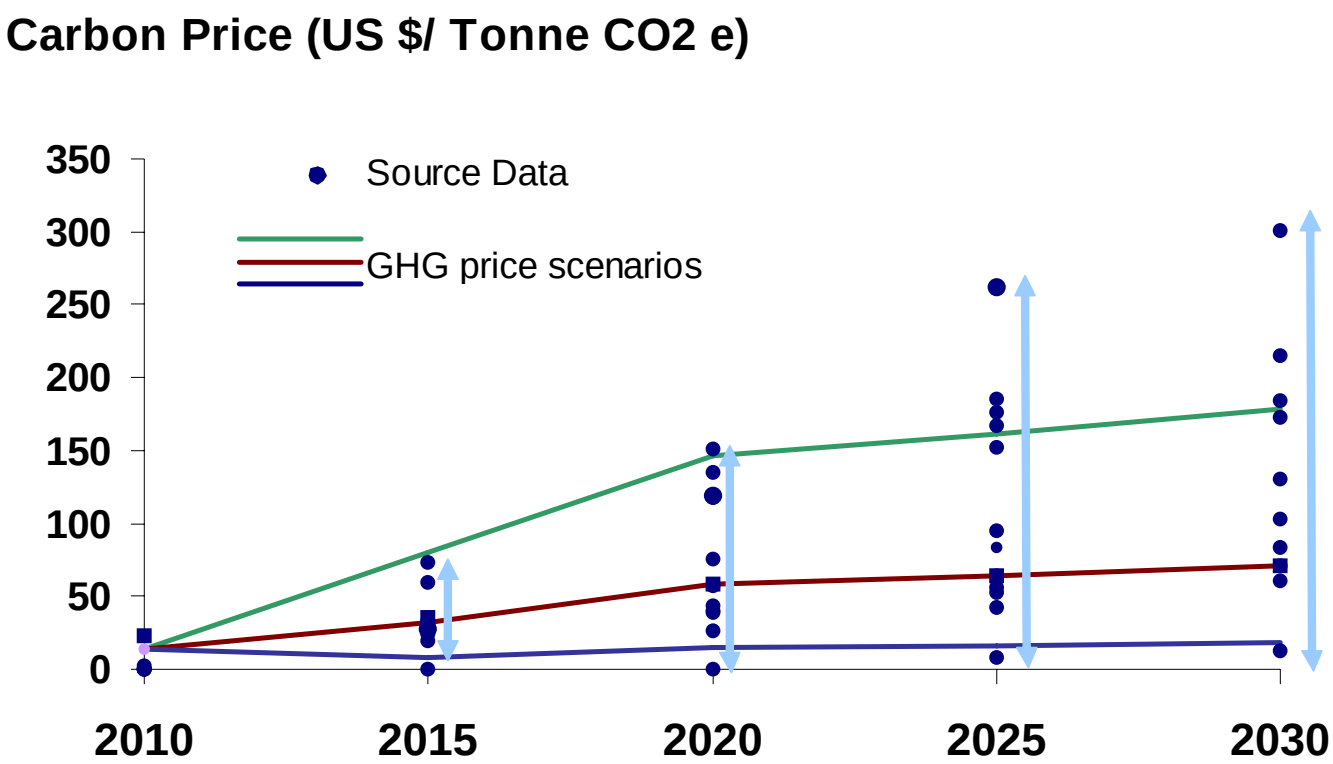
- Environmental Restrictions
  - Greenhouse gas policy
  - Incentives under GHG policy
    - Cogeneration in oil sand developments, renewable development
  - Other environment restrictions
- Future coal retirements
- Technology development
  - Clean coal, storage, oilsands extraction, renewables
- Future natural gas prices

Most of these factors affect the relative economics of generation technologies and need to be considered in the generation scenario development

Key Uncertainties: Environmental Policy

Increased environmental restrictions:

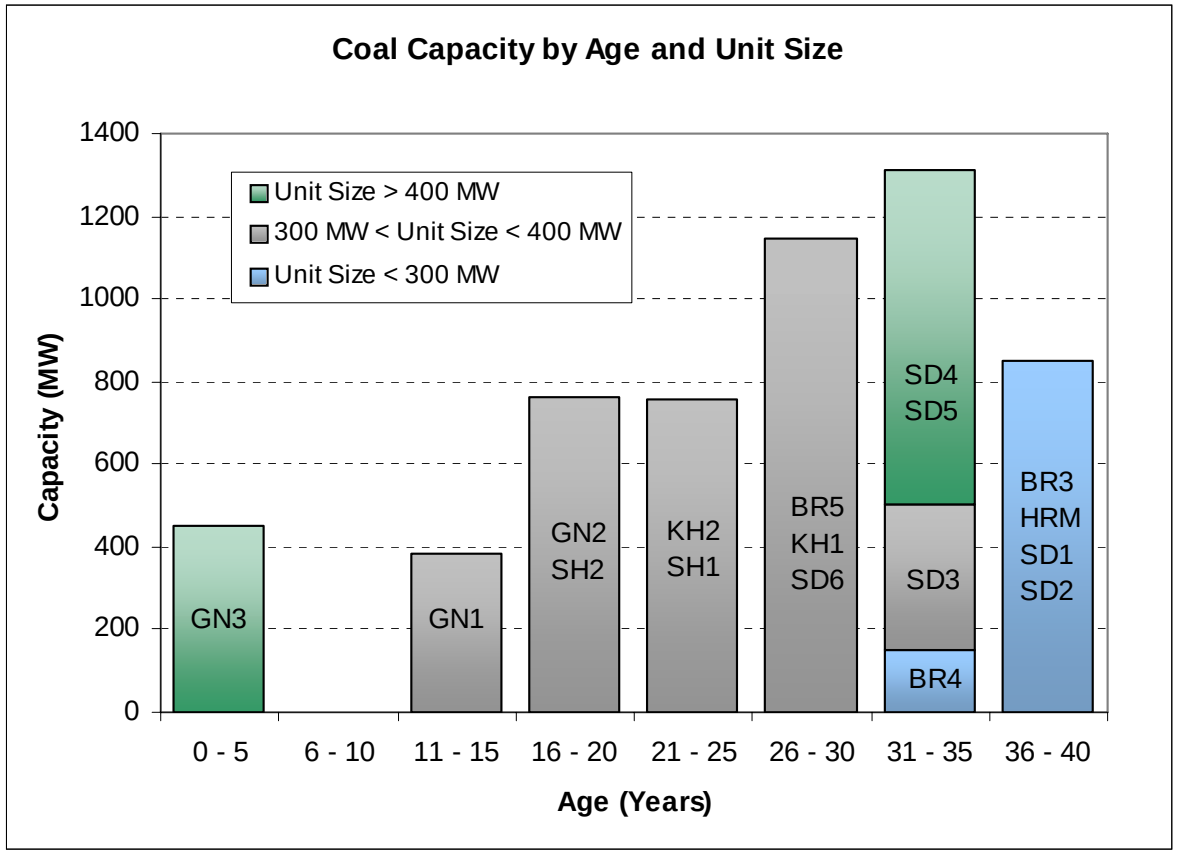
- Greenhouse gas
- SOx
- NOx
- Water
- Particulates



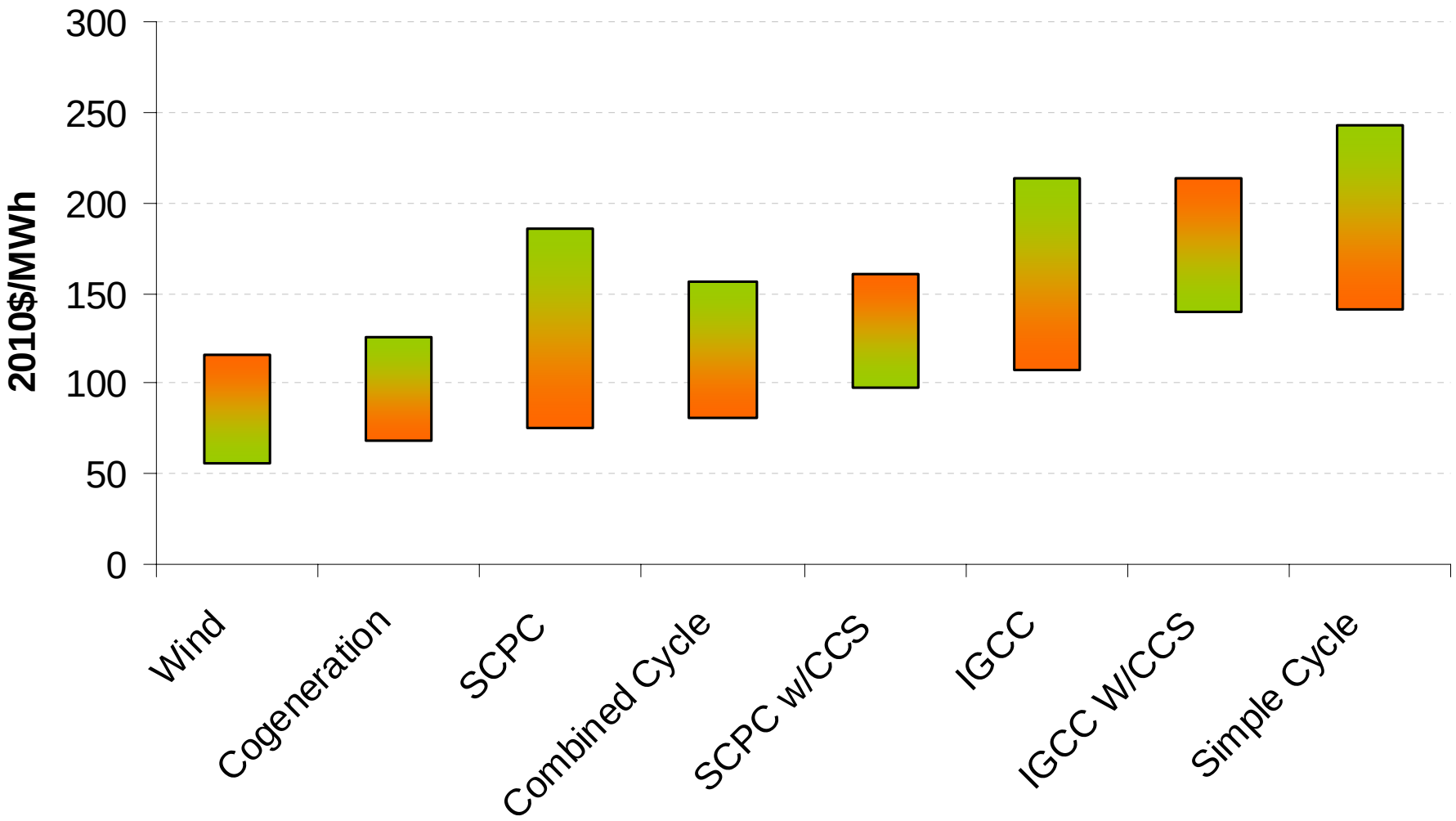
Key Uncertainties: Future Coal Retirements

Lifespan -
•35-45 years is used in draft GHG legislation
•With refurbishment could potentially get to 50 years

If the units will continue to run until they are 40 to 50 years old is highly dependent on:
•Environmental license availability
•Emission costs (CO2, NOx, SOx)
•Future pool prices



Relative costs estimates of the various technologies



Baseline Generation Scenario Fundamental Assumptions

	Baseline Scenario	
GHG costs	$50-60/t in 2020	
Natural Gas costs	Moderate	
Clean coal technology	Not available until after 2020	
Coal Retirements	All plants older than 45 year retired	
Economics of wind	Strong	
Cogeneration	Built to suit	
Gas adds (CC/SC)	South	North
Other renewables, low emission, distributed generation	Moderately developed	

- Most likely generation scenario
- North American climate change policy in place within next 5-6 years.
- Moderate reductions leading to GHG costs $60/t by 2020
- Mainly gas, wind and cogeneration additions

Baseline Generation Scenario
Capacity Additions 2010-2020

2010-2020 (MW)	Baseline
Additions to meet load growth	5,061
Retirements	964
Total Required Effective Additions	6,025
Coal Additions	894
Cogeneration Additions	1,687
Combined Cycle Additions	1,835
Simple Cycle Additions	609
Wind Additions	3,364
Biomass Additions	190
Hydro Additions	100
Other Additions	100
Total Additions	8,779
Total Effective Additions	6,038
Total Installed Capacity by 2020	20,276
Intertie Capability by 2020	1,800

Test scenarios
Fundamental Assumptions

Scenario	Greenest	High Cogen	BAU
GHG costs	$100+/t in 2020	$50-60/t in 2020	$25/t in 2020
Natural Gas costs	High	Moderate	Moderate
Clean coal technology	Available before 2020	Not available until after 2020	Not available
Coal Retirements	Plants older than 42 years retired	All plants older than 45 years retired	Plants refurbished and run as long as possible, retire at 50 years
Economics of wind	Very strong	Strong	Marginal
Cogeneration	Built to suit (Low steam needs post 2020)	Higher build than current expectations	Built to suit
Gas adds (CC/SC)	Distributed	Distributed	Distributed
Other renewables, low emission, distributed gen	Highly developed	Moderately developed	Minimal development

- Additional scenarios to test transmission plan further
- Greenest tests a more stringent environmental future
- Business As Usual tests a less stringent environmental future
- High Cogen tests the possibility of additional cogeneration development driven by policy
- Test additional interties scenarios

Generation Scenario comparison
Capacity Additions 2010-2020

2010-2020 (MW)	Baseline	Greenest	High Cogen	BAU
Additions to meet load growth	**5,061**	5,061	5,061	5,061
Retirements	**964**	1,866	964	668
Total Required Effective Additions	**6,025**	**6,927**	**6,025**	**5,729**
Coal Additions	**894**	1,164	894	970
Cogeneration Additions	**1,687**	1,687	2,537	1,687
Combined Cycle Additions	**1,835**	1,685	918	1,835
Simple Cycle Additions	**609**	829	609	719
Wind Additions	**3,364**	5,364	3,364	1,364
Biomass Additions	**190**	240	190	90
Hydro Additions	**100**	100	100	100
Other Additions	**100**	245	100	50
Total Additions	**8,779**	**11,314**	**8,712**	**6,815**
Total Effective Additions	**6,038**	**6,973**	**5,971**	**5,674**
Total Installed Capacity by 2020	**20,276**	**21,909**	**20,209**	**18,608**
Intertie Capability by 2020	**1,800**	**1,800**	**1,800**	**1,800**

Total installed capacity to meet energy, capacity and AS requirements

2021-2029 generation scenarios

2021-2029 scenarios have additional uncertainties to consider:

- Technology development:
  - Large scale geothermal
  - Large scale storage
  - Smart Grid
- Further coal retirements
- Refurbishment of existing plants with clean coal technology
- Large hydro developments
- Nuclear
- Oilsands extraction technologies

Scenario comparison
Capacity Additions 2021-2029

2021-2029 (MW)	Baseline	Greenest	High Cogen	BAU
Additions to meet load growth	**3,887**	3,887	3,887	3,887
Retirements	**2,463**	2,691	2,463	1,954
Total Required Effective Additions	**6,350**	**6,578**	**6,350**	**5,841**
Coal Additions	**970**	350	970	1,350
Cogeneration Additions	**865**	185	1,205	1,205
Combined Cycle Additions	**1,700**	650	1,500	1,500
Simple Cycle Additions	**700**	700	700	700
Wind Additions	**2,520**	2,700	2,520	1,890
Biomass Additions	**300**	400	300	300
Hydro Additions	**1,500**	2,000	1,500	500
Nuclear Additions	**0**	2,000	0	0
Other Additions	**350**	**650**	**350**	**200**
Total Additiions	**8,905**	**9,635**	**9,045**	**7,645**
Total Effective Additions	**6,139**	**6,475**	**6,279**	**5,883**
Total Installed Capacity by 2029	**26,718**	**28,853**	**26,791**	**24,299**
Intertie Capability by 2029	**2,800**	**3,800-2,800**	**2,800**	**2,800**

Total installed capacity to meet energy, capacity and AS requirements

Intertie assumptions

Intertie Assumptions				
	Current (ATC)	Restoration Initiatives (2010- 2014)	Pre 2020	Post 2020
Total (MW) *	**800**	**1000**	**1800**	**2800 - 3800**
FC 2009 Peak System Demand (MW)	10,200 MW FC 2009 peak forecast for 2010		15,000	19,000
Supply	12,500 MW (Existing) Wind at 5% of installed capacity		20,000 MW Wind to 20% of installed capacity	26,000 MW, Wind to 25% of installed capacity, 1,000 MW nuclear/clean coal, 1,500 MW large scale hydro

- Current import = 750 MW [600 MW (BC) + 150 (SK)]
- MATL add results in no net increase in ATC
- 500 kV HVDC lines in service in 2014
  - Results in no change in import / export due to dynamic issues
  - Improves duration curve of existing intertie ATC, but not volume

Next Steps

- Letter / Comment Matrix posted to website
  - Feedback requested by July 23
- Baseline work commencing on Transmission Plan
- Review of draft transmission options in Fall 2010

Questions?

Please provide comment matrix feedback by July 23, 2010