Integrated Resource Plan
Technical Advisory Committee Meeting #1

December 14, 2010

BC hydro
FOR GENERATIONS

Agenda

Time	Item	Speaker
9:00 – 9:10	1. Welcome and Review Agenda	Anne Wilson
9:10 – 9:30	2. Opening Remarks / Introductions	Cam Matheson / All
9:30 – 10:15	3. TAC Terms of Reference	Anne Wilson
10:15 – 10:30	Break	
10:30 – 11:00	4. Legal and Policy Framework	Craig Godsoe
11:00 – 12:00	5. Planning Process and Meeting Schedule	Randy Reimann
12:00 – 12:45	Lunch	
12:45 – 2:15	6. Review Load Forecast	Dave Ince
2:15 – 2:45	7. Review Long-Term Rate Forecast	Cheryl Yaremko
2:45 – 3:00	Break	
3:00 – 4:00	8. Review Load Resource Balance	Lindsay Fane
4:00 – 4:45	9. Introduction to Risk Framework	Basil Stumborg
4:45 – 5:00	10. Wrap-up and Next Steps	Anne Wilson
30 minutes	Time Permitting: Natural Gas Price Forecast	Dave Ince

BC hydro
FOR GENERATIONS

Welcome

Cam Matheson
Executive Director
Integrated Resource Planning

BC hydro
FOR GENERATIONS

Legal and Policy Framework

Craig Godsoe

BC hydro
FOR GENERATIONS

Topics

- Integrated Resource Plan (IRP) Process and Requirements
- Exemptions under section 7 of Clean Energy Act (CEA)
- Direction to BCUC
- Relationship of IRP to Projects, Programs and Expenditures

BC hydro
FOR GENERATIONS

CEA – IRP Process & Requirements

- BC Hydro submits IRP to Minister for Cabinet approval
  - First IRP filing due no later than December 3, 2011
  - At least every 5 years thereafter or can be amended in interim
- Prescribed requirements for self-sufficiency
  - Energy & capacity - Mid level load forecasts
  - Water conditions for heritage assets - critical water
- Transmission needs for 30 years in 2011 IRP
  - Assessment of clean resource development grouped by geographic area
- Exports: demand, opportunities, and expenditures
- Report respecting 2011 IRP Consultation

BC hydro
FOR GENERATIONS

CEA – Exemptions

- Exempted Projects, Programs, Contracts and Expenditures
- Mica Units 5 and 6
- Northwest Transmission Line
- Bio-Energy Phase 2 – up to 1000 GWh/yr
- Integrated Power Offer – up to 1200 GWh/yr
- Clean Power Call – up to 5000 GWh/yr (actual: 3266 GWh)
- Standing Offer Program
- Feed-in Tariff Program
- Installation of smart meters by end of 2012
- Installation of a smart grid
- Revelstoke Unit 6
- Site C (currently in stage 3 of 5)

BC hydro
FOR GENERATIONS

IRP Relationship to Projects, Programs, and Expenditures

Projects

- Two Resource Smart Projects - Ruskin, John Hart - will be the subject of CPCN Applications to BCUC in 2011
- IRP will compare a third Resource Smart Project - Revelstoke Unit 6 - against capacity-focused demand side measure (DSM) and supply side options;
  - Revelstoke Unit 6 likely requires Environmental Assessment (EA)
- IRP will examine the need for and alternatives to Site C, and this may be used in the EA

Programs/Expenditures

- SMI expenditures are a Revenue Requirement Application issue, not an IRP issue;
- Time of Use rate structure will be compared in IRP to other capacity-focused DSM and supply side options;
  - BC Hydro will need to apply to BCUC for rate design detail and implementation;
- DSM level is to be addressed in IRP
  - the most cost-effective way to get to the level to be addressed through section 44.2 filings
- IRP will address need for new domestic call(s) for power

BC hydro
FOR GENERATIONS

Planning Process & Meeting Schedule

Randy Reimann

BC hydro
FOR GENERATIONS

Topics

- IRP Purpose
- CEA 16 Energy Objectives
- Resource Planning Process
- Key Issues – Domestic and Export
- Technical Advisory Committee – Meeting Schedule and Content

BC hydro
FOR GENERATIONS

IRP Purpose

20-year strategic level plan to meet customers' load requirements (including 30 year view of transmission)

- Consistent with good utility practice, enables BC Hydro's Board to fulfill its fiduciary responsibility
- Provides vehicle to consult First Nations / public on BC Hydro's long-term plans
- Enables government, through its review and approval of the IRP, to ensure BC Hydro's plans contribute to B.C.'s energy objectives
- Supports future regulatory filings with the BCUC and other regulatory agencies

Consistent with good utility practice

- Obligation to supply customers' requirements
- Meet reliability criteria
  - Capacity – 1 day in 10 year Loss of Load Expectancy
  - Energy – Firm Energy Carrying Capability
- Minimize ratepayer costs
- Minimize environmental impacts/ footprint

BC hydro
FOR GENERATIONS

CEA – 16 Energy Objectives

- Achieve self-sufficiency
  - By 2016, plus 3000 GWh by 2020
    - Mid-load forecast / critical water conditions
  - No energy from Burrard
    - Minister's Regulation – Burrard's capacity can be relied upon until Mica 5/6, ILM and Meridian transformer are in-service
- Reduce growth in electricity demand by at least 66% by 2020
- Generate 93% of the electricity from clean or renewable resources
- Ensure ratepayers receive benefits of heritage assets
- No nuclear
- BCUC continues to regulate rates but not expenditures for export

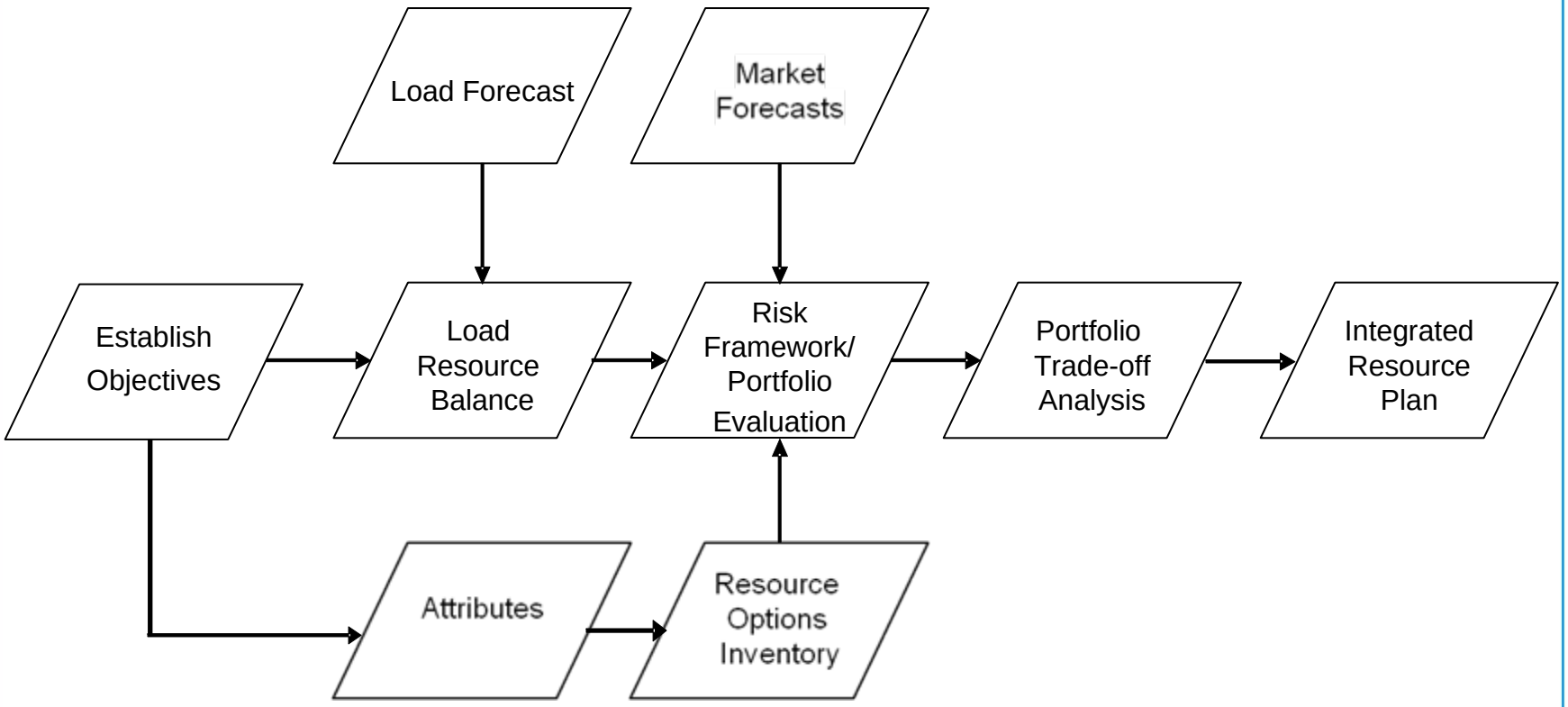
BC hydro
FOR GENERATIONS

Clean Energy Act - 16 Energy Objectives

- Ensure utility rates remain competitive with public utilities in NA
- Reduce B.C. greenhouse gas (GHG) emissions
  - Encourage fuel switching to decrease GHG emissions
  - Encourage communities to reduce GHG emissions / use energy efficiently
- Reduce waste by use of waste heat / bio-energy
- Maximize value of generation & transmission assets for benefits of B.C.
- Be a net exporter of clean electricity
- Encourage economic development and job creation / retention
  - Foster use of innovative technologies
  - Foster development of First Nations / rural communities thru clean resources

BC hydro
FOR GENERATIONS

Resource Planning Process



BC hydro
FOR GENERATIONS

IRP Key Analytical Issues

Domestic

- 20 year analysis of forecast needs drives
  - DSM targets
  - Resource Smart Projects
  - Site C
  - Timing, size and nature of future calls
  - Capacity, energy shaping and renewable integration needs
- 30 year analysis of scenarios addresses
  - Transmission infrastructure needs
  - Electrification Impacts - To achieve GHG reductions
    - Based upon E3 Consultings' work for Section 5 Transmission Inquiry
- Fort Nelson Interconnection/ Resource Plan
- Results in Base Resource Plan
- Address risks in Contingency Resource Plans

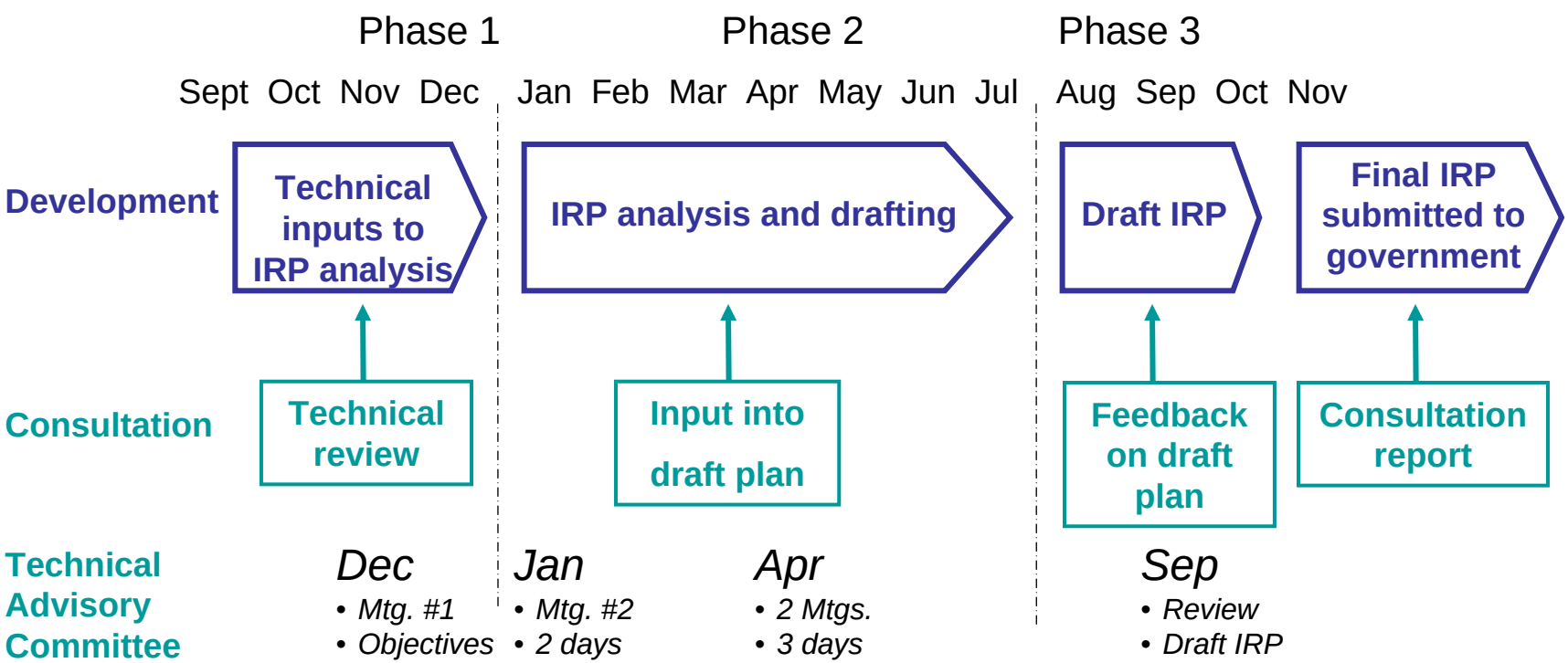
BC hydro
FOR GENERATIONS

IRP Key Analytical Issues

- Exports - Beyond self-sufficiency surplus
- Further exports will require increased transmission
- Analyze impacts of exports in 30 year scenarios
  - 1 & 2 x 500 kV lines
- Consultant assessment of export market potential
- Identify “expenditures for exports”

BC hydro
FOR GENERATIONS

IRP Process Timing / Meeting Schedule



BC hydro
FOR GENERATIONS

2011 IRP Inputs Review – Meeting #1

Topic	Description	Report Available
2010 Load Forecast	Overview of methodology and results	February 2011
Long-Term Rate Forecast	Review inputs / results	Summary Brief Dec 14, 2010
Load Resource Balance	Establish gap for analysis purposes	Summary Brief Dec 14, 2010
Risk Framework	Overview	
- if time available		
Natural Gas Forecast	Review range of forecasts	

BC hydro
FOR GENERATIONS

2011 IRP Inputs Review – Meeting #2 (2 days)

Topic	Description	Report Available
Resource Options Update	Summary overview w/ DSM	January 2011
Wind Integration Adder	Review of study results	TBD
DSM Options	Review options' details	
Electrification Scenarios	Method and results	January 2011

BC hydro
FOR GENERATIONS

2011 IRP Inputs Review – Meeting #2 ...continued

Topic	Description	Report Available
GHG Price Forecast	Review scenarios and results	January 2010
REC Forecasts	Link to GHG scenarios and results	TBD
Electricity Market Price Forecast	Review methodology and results	TBD
Exports	Review process / studies	TBD
Risk Framework	Complete review	
Portfolio Analysis	Review proposed analysis	

BC hydro
FOR GENERATIONS

Load Forecast

David Ince

BC hydro

FOR GENERATIONS

Load Forecast Methodology and Review

- Load Forecast data inputs, methodology and process extensively reviewed during 2006 IEP/LTAP, 2008 LTAP, F09/10 RRA, and the F2011 RRA
- From these review only 2 directives from 2008 LTAP were assigned to the Load Forecast
  - Directive comparing historical trend analysis to detailed sector model approaches for residential, commercial and industrial
  - Directive on reviewing impact of historical DSM on load forecast model and addressing issues on Load Forecast / DSM integration
  - These directives are dealt within the 2010 Annual Load Forecast

BC hydro
FOR GENERATIONS

Load Forecast Methodology and Review

- Methodology for the 2010 Load Forecast is substantially unchanged
- Minor adjustments made to the industrial distribution forecast
- Sub-sector analysis for oil and gas and mining is combined with regression (econometric) analysis
- This replaces a wholly top-down approach regression analysis

BC hydro
FOR GENERATIONS

Introduction to the Load Forecasts

2 MAIN PRODUCTS

Annual Peak Forecast

- Distribution substations
- Transmission substations

&

Annual Energy Forecast

Total Sales forecast includes

- Residential
- Commercial
- Industrial

3 PRIMARY APPLICATIONS

Generation operations capital planning & Revenue Forecast & Supply and demand balance for system planning

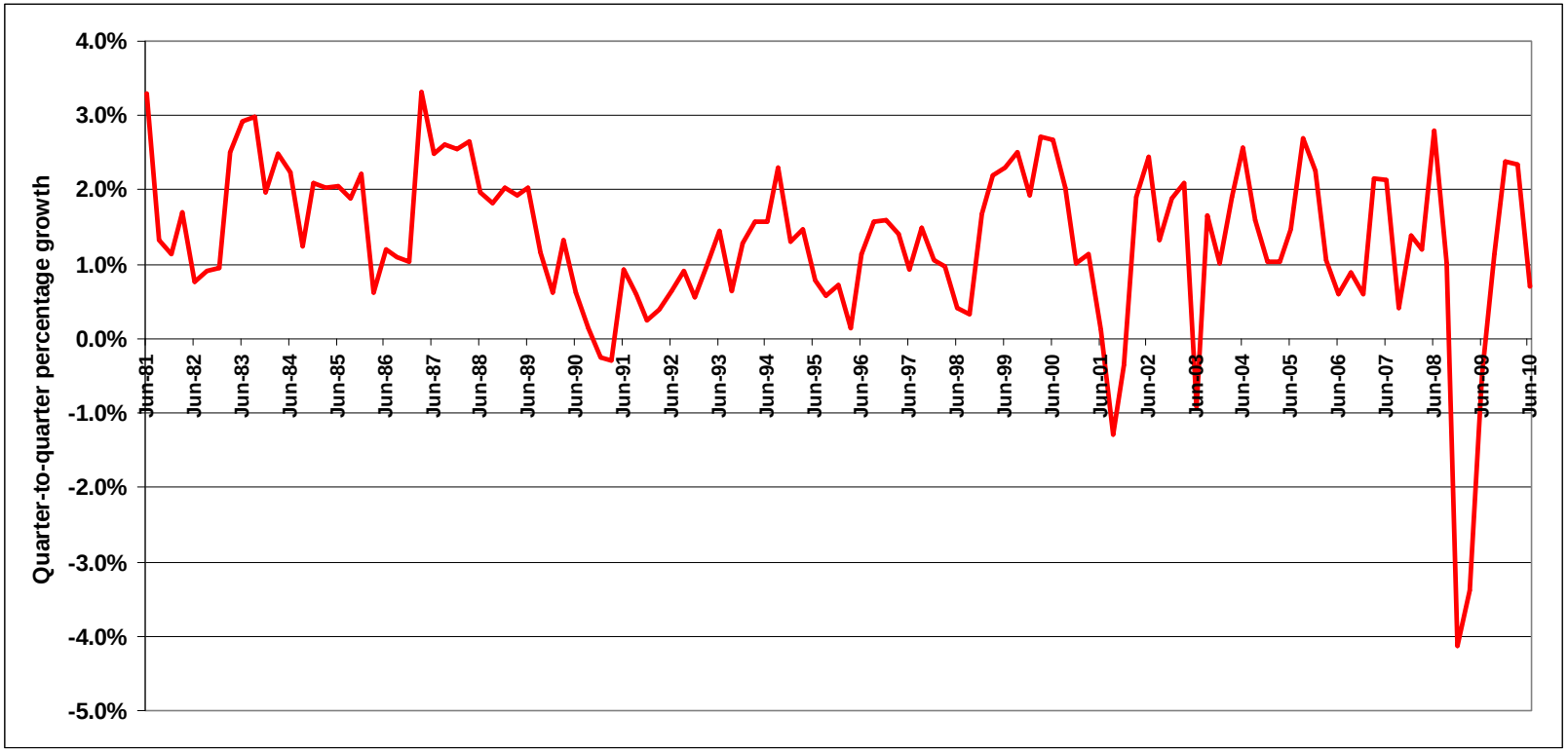
- **Load Forecasts reflect economic forecasts, impacts of general rate level changes, information from BC Hydro Key Account Managers and industry reports.**
- **Forecasts are prepared before and with incremental DSM.**
- **DSM projections are to be provided by Power Smart. In the Integrated Resource Plan, DSM is treated as a supply-side option.**
- **Long-term load forecast is prepared annually**

Overview – Substantive Issues in the 2010 Load Forecast

- Revised long term electricity rate change assumptions; short-term directionally consistent with service plan and long term extended to 20 years.
- Oil & Gas and Mining sector growth
- Electric vehicles included in 2010 Forecast
- Adjustment to load projections for load forecast DSM / Integration: Resolution of the overlap with the Power Smart Codes and standards saving

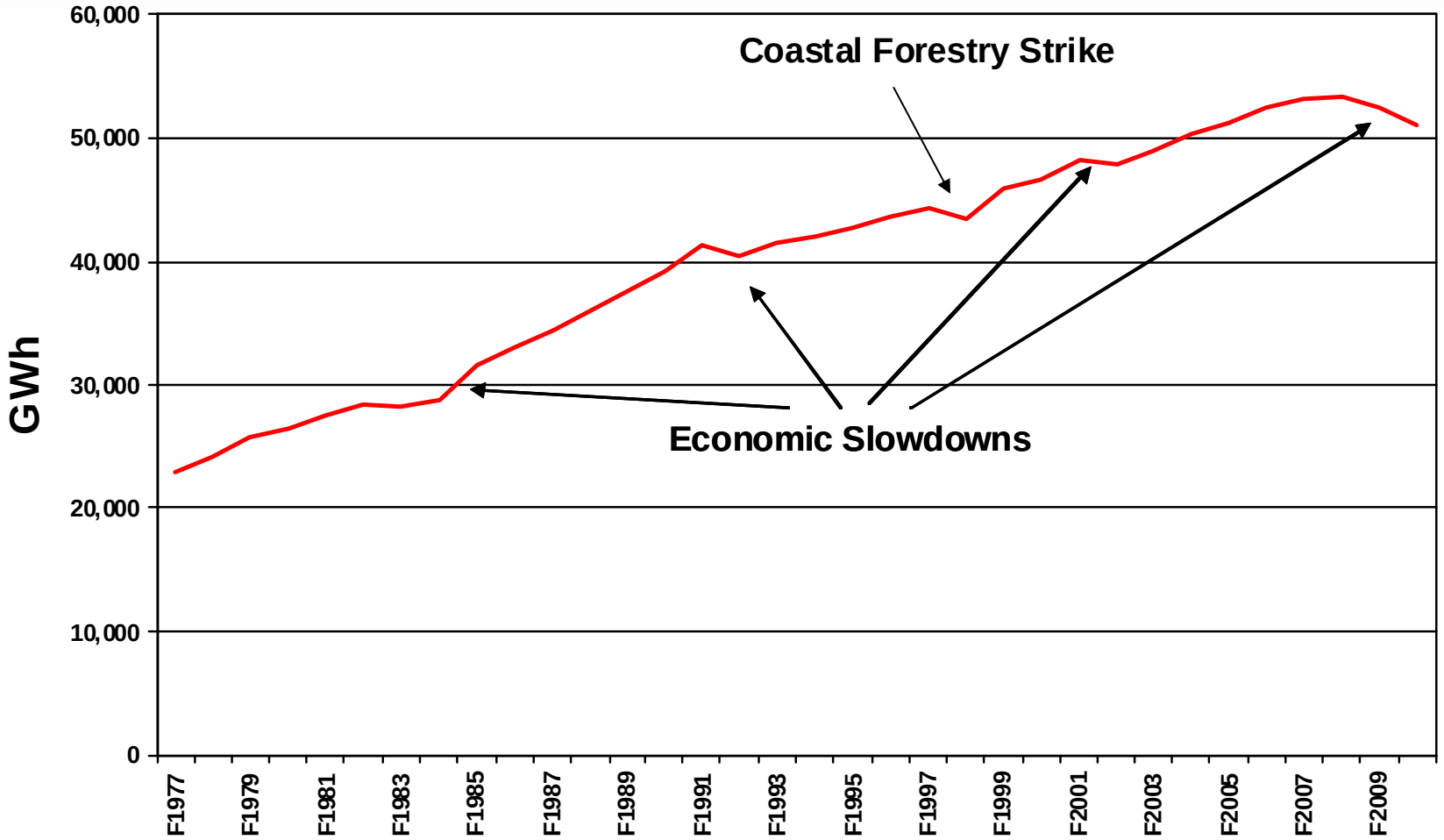
BC hydro
FOR GENERATIONS

Canadian Quarter-to-Quarter GDP Growth at Current Market Price: 1980 – Present



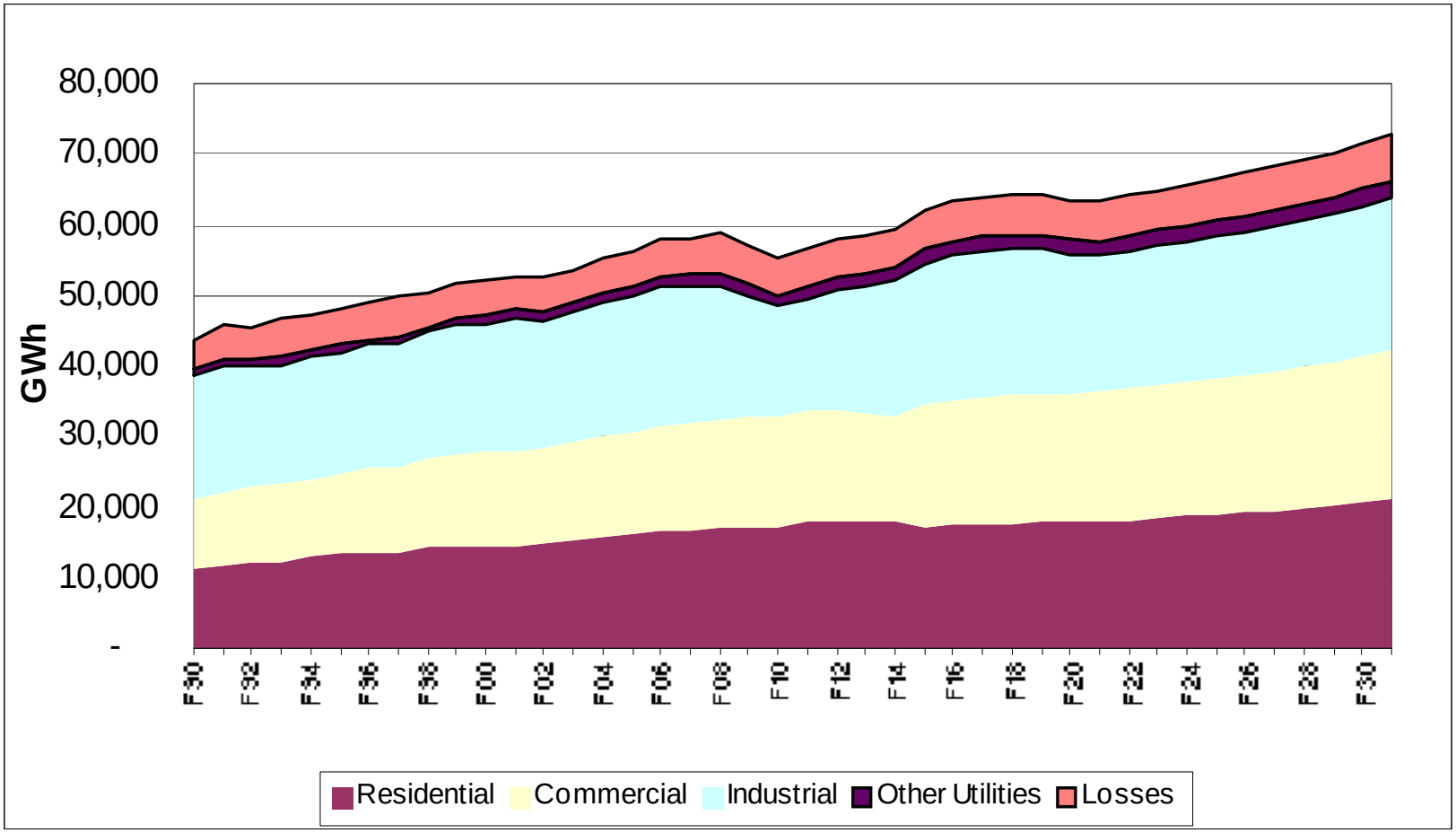
BC hydro
FOR GENERATIONS

BC Hydro Sales History



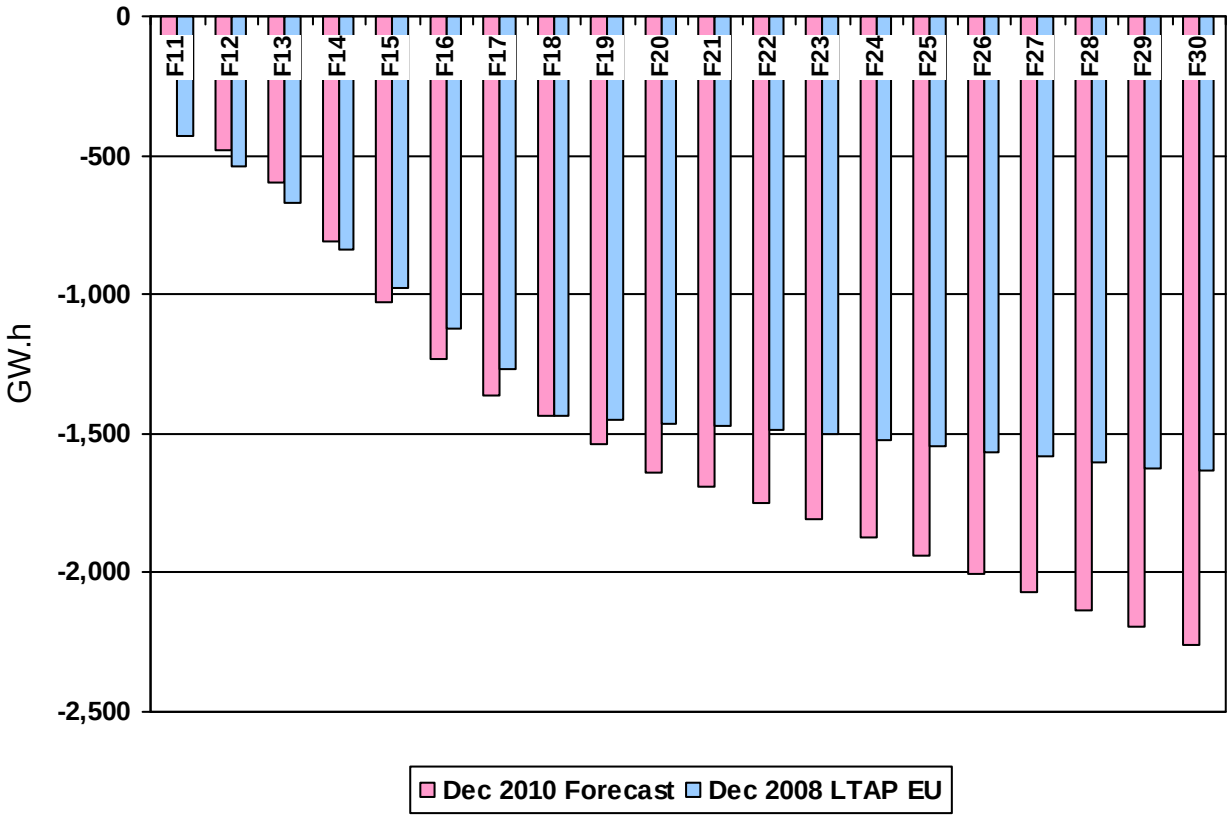
BC hydro
FOR GENERATIONS

Historical and Forecast Loads (Weather and Strike-Adjusted) with Rate Impacts and with DSM



BC hydro
FOR GENERATIONS

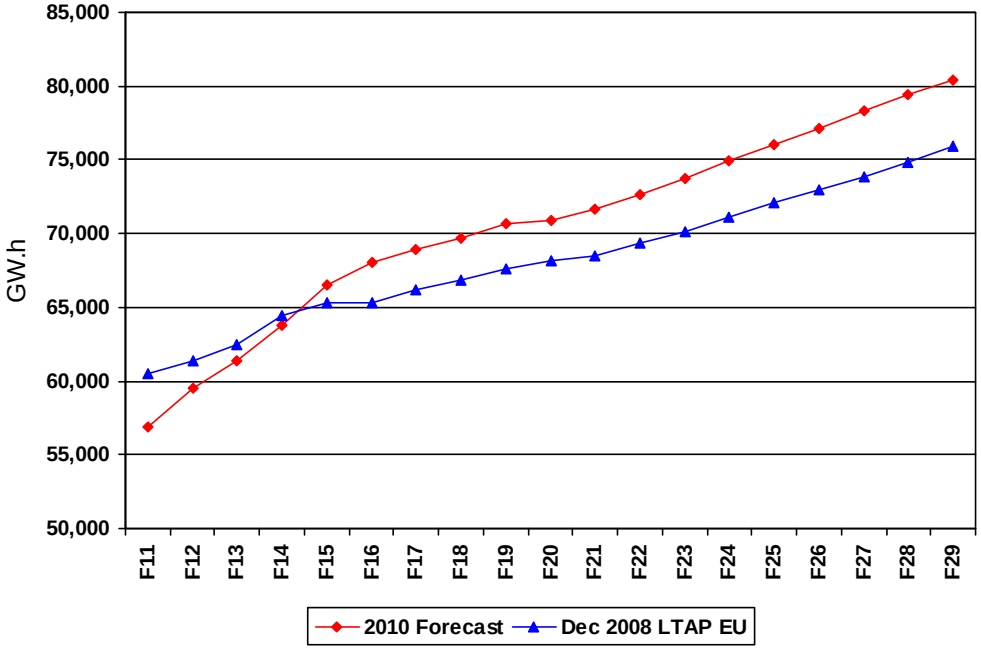
Load Reduction due to Rate Impacts
2010 vs. 2008 LTAP EU Forecast



	Load Reduction due to rates with losses 2010 (GWh)	Load Reduction due to rates with losses Dec. 2008 (GWh)
2010/11	(152)	(427)
2011/12	(481)	(538)
2012/13	(601)	(671)
2013/14	(812)	(835)
2014/15	(1,027)	(976)
2015/16	(1,232)	(1,122)
2016/17	(1,366)	(1,269)
2017/18	(1,436)	(1,433)
2018/19	(1,536)	(1,449)
2019/20	(1,640)	(1,463)
2020/21	(1,692)	(1,469)
2021/22	(1,749)	(1,487)
2022/23	(1,809)	(1,505)
2023/24	(1,874)	(1,525)
2024/25	(1,937)	(1,546)
2025/26	(2,001)	(1,564)
2026/27	(2,068)	(1,583)
2027/28	(2,132)	(1,604)
2028/29	(2,197)	(1,628)

- Load Reductions estimated with -0.05 Elasticity applied to base load (i.e., load P\projection Before DSM)
- Load reductions shown here do not include DSM impacts i.e.,, associated load reductions from two-tier (conservation) rates such as RIB, LGS and TSR. These are separately accounted for in the DSM forecast.

Total Integrated Gross Requirements Before DSM and With Rate Impacts*
2010 Forecast vs. December 2008 LTAP EU Forecast



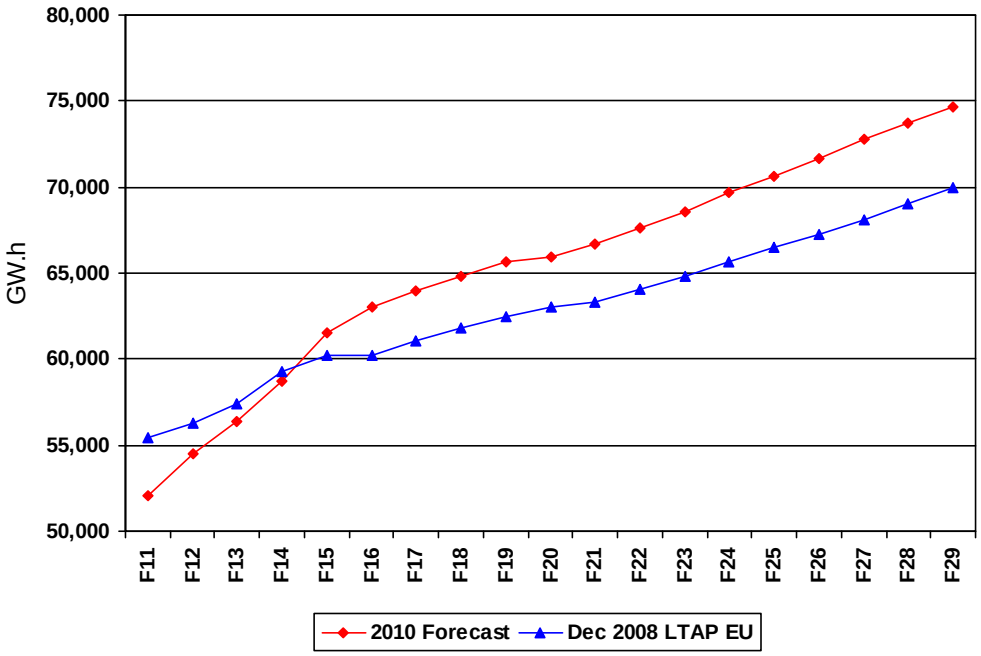
Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less 2008 EU (%)
F11	56,913	60,490	(3,577)	-5.9%
F12	59,478	61,362	(1,885)	-3.1%
F17	68,908	66,172	2,736	4.1%
F20	70,866	68,209	2,658	3.9%
F25	76,042	72,080	3,962	5.5%
F29	80,399	75,937	4,463	5.9%

* Rate Impacts refers to load reductions from forecast electricity rate changes but does not include load reductions from two-tier rate design

- Between F2008 and F2010, total requirements have declined by approximately 3,500 GWh or 6.0 percent.
- Transmission sales have declined by 2,400 GWh or 15.0 percent over the same time period. This reflects a number of permanent closures, curtailments and rapid decline in demand for BC's raw exports. Sector most effected by global slow down includes forestry and mining. Recent trends indicated that commodity prices and demand has stabilized.
- Current load growth projections reflect agreements reached for NTL; and increased inquires and nomination for electricity service for mining and oil gas. However these loads can be volatile – up or down.
- Above projections include impact of EPVs (2,100 GWh in F2030) and adjustments for Load Forecast DSM Integration Overlap of efficiency estimates associated with codes and standards (1,000 GWh in F2030).

Total Firm Sales Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast

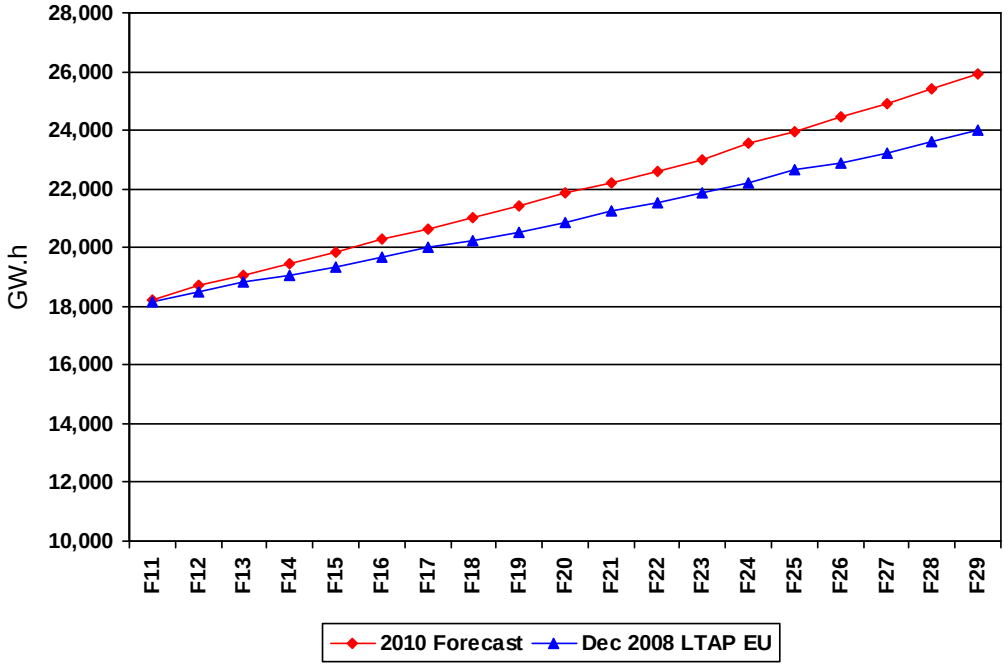


Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less 2008 EU (%)
F11	52,024	55,442	(3,419)	-6.2%
F12	54,494	56,278	(1,784)	-3.2%
F17	63,988	61,074	2,914	4.8%
F20	65,939	63,021	2,918	4.6%
F25	70,668	66,531	4,137	6.2%
F29	74,610	70,005	4,605	6.6%

- Total Firm Sales includes residential, small and large commercial and small and large industrial and sales to other utilities
- Residential forecast is above last years primarily reflecting stronger growth projection in accounts forecast.
- Commercial forecast below last year forecast. Revised expectations of higher efficiency of commercial end uses combined with modestly growing drivers has resulted in lower level of sales.
- EPVs and adjustments for Load Forecast / DSM Integration reflected in residential and commercial forecast
- Industrial sales above last years reflecting; improved outlook for mining NTL announcement has resulted in revised probability of future load. Revised oil and gas projection stems from updated information on customer requirements. New projects such as LNG storage and pipeline have increased load expectations.

Residential Sales Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast

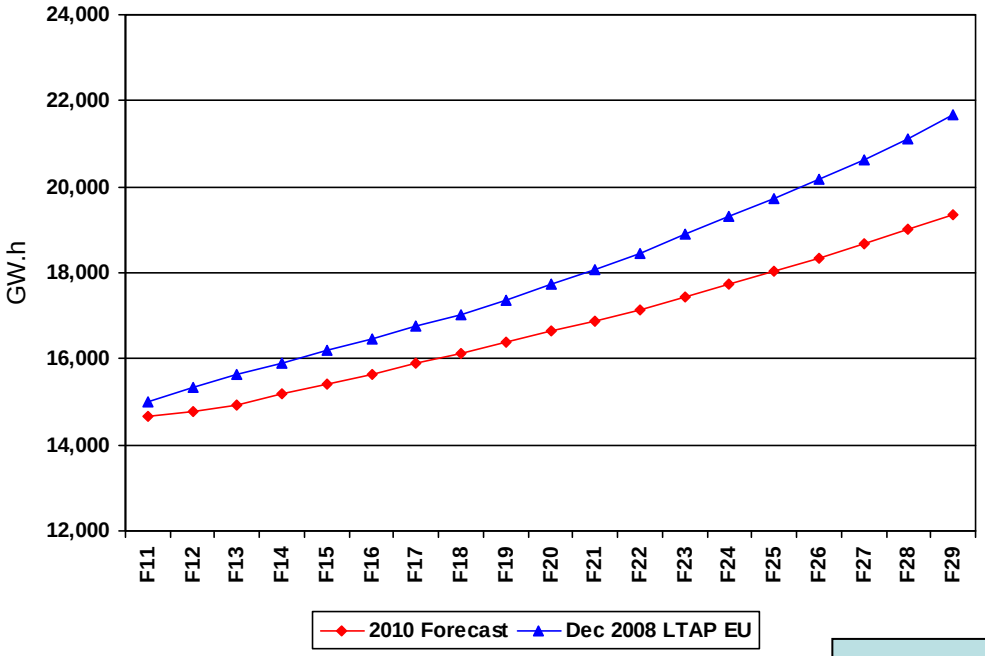


Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 LTAP EU Forecast (GWh)	2010 Less Dec 2008 (GWh)	Oct 2010 Less Dec 2008 (%)
F11	18,213	18,167	46	0.3%
F12	18,691	18,485	207	1.1%
F17	20,632	19,998	634	3.2%
F20	21,862	20,849	1,012	4.9%
F25	23,951	22,632	1,319	5.8%
F29	25,900	23,981	1,919	8.0%

- Drivers of Forecast: Use per Account times the number of accounts.
- This year's account growth forecast is above last year.
- Use per account forecast to be lower than due to lower growth rate in the economy and the impact of improved stock efficiency forecasts from the EIA.
- Overall, stronger growth in accounts has offset slower growth projection in use per account
- 2010 projections includes EPV impact and overlap adjustments for codes and standards

Commercial General Sales Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast

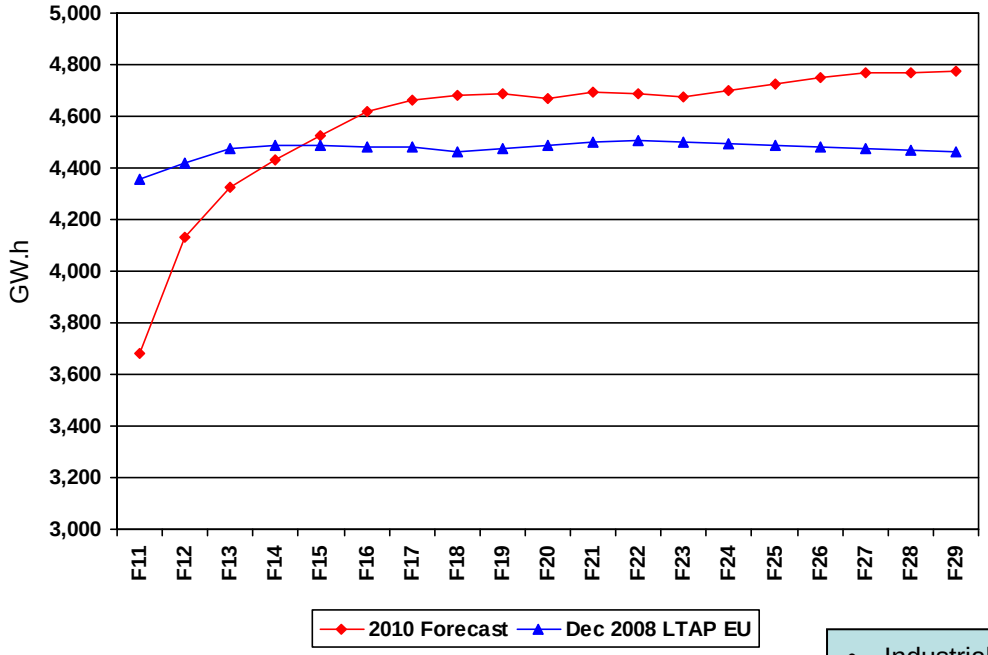


Forecast Before DSM and With Rates

	October 2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less 2008 EU (%)
F11	14,646	15,016	(370)	-2.5%
F12	14,771	15,347	(576)	-3.8%
F17	15,893	16,746	(853)	-5.1%
F20	16,639	17,731	(1,092)	-6.2%
F25	18,050	19,736	(1,686)	-8.5%
F29	19,344	21,658	(2,314)	-10.7%

- Commercial General is 80 percent of the total General Service sales.
- Drivers of the forecast include commercial end-use efficiencies and projections of retail sales, employment and commercial output
- In the longer-term, the forecast is below last years forecast due to economic drivers growing slower, and assumed higher efficiencies in commercial end-uses.

Industrial General Sales Before DSM and With Rate
2010 Forecast vs. December 2008 LTAP EU Forecast

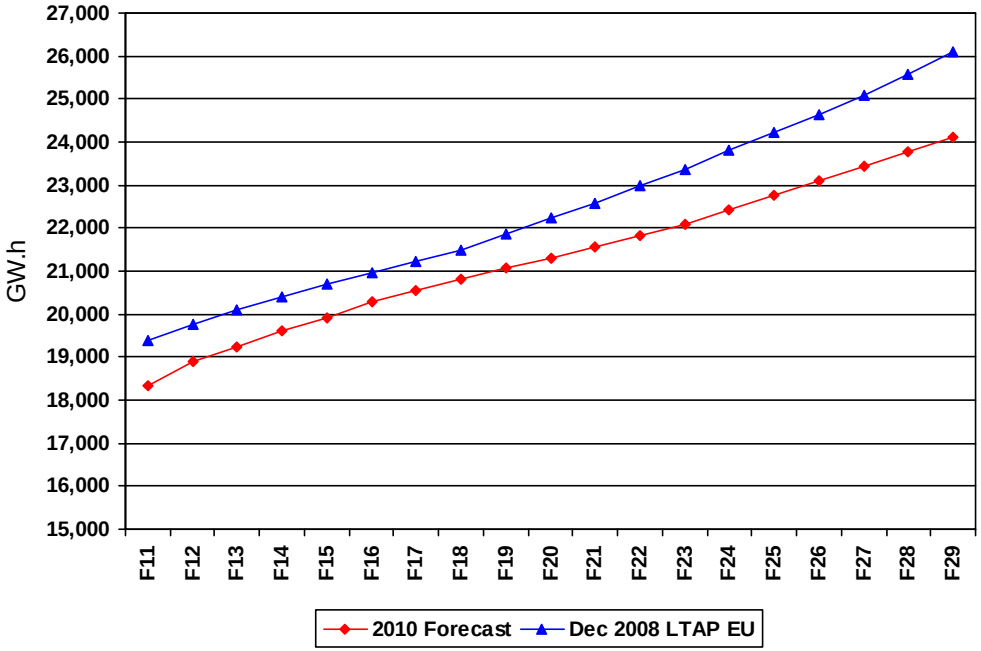


Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less 2008 EU (%)
F11	3,684	4,358	(674)	-15.5%
F12	4,129	4,421	(292)	-6.6%
F17	4,664	4,480	184	4.1%
F20	4,667	4,489	178	4.0%
F25	4,727	4,487	240	5.3%
F29	4,773	4,460	313	7.0%

- Industrial General sector is about 20 percent of total General Sales. Sales is primarily made up manufacturing, wood processing, mining and agriculture.
- In the last 2 years, sales has declined by over 500 GWh. Manufacturing and wood processing have experienced lower sales due to recession, the high dollar and lower prices for wood products.
- Near-term sales are expected lower reflecting the impact of the pine beetle infestation, leading to reduced sales from sawmills and other wood related industries.
- For 2010 Forecast, the methodology has been refined/improved by splitting the overall Industrial General category into sub-sectors and forecasting these individually.

General Sales Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast

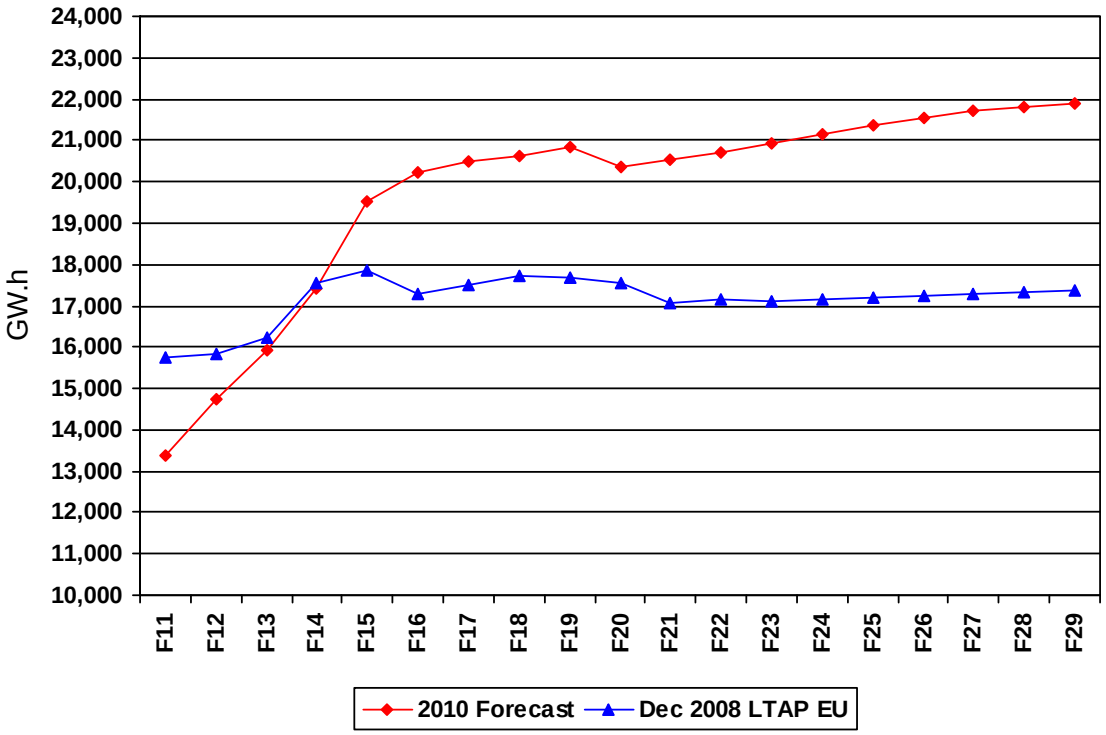


Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	010 Less 2008 EU (%)
F11	18,330	19,374	(1,044)	-5.4%
F12	18,900	19,768	(868)	-4.4%
F17	20,557	21,227	(669)	-3.2%
F20	21,306	22,220	(914)	-4.1%
F25	22,776	24,223	(1,446)	-6.0%
F29	24,117	26,118	(2,001)	-7.7%

- This is a summation of the Industrial and Commercial General Sales categories

Transmission Sales Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast

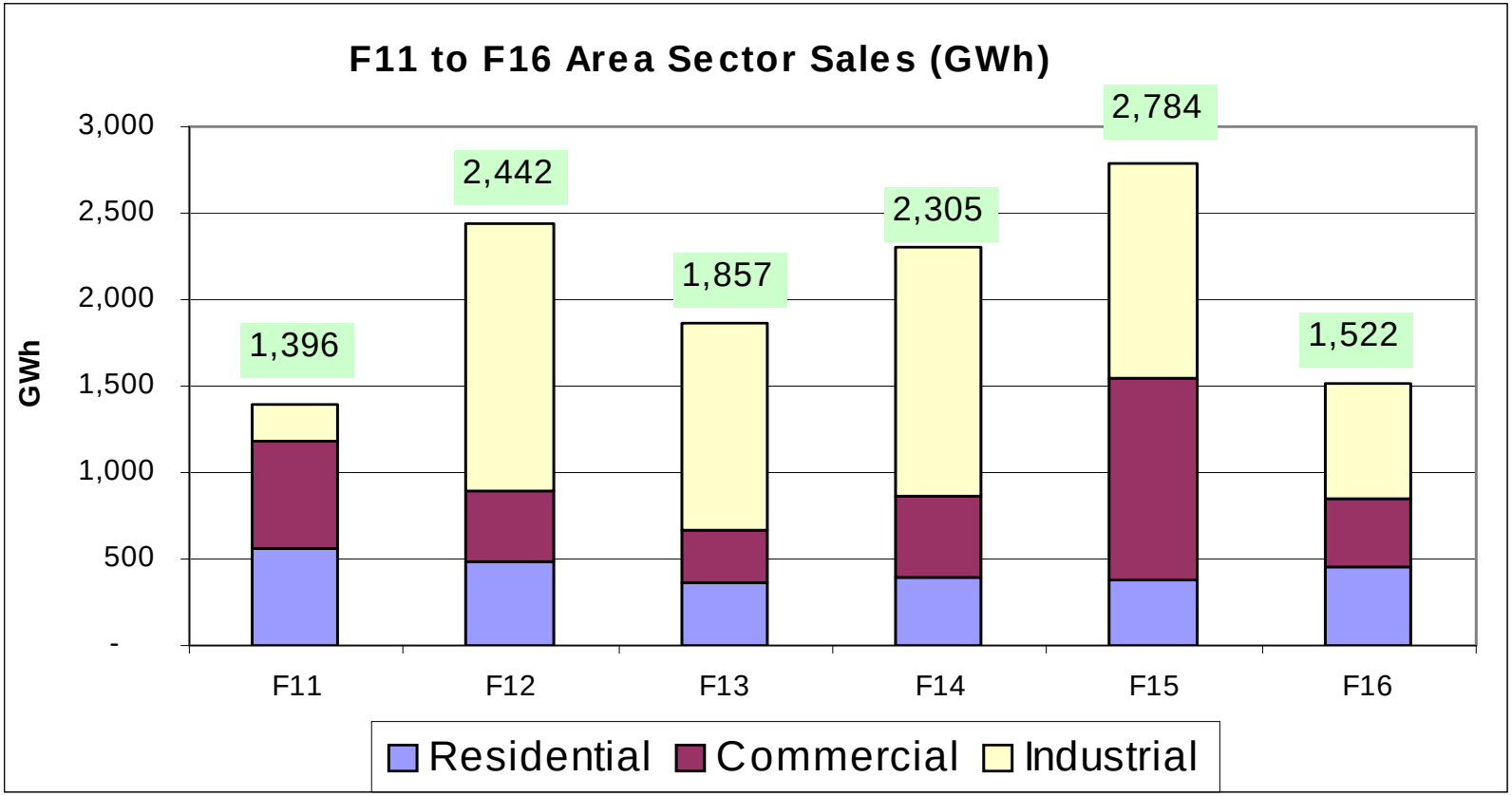


Forecast Before DSM and With Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less Dec EU 2008 (%)
F11	13,366	15,758	(2,392)	-15.2%
F12	14,756	15,829	(1,073)	-6.8%
F17	20,492	17,515	2,978	17.0%
F20	20,364	17,560	2,804	16.0%
F25	21,365	17,201	4,164	24.2%
F29	21,882	17,360	4,522	26.0%

- Detailed sector by sector analysis follows. Main reason for the higher forecast is expected ramp-up in mining and oil & gas sector loads.

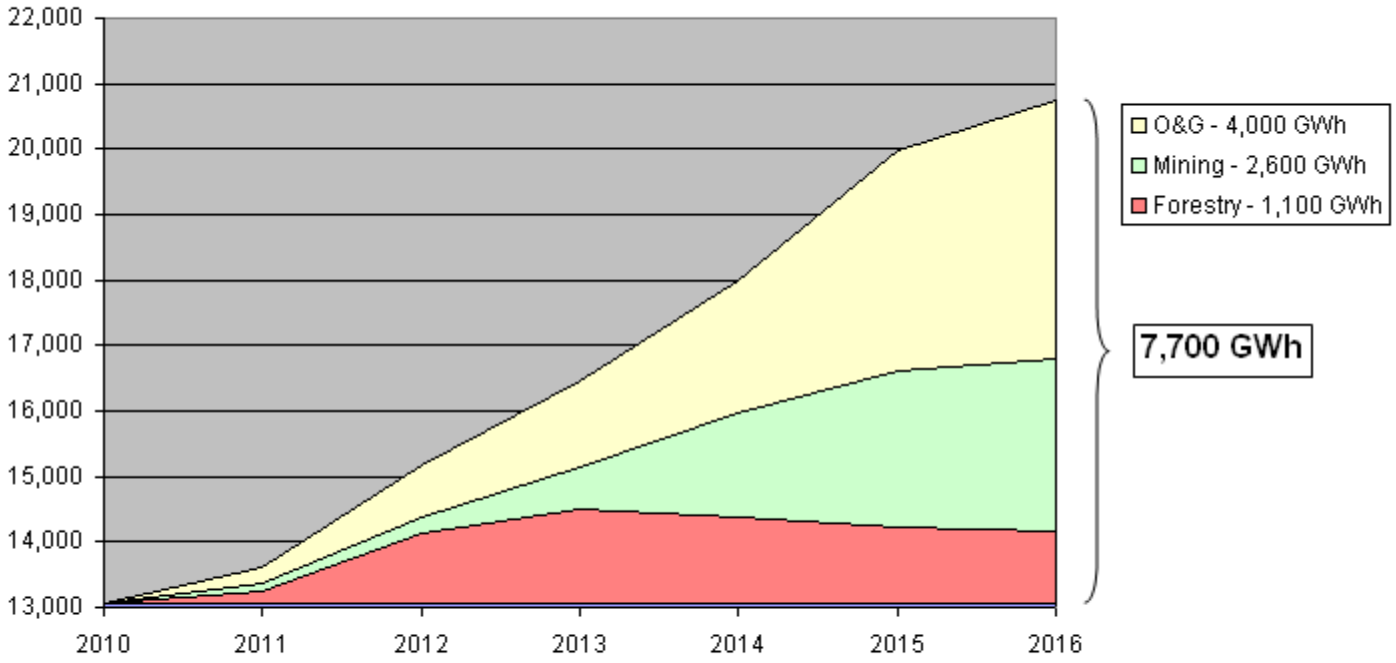
Total Area Sales F11 to F16 before DSM with Rate Impacts



From F11 to F16, it is anticipated that industrial sales led by Oil & Gas and Mining will have a significant share of the year-over-year load growth.

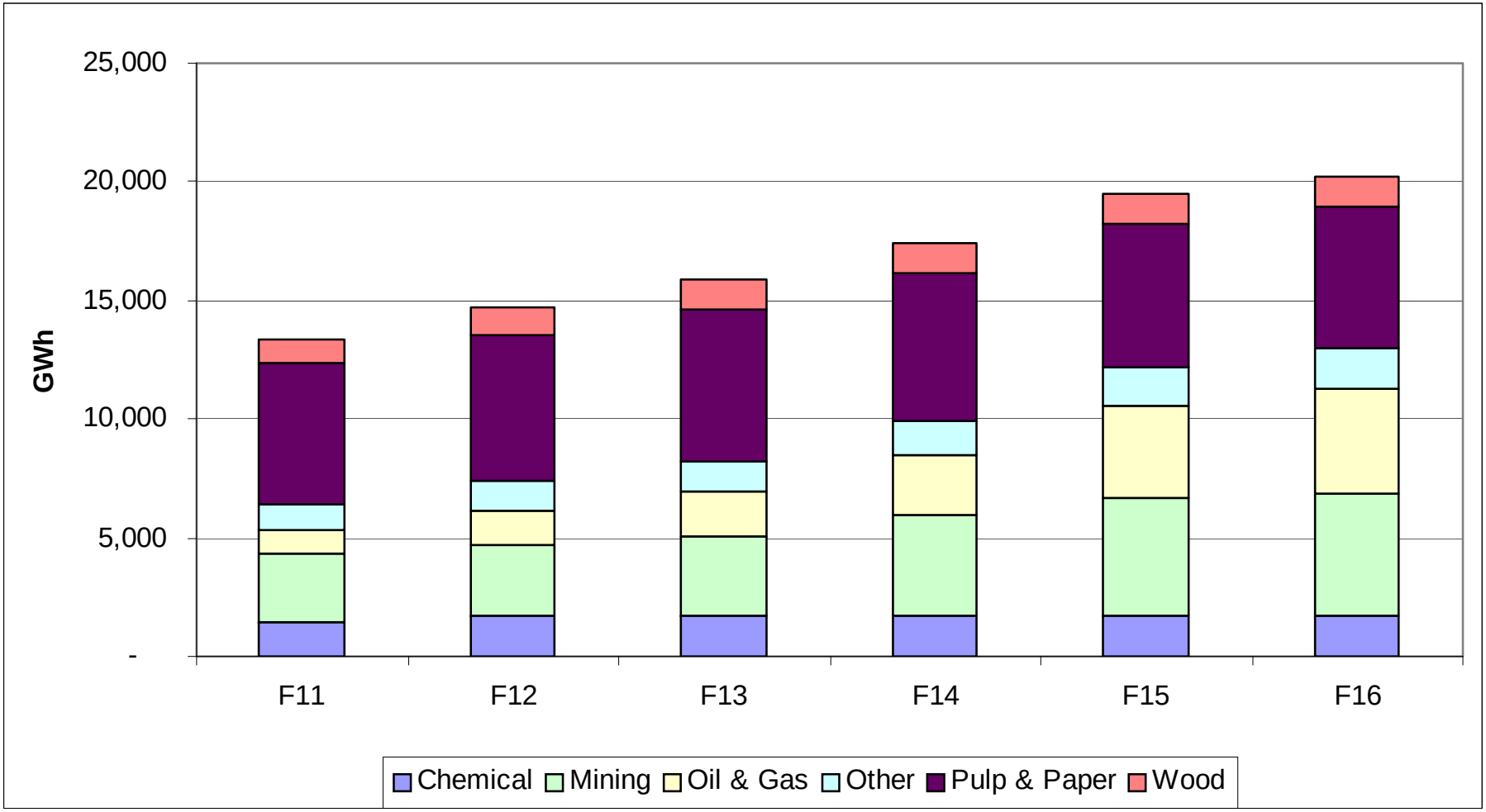
Industrial Load Explanation - F10 to F16

Main Sectors Contributing to Industrial Load Growth

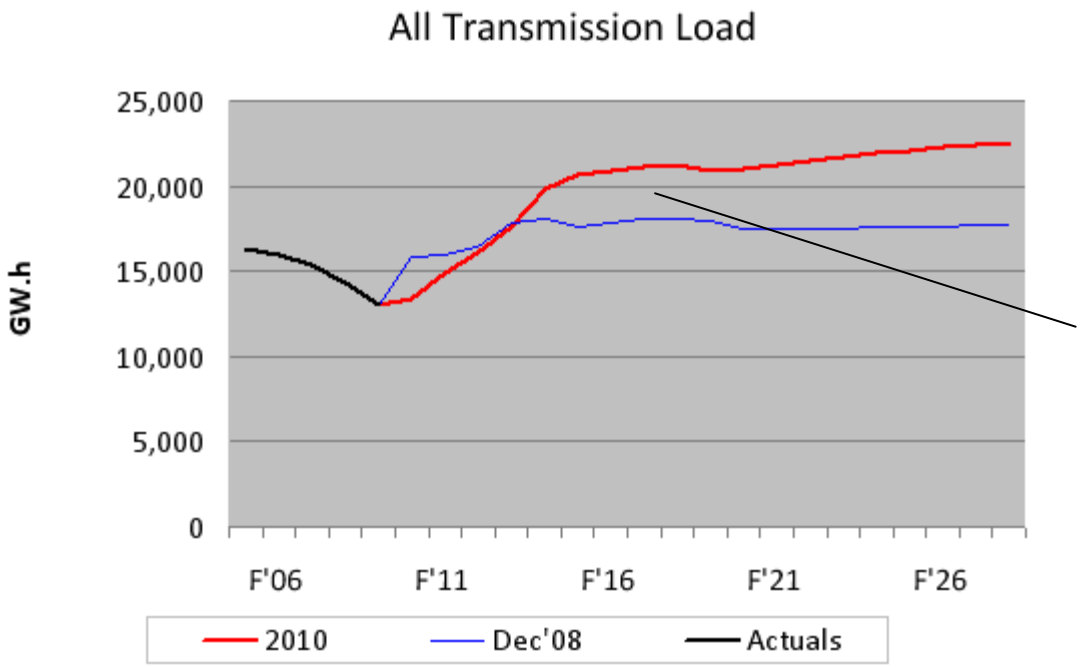


BC Hydro Service sales area growth	**12,700 GW.h**
Industrial load growth	**7,700 GW.h or 61%**

Industrial Load Growth Explanation – F11 to F16



Transmission Forecast Comparison (Before DSM & Rate Impacts)



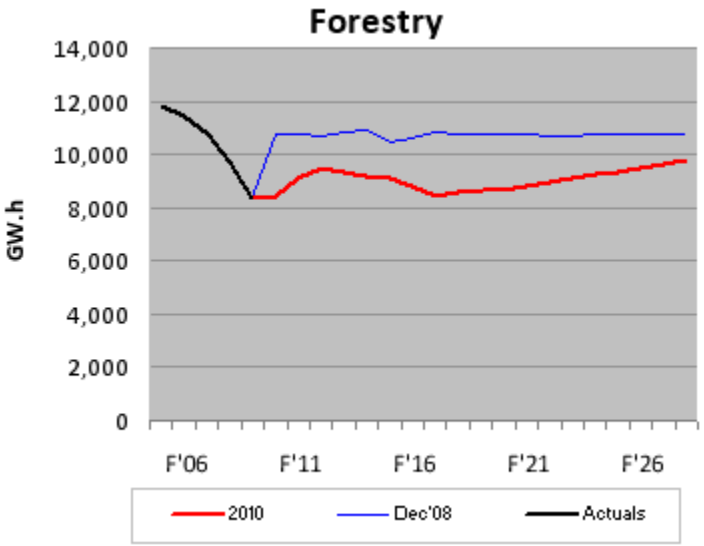
Increase mainly due to
- Oil & Gas &
- Mining

Transmission Sector Forecast Changes

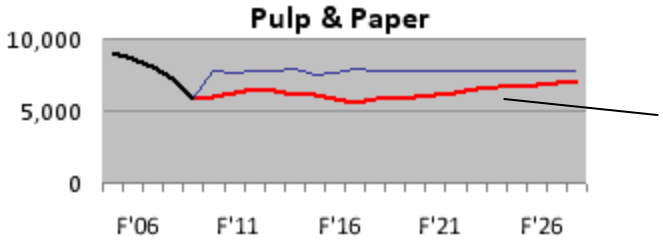
- Increased load expected in Oil & Gas and Mining, and lower in Forestry.
  - Forestry – Forecast is lower due to the closures of Elk Falls.
  - Mining - Stronger mining expectations.
  - Oil & Gas - More confidence in gas development in the Peace Region.
  - Other - Two new customers.

BC hydro
FOR GENERATIONS

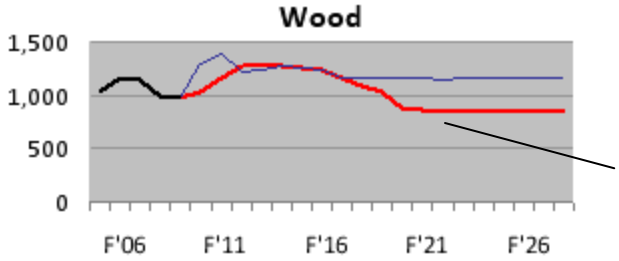
Transmission: Forestry (Before DSM & Rate Impacts)



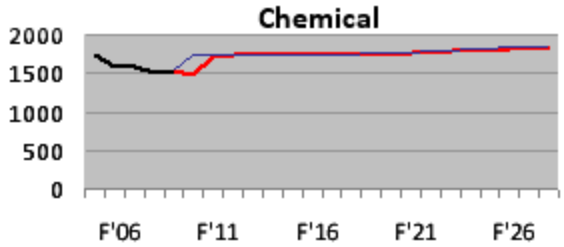
Consists of 3 sub-sectors:



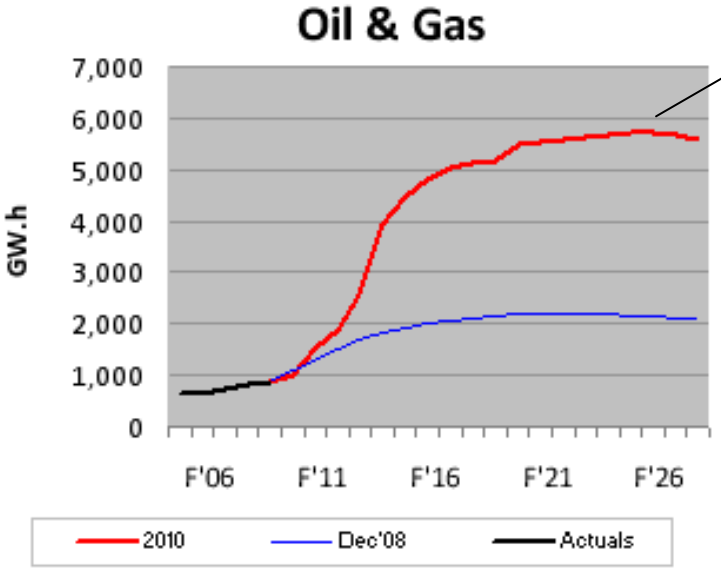
Decrease due to closure of Elk Falls.



Bigger lumber shortage expected from the Mtn. Pine Beetle

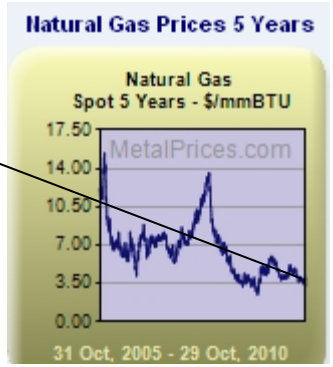


Transmission: Oil and Gas (Before DSM & Rate Impacts)

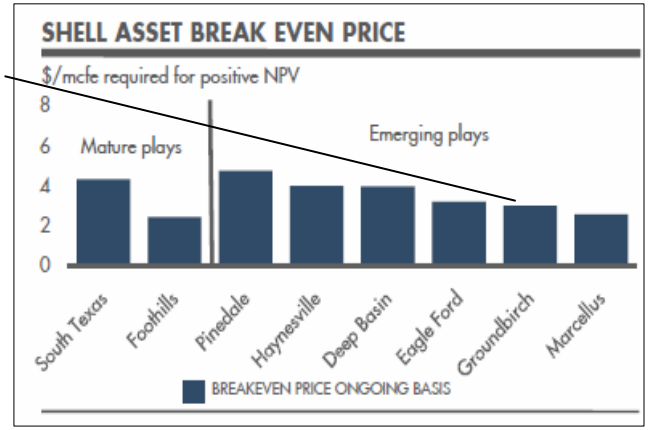


Increase due to increasing load requests from gas producers.

Despite low gas prices, Shell (in Aug'10), requested 281 MW.

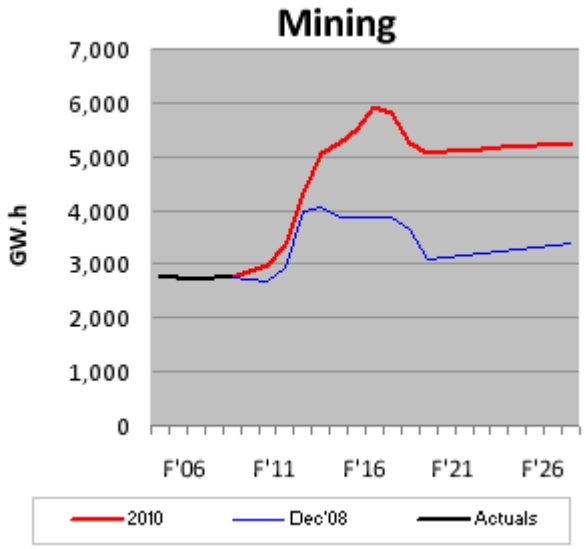


Shell's published reports show the Peace region as being one of their low cost areas.

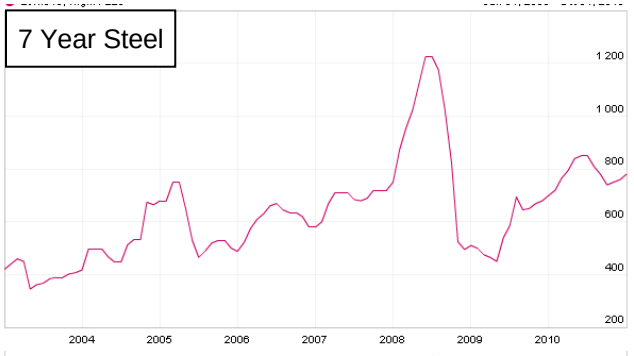


BC hydro
FOR GENERATIONS

Transmission: Mining Sector (Before DSM & Rate Impacts)

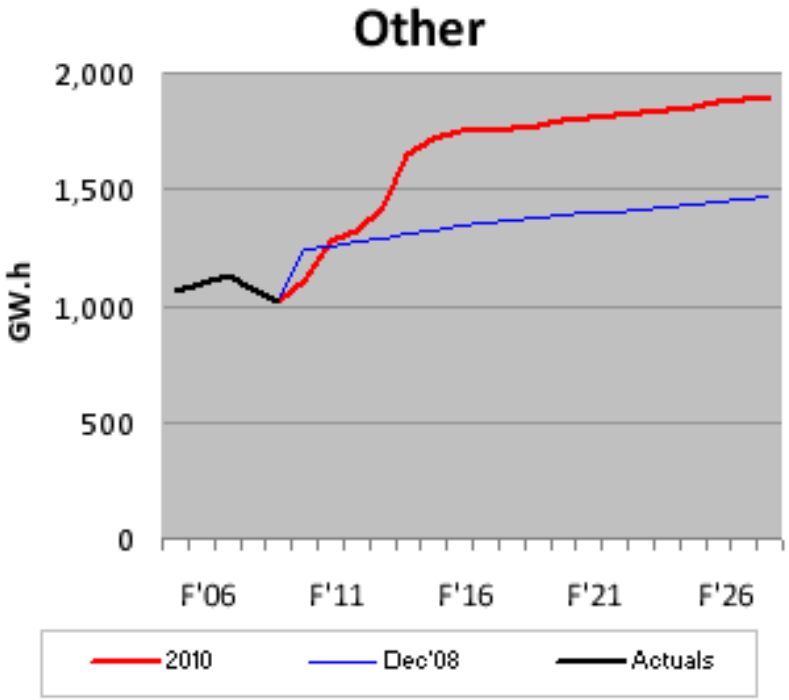


Improved economic outlook for B.C.'s copper, gold and coal mines.



BC hydro
FOR GENERATIONS

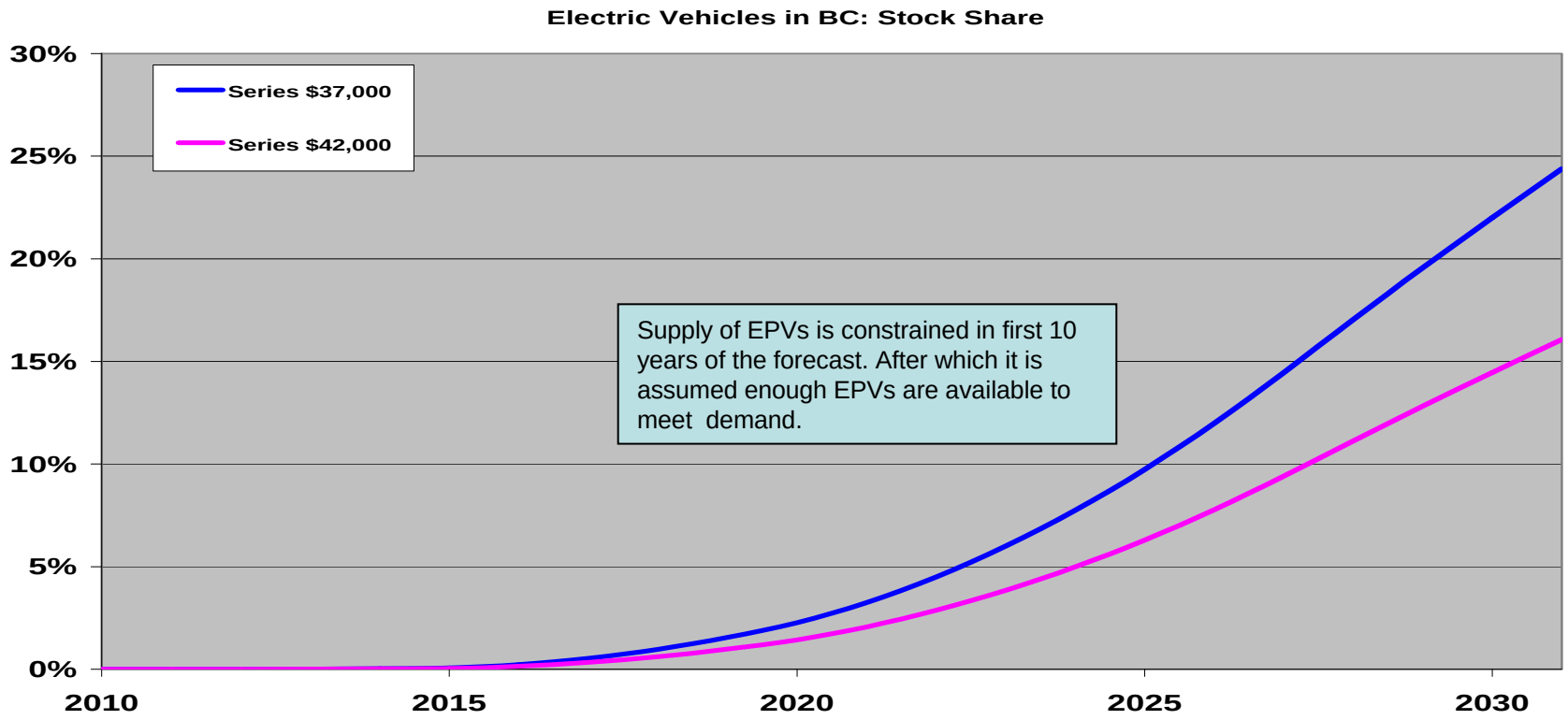
Transmission: All Other Sectors (Before DSM & Rate Impacts)



- Major customers in this sector include: GVRD, UBC, SFU, cement companies and YVR.
- Increase due to two new customers - 400 GWh Esquimalt Graving Dock & Neptune Bulk Terminal.

BC hydro
FOR GENERATIONS

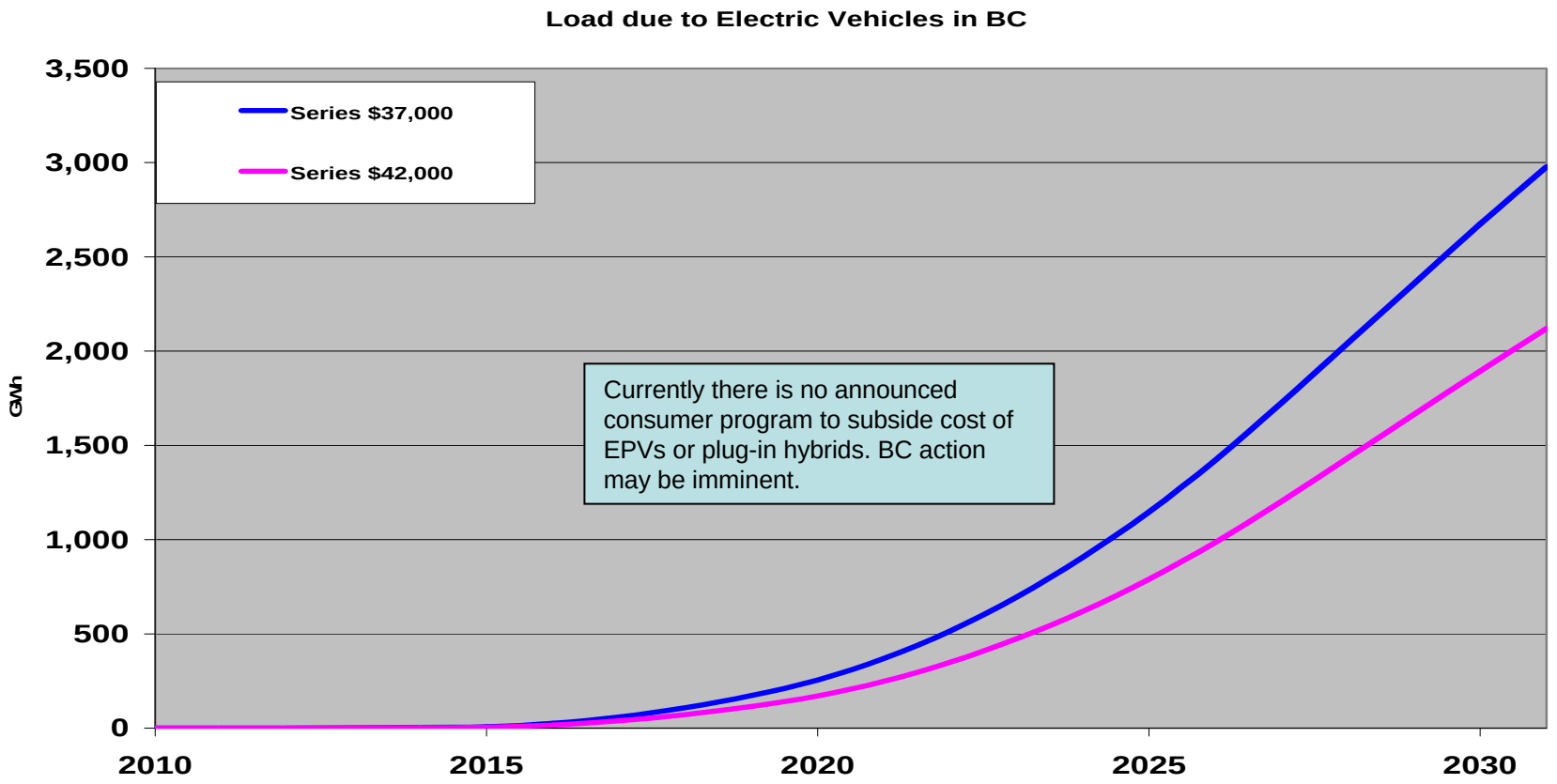
Electric Vehicles Projection in B.C.



Electric Vehicle Scenarios

- EV scenarios take into account many variables including: population and vehicle growth rate forecasts, gasoline and electricity price forecasts, efficiencies for both electric and gasoline cars, feebates/subsidies, carbon taxes, consumer acceptance and most critical in the near term: vehicle supply constraints.
- For the scenarios above, efficiency and capital costs were held constant (in $Real) throughout the forecast. Capital costs include home rewiring costs. In these scenarios, these costs would be passed directly to the consumer.

Electric Vehicles Load Impact



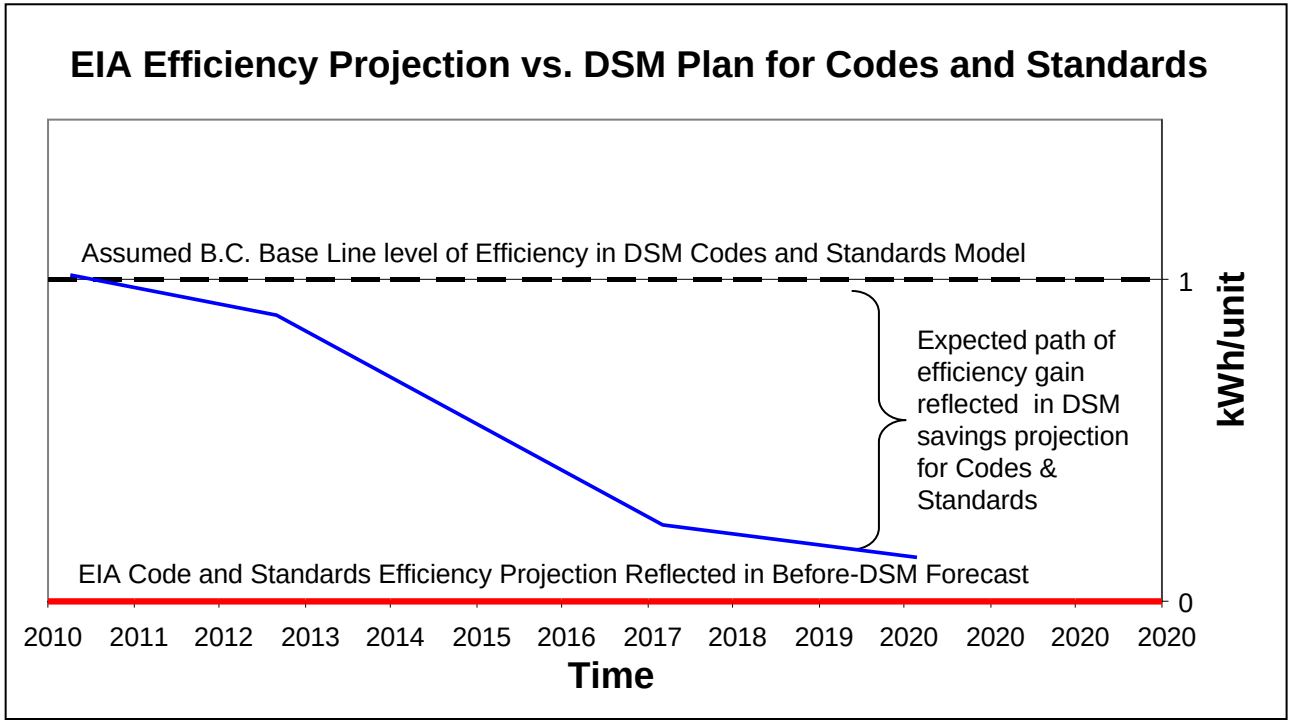
The impact on load under these scenarios is very small in the first 5 years of the forecast, but increases rapidly from 2020 due to relaxed supply constraints.

Under the $42,000 capital cost scenario, the total impact on BC Hydro's energy requirements is as follows:

- 2017: 38 GWh
- 2031: 2,100 GWh

Load Forecast DSM Integration
Codes and Standards

- **The blue line represents the projected path of efficiency gains in the B.C. market as result of codes and standards. The red line represents the assumed efficiency of end-uses (such as lighting and appliances) by the US Energy Information Administration.**
- **BC Hydro's load forecasting models already assume the EIA level of end-use efficiencies.**
- **This is the basis of double-counting – that BC Hydro's load forecast assumes the EIA efficiency level, which results in a lower load forecast, and then in addition, DSM savings due to Power Smart Codes and Standards are subtracted from the forecast.**



- Currently known areas of Codes and Standards that overlap include: incandescent lighting, set top boxes, battery chargers & standby power, external power supplies & building shell efficiency requirements for commercial buildings.
- Based on DSM Planned 2008 LTAP EU estimates the overlap amount 2,150 GWh for F2001 in savings for residential & commercial sectors. About 760 GWh or 36 % is due to lighting the remainder 1,300 GWh is due to small technologies and commercial building shell efficiencies.
- Impact on lighting can be resolved by including a higher (and older) EIA projection of lighting efficiency in the load forecast models..
- For uncertainties with respect to the compliance levels of efficiency in the EIA estimates and transformation in BC, it is proposed that half of the 1,300 GWh overlap estimate is added back to forecast projection before DSM.

Peak Forecast Overview

- Peak is an extreme event!
- Maximum amount of power consumed in a single hour
- Units are MW
- BC Hydro System is winter peaking utility and highly responsive to colder temperatures
- Peak forecast is prepared for average cold conditions (i.e., Design Temperature)

BC hydro
FOR GENERATIONS

Peak Forecast Overview

- Design Temperature is the average of the coldest daily average temperatures over the most recent 30 years
- Design Temperature for four regions are

  Lower Mainland: -5.3ºC

  Vancouver Island: -3.6ºC

  Southern Interior: -16.8ºC

  Northern Region: -28.5ºC

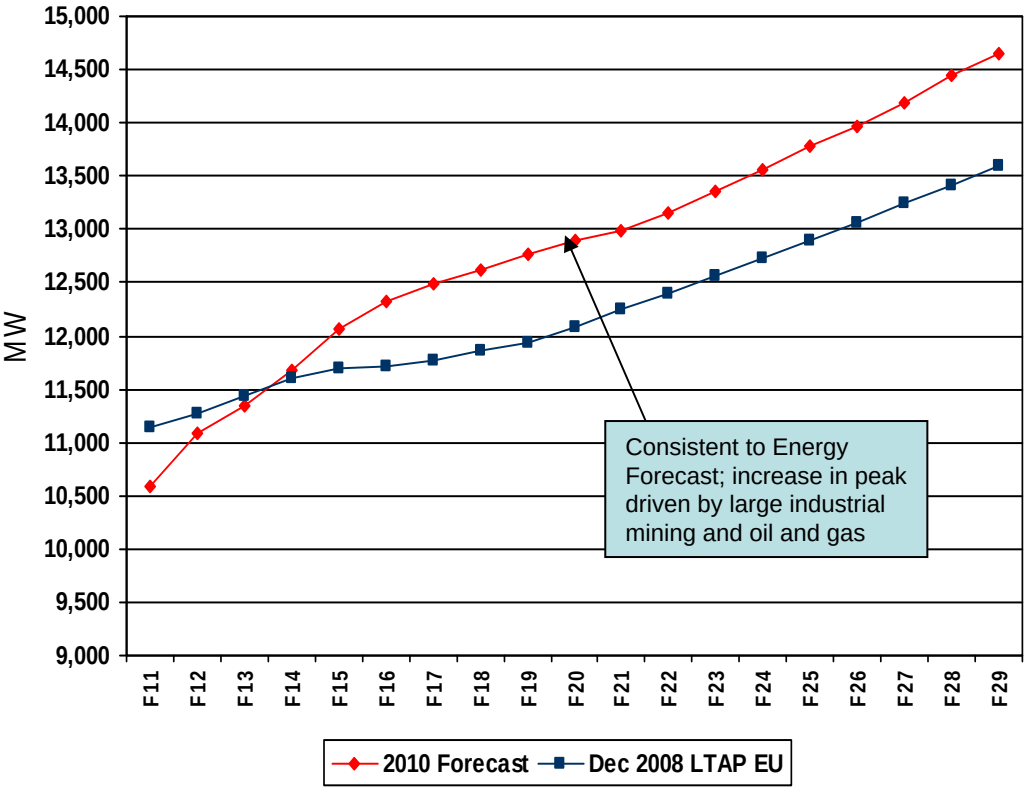
BC hydro
FOR GENERATIONS

Peak Forecast Overview

- The updated forecast reflects
  - Latest estimates of drivers such as number of residential accounts and employment
  - Expected new load development on the distribution system
  - Market intelligence from BC Hydro's Key Account Managers and forestry studies

BC hydro
FOR GENERATIONS

Integrated Total Peak Before DSM and With Rate Impacts
2010 Forecast vs. December 2008 LTAP EU Forecast



Forecast Before DSM and Before Rates

	2010 Forecast (GWh)	December 2008 EU Forecast (GWh)	2010 Less 2008 EU (GWh)	2010 Less 2008 EU (%)
F11	10,580	11,144	(564)	(5.1)
F12	11,078	11,279	(201)	(1.8)
F17	12,483	11,761	722	6.1
F20	12,899	12,088	811	6.7
F25	13,776	12,891	886	6.9
F29	14,658	13,604	1,055	7.8

•Forecast excludes Fort Nelson and includes capacity transfers from BC Hydro to other Utilities including Fortis BC, Seattle City Light and the City of New Westminster

- Current Peak demand projection is below 2008 forecast in the short term. Reflects historical decline in transmission peak demand form reduced loads and closures.
- Middle and long term forecast above 2008 forecast. Reflects anticipated higher peak demand from oil and gas and mining loads.
- EPV impact reflected in later 10 years of the forecast. EPV peak impact reflects a charging profile that builds up through the day. Profile based on battery depletion rates and driving patterns and data is supported by EPRI studies.

Future Releases of Forecasts

- Annual Load Forecast document with Forecasts before DSM expected to be available in mid winter 2011
- Forecasts with DSM included in F2012 to F2014 Revenue Requirements and other Applications

BC hydro
FOR GENERATIONS

Long-Term Rate Forecast

Cheryl Yaremko

BC hydro
FOR GENERATIONS

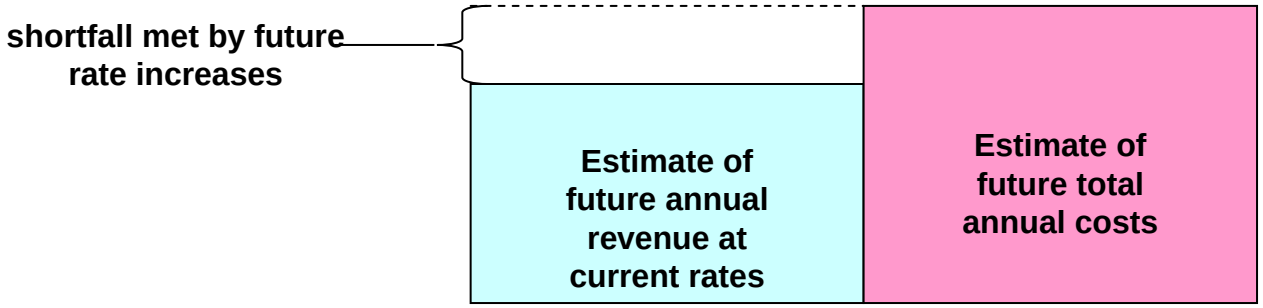
Long Term Rate Forecast (LTRF)

- BC Hydro has prepared an estimate of future electricity rates (LTRF) for use as input into load forecast and DSM plans in the 2011 IRP.
- LTRF must be treated as indicative only, produced solely for the purpose of informing the load forecast and DSM analysis, as required by the BCUC directive from the 2006 IEP / LTAP.
- A long term rate forecast is highly uncertain and is subject to significant variability depending on the assumptions made.
- Rates will not increase until BC Hydro files a Revenue Requirement Application (RRA) and obtains approval from the British Columbia Utilities Commission (BCUC).
- The LTRF used in 2011 IRP is not official BC Hydro plan of future RRAs, which will be based on detailed assessments of expected revenues/costs for the relevant test period at the time of filing.

BC hydro
FOR GENERATIONS

LTRF Approach

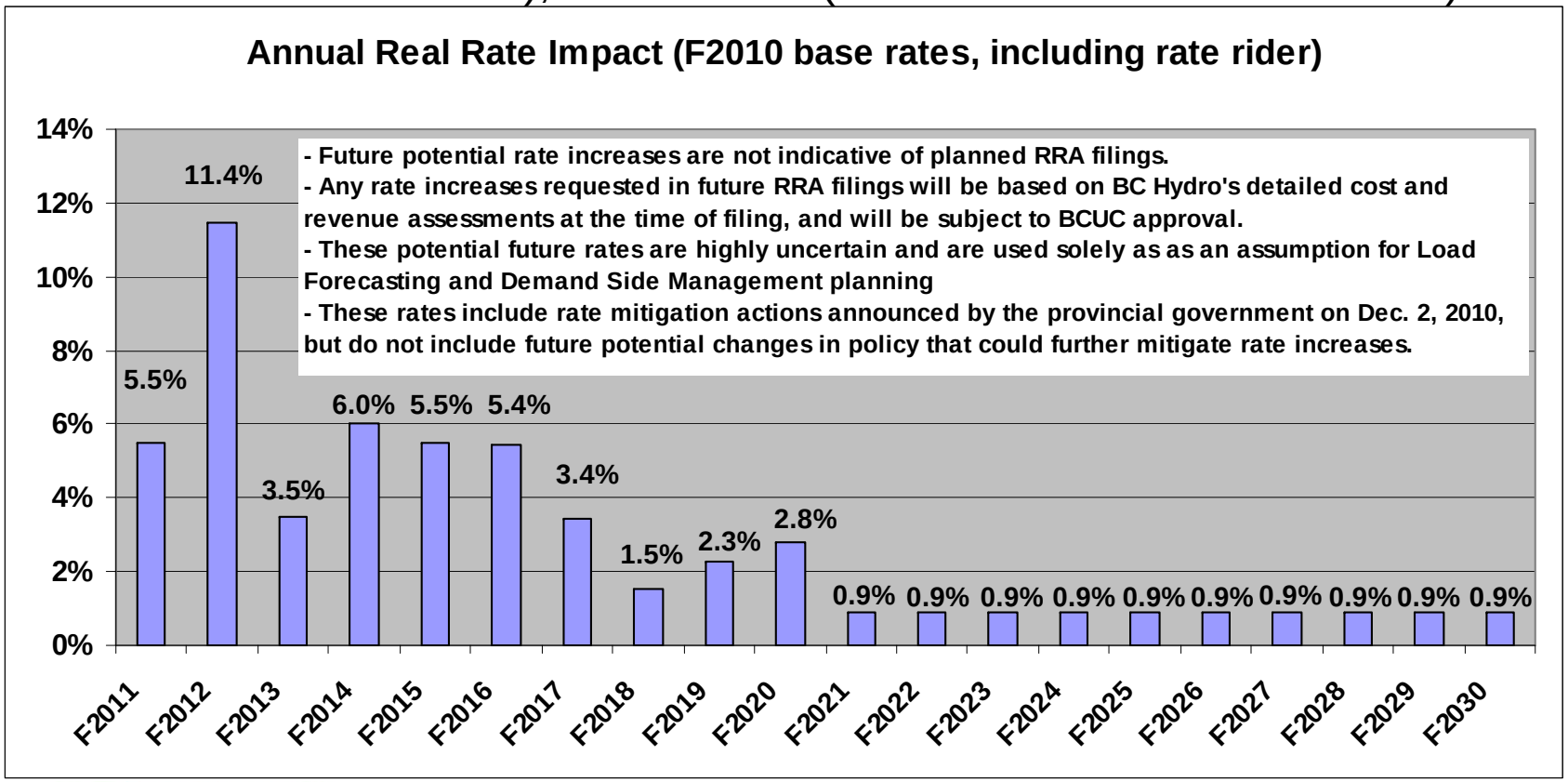
- LTRF assumes that costs associated with BC Hydro expenditures and activities are recovered through customer rates.
- Revenue (future energy sales at current rates) is calculated for each year over the forecast period, based on the after-DSM load forecast.
- Future costs are estimated for each year over the forecast period (energy costs, costs associated with capital expenditures, operating costs, taxes and grants, other costs).
- Any estimated future revenue shortfall is recovered through increases in customer rates.
- Changes to future rates are assumed to applied ‘across-the-board’ to all customer classes.



BC hydro
FOR GENERATIONS

LTRF used for 2011 IRP

- LTRF results presented in terms of bill impact (rate increase and changes to deferral account rate rider), in real terms (net of forecasted inflation rates):



BC hydro
FOR GENERATIONS

LTRF Drivers & Assumptions

- BC Hydro forecasts that the province's electricity needs will grow substantially over the next 20 years, due to industrial activity and general economic growth. To meet B.C.'s future electricity needs, there is a need to:
  - Renew, replace and expand BC Hydro's aging generating, transmission and distribution infrastructure, built mostly in the 1950s-80s;
  - Conserve more (higher target of 66 per cent of incremental electricity needs by 2020);
  - Consider new energy resources such, as the Site C Clean Energy Project, renewable power projects, bioenergy.
- LTRF rate increases are driven by expenditures related to these activities
- LTRF used in 2011 IRP is based on assumptions consistent with the direction set forth in the Clean Energy Act, and includes the following:
  - Self-sufficiency by 2016
  - 3,000 GWh insurance by 2020
  - Site C in service by F2021
  - Mica 5/6 in service by F2015/F2016
  - Future energy requirements met by DSM and clean energy purchases
  - Capital expenditures to refurbish and grow BC Hydro's system ~$2B per year
  - Powerex income of ~$100M per year
  - SMI and Smart Grid implemented by F2015

BC hydro
FOR GENERATIONS

LTRF Uncertainties

- Sensitivities – LTRF is uncertain and subject to variability depending on assumptions made. Examples of key sensitivities are: customer load (before and after DSM), capital expenditures, future energy costs, interest rates.
- IFRS – BC Hydro has not yet reflected the impact of the transition to International Financial Reporting Standards on the LTRF.
- BC Hydro acknowledges concern of customers regarding future rate increases, and shares this concern. We are committed to increasing focus on management and control of our cost structure with the objective of reducing potential future rate increases.
- Mitigations – LTRF includes estimated impact of recent rate mitigations announced by BC Government (water rentals and calculation of shareholder returns). BC Hydro will continue to discuss with government changes to government-related aspects of BC Hydro's revenue requirement, with the objective of mitigating potential future rate increases.

BC hydro
FOR GENERATIONS

Load Resource Balance

Lindsay Fane

BC hydro
FOR GENERATIONS

Load Resource Balance

Load Resource Balance Inputs

- Load
- DSM
- Heritage Hydroelectric and Thermal Contribution
- Resource Smart
- IPP Contracts
- 2,500 GWh non-firm / market allowance
- 400 MW market reliance

Load/Resource Balance

Capacity and Energy surplus or deficit

IRP will examine options to fill the gap

- Examine the attributes of different portfolios to inform decision making.
- Gaps shown are based on existing and committed and planned resources

Clean Energy Act

- Key provisions for the Load Resource Balance
  - Self Sufficiency
  - 3,000 GWh of Insurance Energy
  - 93% Clean
  - 66% Conservation
  - Burrard Thermal Regulation
  - Mica Units 5 & 6
  - Bioenergy Phase 2
  - Standing Offer Program (SOP)
  - Integrated Power Offer (IPO)

BC hydro
FOR GENERATIONS

Clean Energy Act

- **Self-sufficiency**
  - Must hold the rights to electricity to meet supply obligations by 2016
- **Insurance**
  - Must hold the rights to an additional 3,000 GWh of energy by 2020
- Assuming Critical Water (42,600 GWh)
- Using only resources in BC
- Based upon mid-load forecast
- Impact on the planning supply stack
  - Remove the 400 MW market reliance in F2017
  - CE used as contingency resource
  - Remove the 2,500 GWh non-firm/market reliance in F2017

Clean Energy Act

2,500 GWh Non-Firm Market Reliance

TWO COMPONENTS

- **Non-Firm Heritage Hydroelectric**
- **Market Purchases**

Removed from the Load/Resource balance in F2017 to comply with CEA

BC hydro
FOR GENERATIONS

Clean Energy Act

- 93% Clean
  - Must continue to measure clean contribution from resources
- Demand Side Measures and Conservation
  - 2008 LTAP Evidentiary Update
    - DSM Option A
  - Adjusted for achieved savings from F2008, F2009 and F2010

BC hydro
FOR GENERATIONS

Clean Energy Act

Burrard Thermal – Planned Reliance

- No energy
- Up to 900 MW of capacity
  - until all of the following projects are completed and the resulting facilities are providing service
    - Mica Units 5 and 6,
    - the Interior to Lower Mainland Transmission Project, and
    - the Meridian substation transformer project.
  - Thereafter, no planned capacity reliance

BC hydro
FOR GENERATIONS

Clean Energy Act

- BCUC Exempt Projects
  - Clean Power Call
  - Mica Units 5 and 6 in F2015 and F2016
  - Bioenergy Phase II Call
  - Integrated Power Offer
  - Standing Offer Program

BC hydro
FOR GENERATIONS

Committed vs. Planned Resources

- Committed Resources
  - IPPs with awarded EPAs
  - BC Hydro projects
    - CEA Section 7 exempted projects that have environmental regulatory and board authorization
    - e.g., Mica Units 5 & 6
- Planned Resources
  - IPPs
    - CEA Section 7 exempted projects that do not have board authorization (i.e. awarded EPA)
    - e.g., Bioenergy Phase II, 2010 SOP, IPO (without EPAs), Alta Gas (2 without EPAs)
- CEA Section 7 Resources that are not Committed or Planned
  - Site C
  - Revelstoke Unit 6

BC hydro
FOR GENERATIONS

Supply Resources

- **Existing and Committed Resources**
  - Heritage Hydroelectric
  - Heritage Thermal
  - Resource Smart
  - Existing and Committed IPPs
    - Pre-Clean Power Call
    - Clean Power Call
    - Alcan
    - Island Generation
    - Bioenergy Phase 1
    - SOP (signed EPAs)
    - IPO (signed EPAs)
    - Alta Gas (signed EPA)
    - Waneta Expansion
  - Waneta Transaction
  - Mica Units 5 and 6

- **Planned Resources**
  - Alta Gas (2 without EPAs)
  - Bioenergy Phase II
  - IPO (without EPAs)
  - 2010 SOP

BC hydro
FOR GENERATIONS

Supply Resources

- **Resource Smart**
  - Completed Projects
    - GMS Turbine Upgrades
    - GMS Capacity Increases
    - CMS Turbine 1 Upgrade
    - Aberfeldie Redevelopment
    - Revelstoke Unit 5
  - Committed Projects
    - GMS Turbine Upgrades (G1-G5)
    - GMS Capacity Increases (G6-G8)
    - CMS Turbine 2 Upgrade
    - Mica Units 5 & 6

2011 IRP is currently updating Resource Smart estimates.

BC hydro
FOR GENERATIONS

Supply Resources

- **IPPs**
  - Some EPAs are Pre-COD
    - Have signed contracts but are not yet delivering
- **Three main reasons for attrition**
  - Permitting
  - Project Economics
  - Financing Difficulties
- **IPP attrition for pre-COD projects**
  - 30% attrition for planned or recently signed EPAs with a greenfield project
    - e.g. Clean Power Call, Bioenergy Phase II, SOP and Alta Gas
  - 10% attrition for planned or recently signed EPAs with an existing asset
    - e.g. Integrated Power Offer
  - BC Hydro's Contract Management group will revise attrition estimates on a project-by-project basis based on updated development information

BC hydro
FOR GENERATIONS

Planning Definitions

- Dependable Generating Capacity (DGC)
  - The amount of megawatts a plant can reliably produce when required, assuming all units are in service.
  - External Factors can impact.
  - Planned and forced outage rates are not included.
- Effective Load Carrying Capability (ELCC)
  - The maximum peak load that a generating unit or system of units can reliably supply such that the *Loss of Load Expectation* will be no greater than one day in ten years.
- Firm Energy
  - The energy that is available (i.e., equalled or exceeded) 100 per cent of the time, either for a given period such as 25 years, or for an analysis period such as a period covered by flow records.
  - Hydro – FELCC
  - Thermal – Installed Capacity, fuel supply, availability

BC hydro
FOR GENERATIONS

2011 IRP Planning / Reliability Framework

- Reliability Assessment
  - Capacity Planning
    - Capacity contribution based upon DGC plus likelihood of availability
    - Availability includes forced/ maintenance outages and fuel availability
    - ELCC calculation to assess resources required to meet 1 d/ 10 yrs
    - Intermittent resources shown at ELCC contribution
    - Results in continued 14% Reserve Margin
    - Operational value of intermittent capacity still uncertain
  - Energy Planning
    - FELCC calculation for Heritage Hydro system
    - Intermittent resource contribution based upon annual variability as it contributes to Heritage Hydro system critical water period

2011 IRP will update these studies.

BC hydro
FOR GENERATIONS

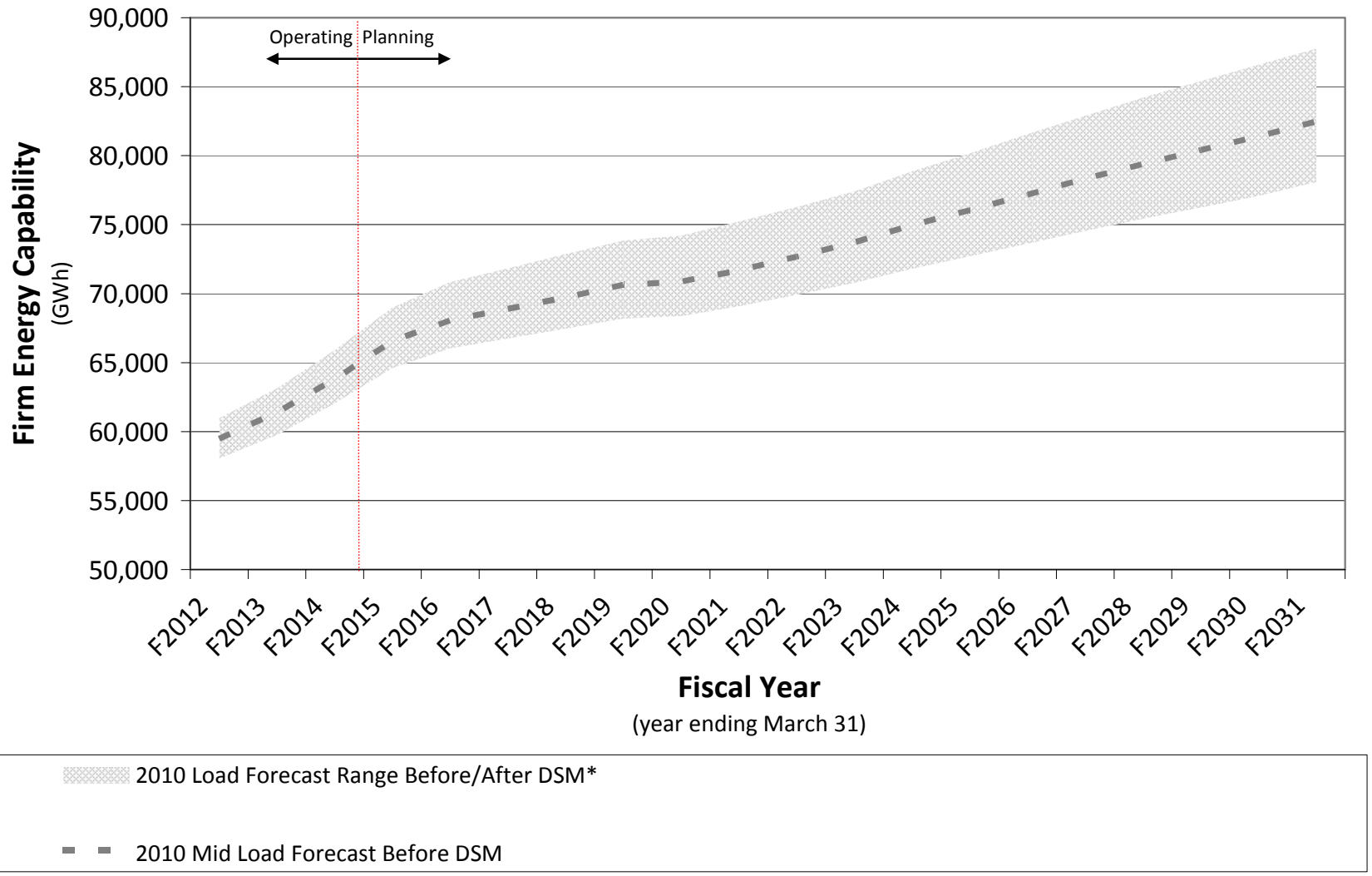
Intermittent Resources

- 2008 LTAP
  - Reviewed the capacity and firm energy contributions of intermittent resources
- 2011 IRP
  - Will be reviewing these assumptions again

Resource	FELCC	ELCC
Small Hydro – Existing Pre-06 CFT	85% of Average Annual Energy	60% of the historical average MW in December/January
Small Hydro – F2006 CFT Small Project Stream	85% of Average Annual Energy	60% of the forecast average MW in December/January
Small Hydro – F2006 CFT Large Project Stream	Contractually committed firm energy levels	As per contractual firm energy commitment (100% of average MW in December / January period)
Small Hydro – Planned Resources less than 15 MW (e.g. SOP)	70% of Average Annual Energy (2008 LTAP Appendix F12)	60% of forecast average MW in December/January
Small Hydro – Planned Resources greater than 15 MW (e.g. Alta Gas)	Contractually committed firm energy levels	As per contractual firm energy commitment (100% of average MW in December / January period)
Wind – Onshore Resources	100% of Average Annual Energy	21% of Installed Capacity

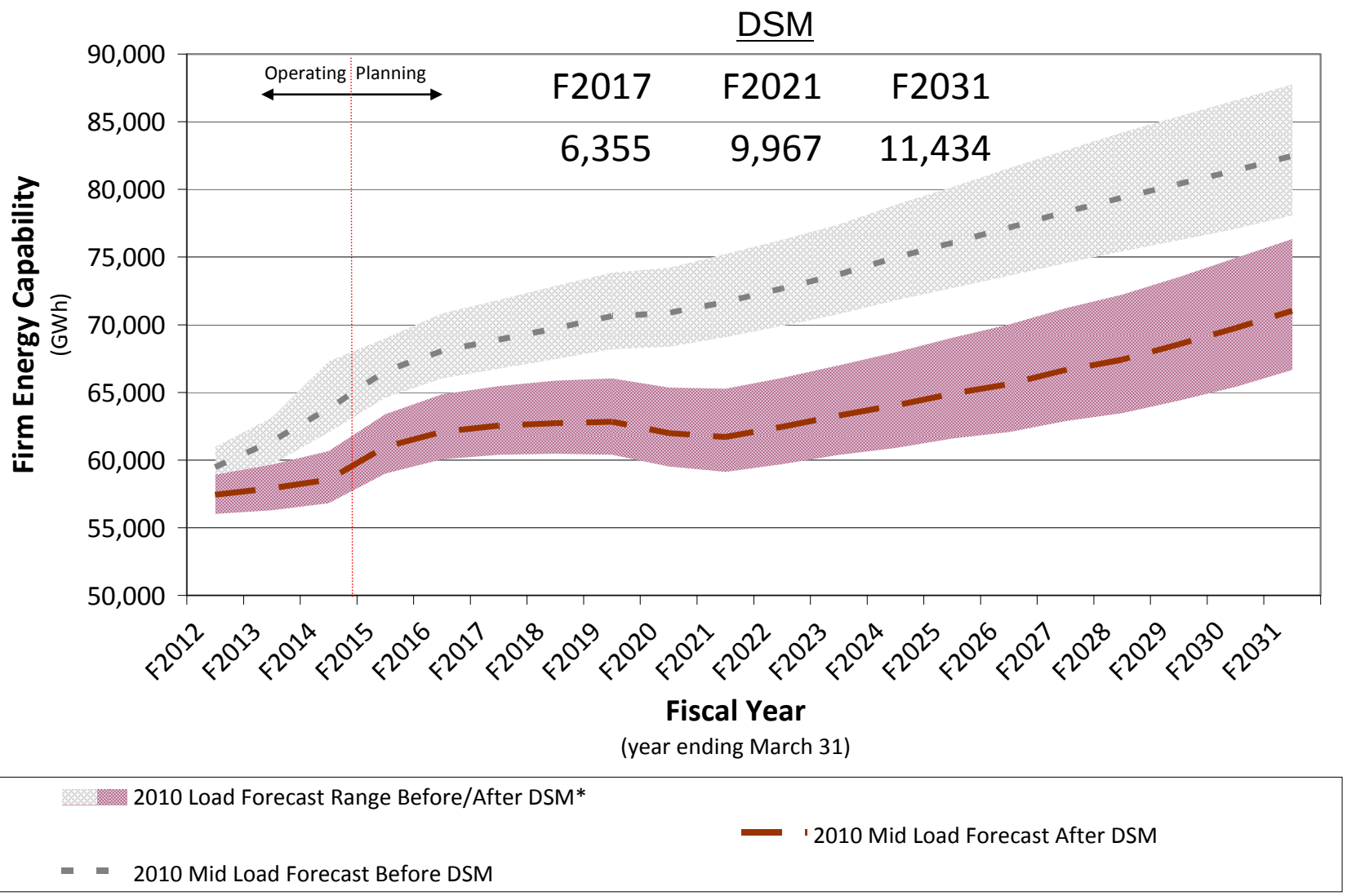
BC hydro
FOR GENERATIONS

Energy: Demand before DSM



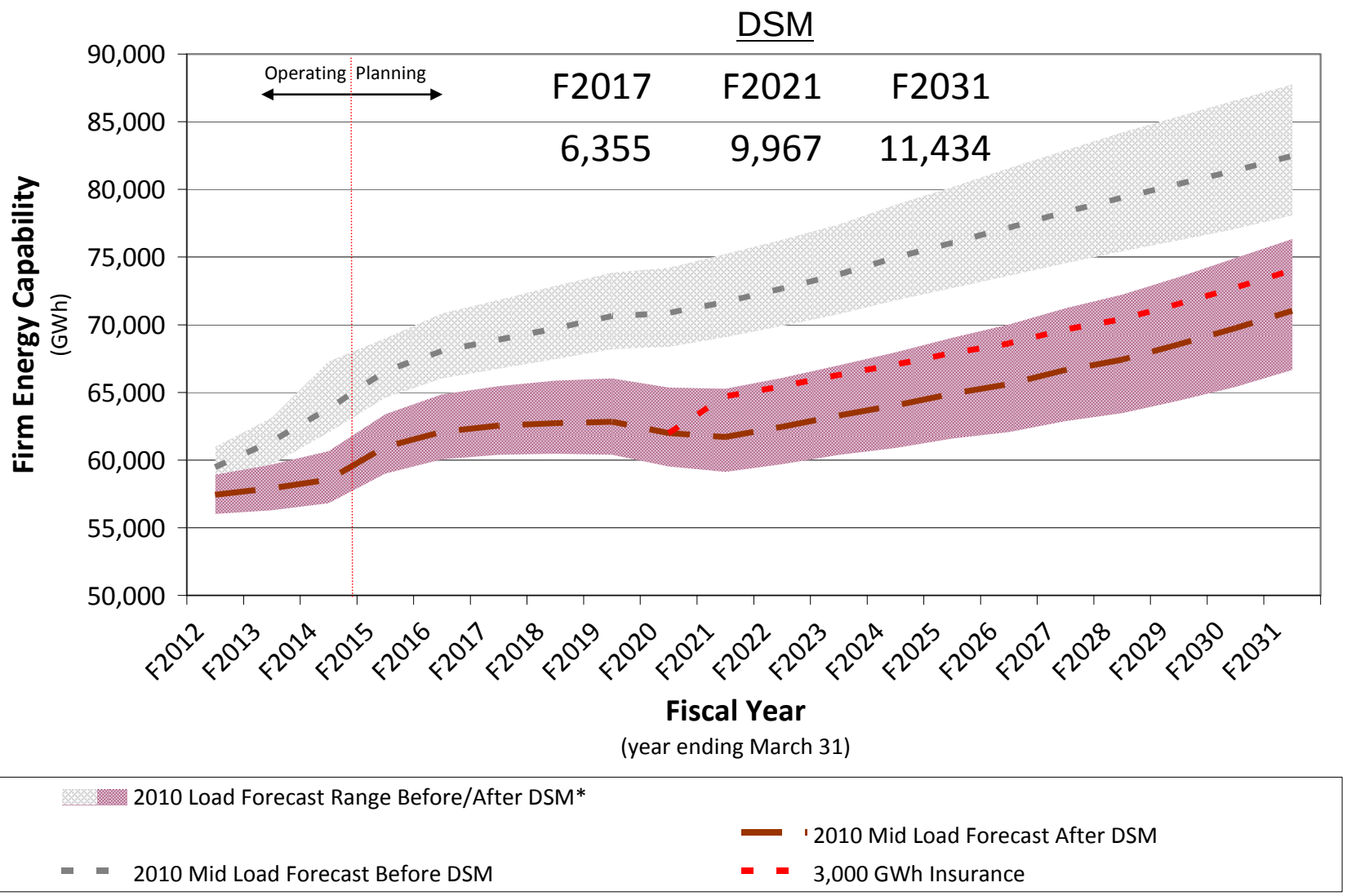
* Draft Load Forecast Range

Energy: Demand before/after DSM



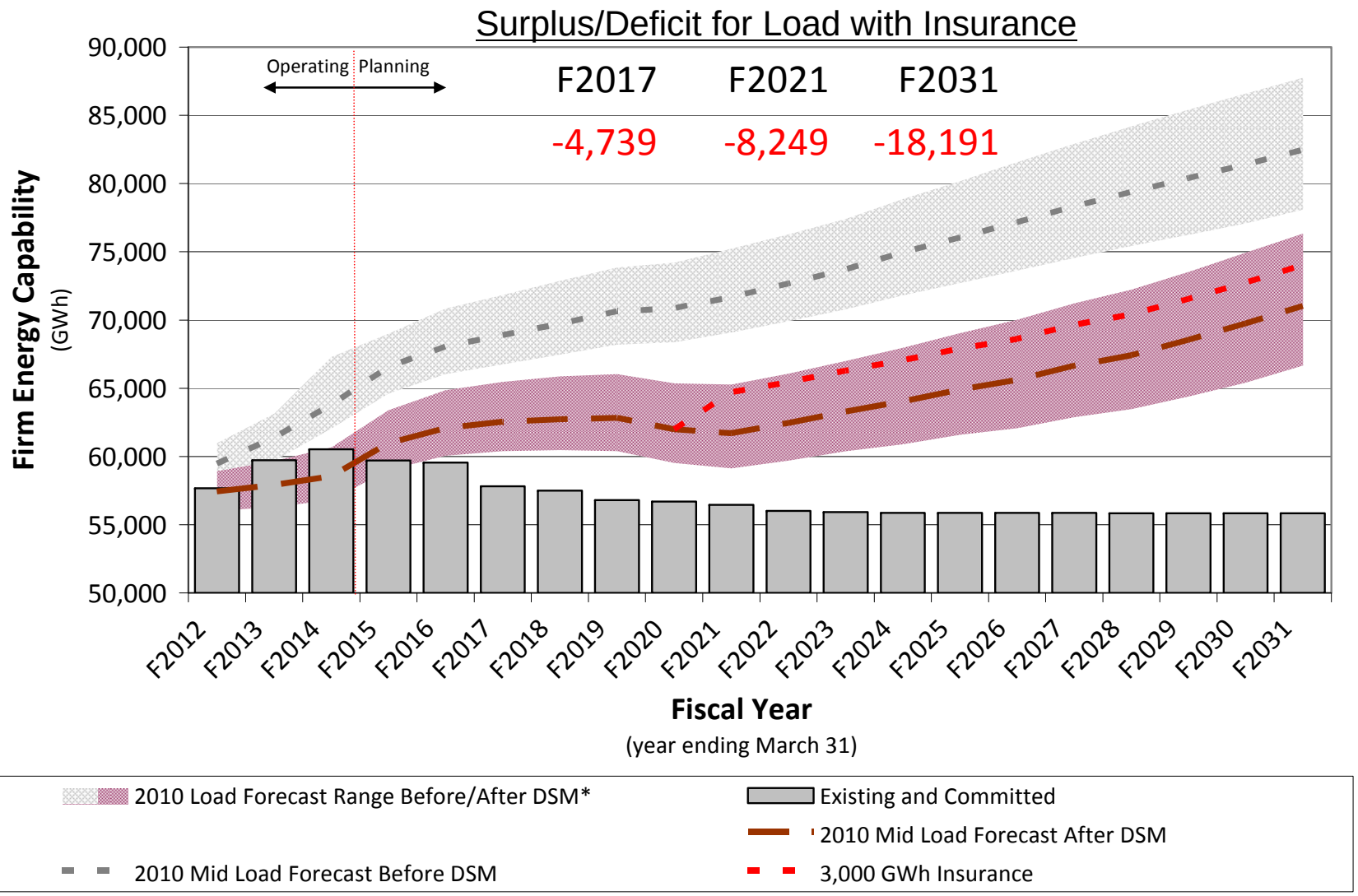
* Draft Load Forecast Range

Energy: Demand before/after DSM + Insurance



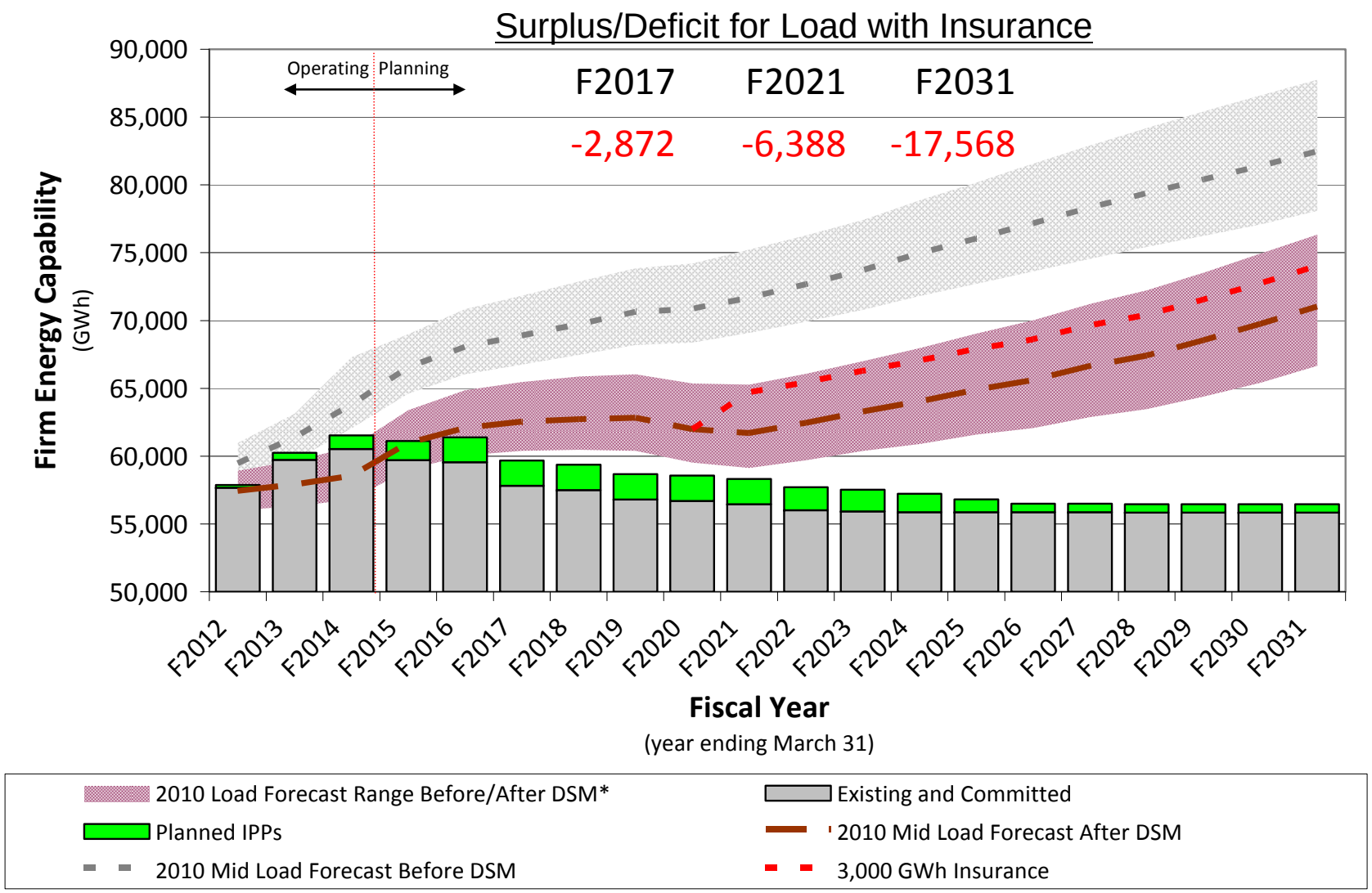
* Draft Load Forecast Range

Energy: Existing and Committed



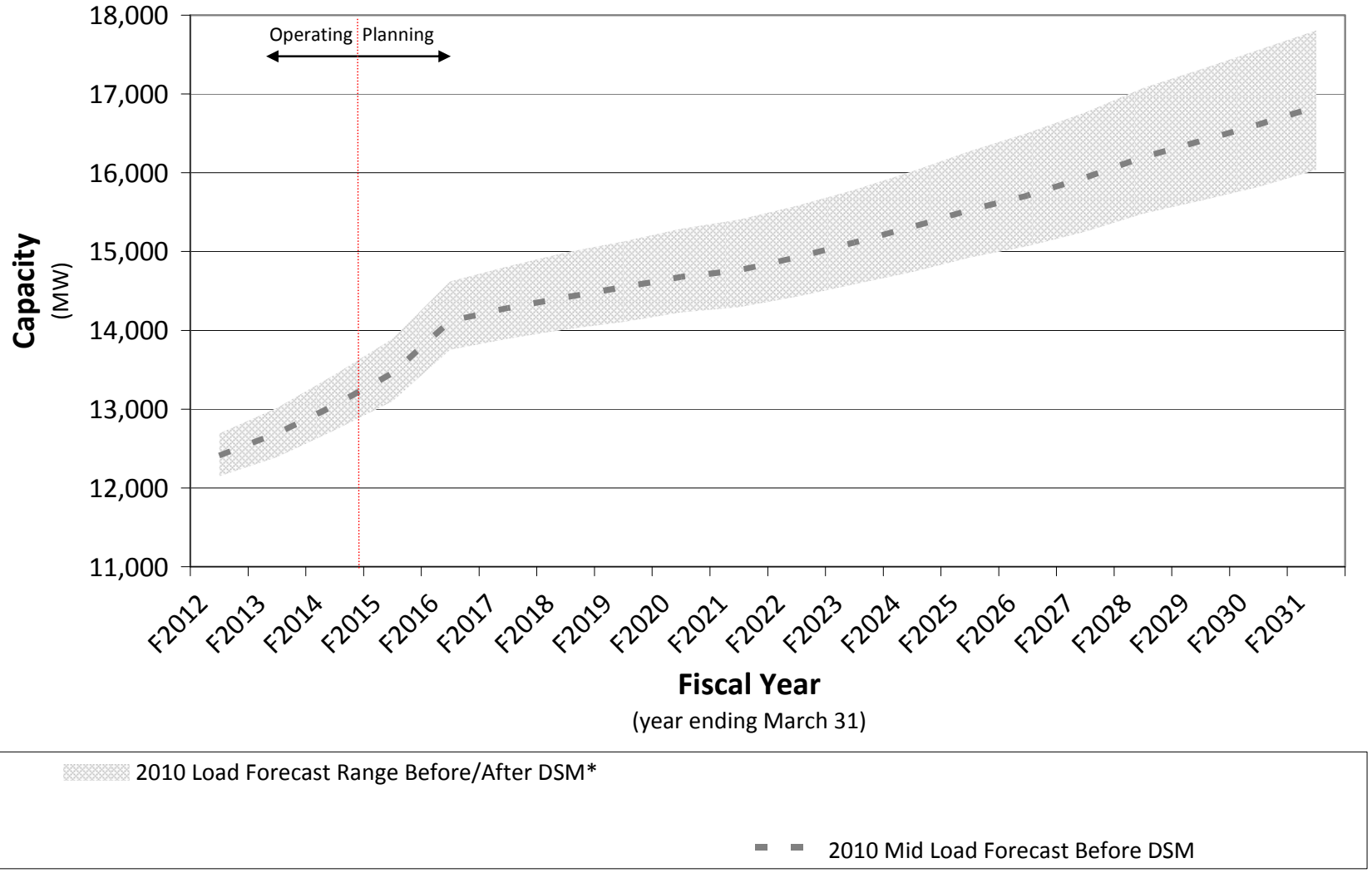
* Draft Load Forecast Range

Energy: + Planned IPPs



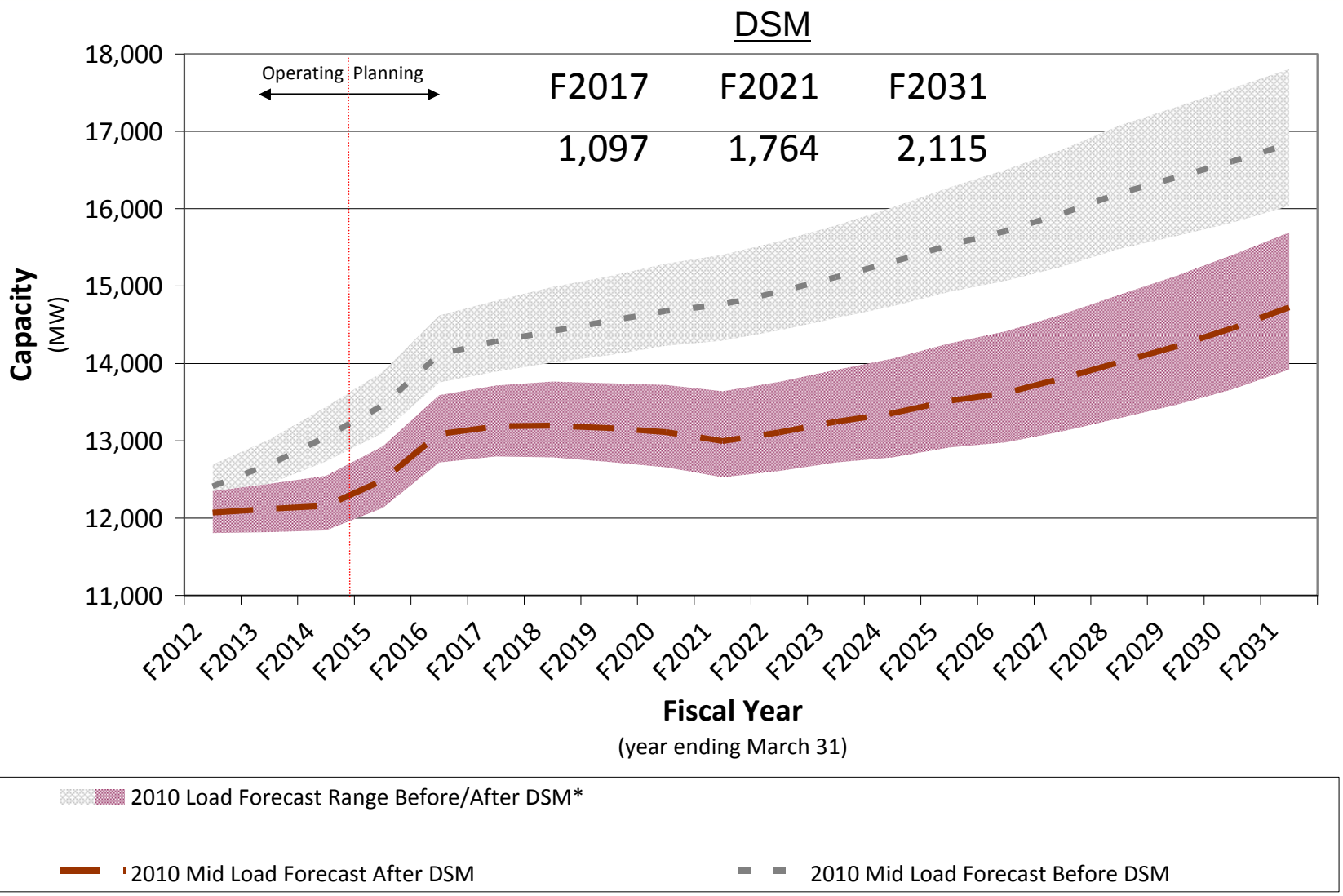
* Draft Load Forecast Range

Capacity: Demand Before DSM



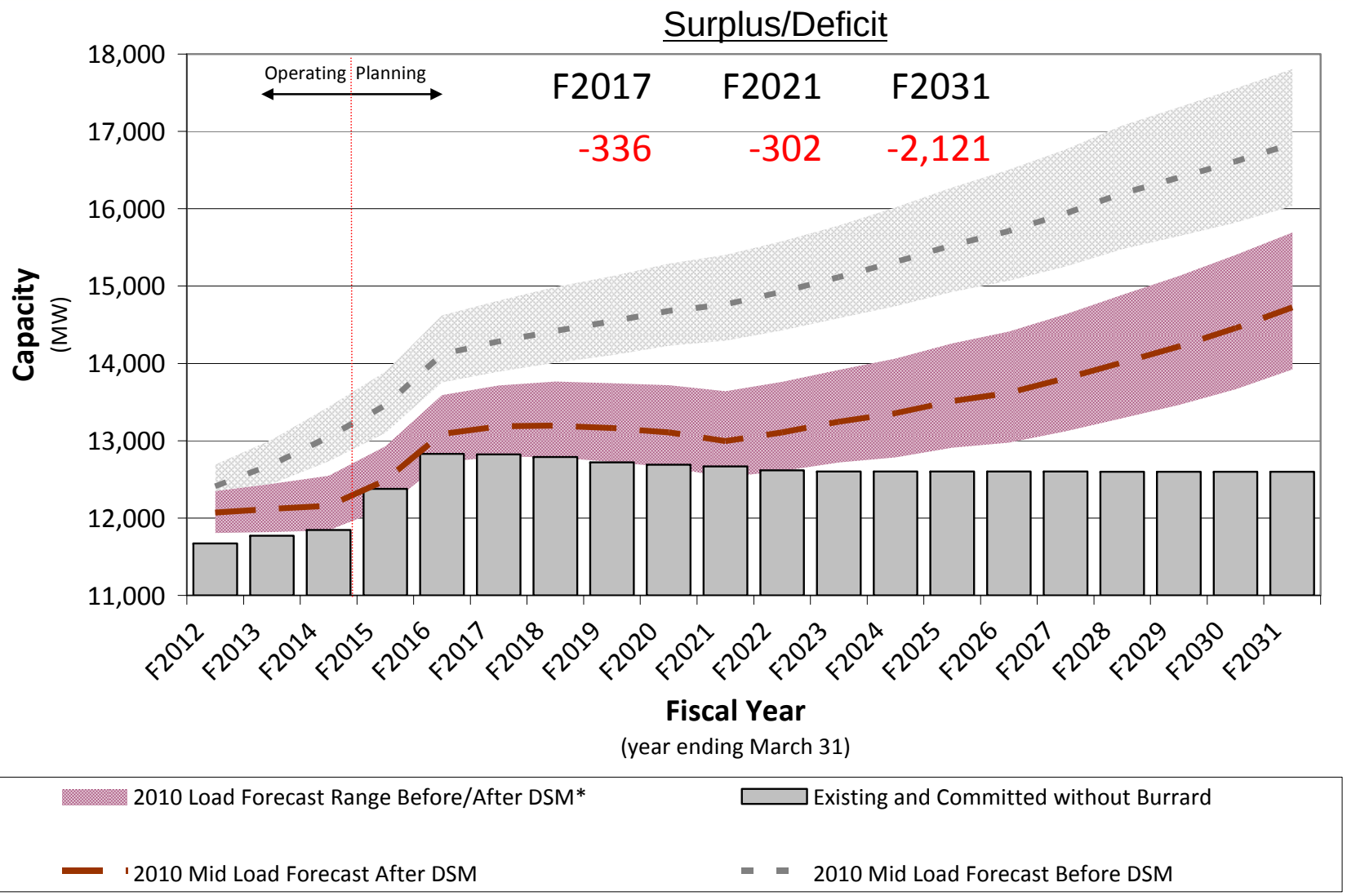
* Draft Load Forecast Range

Capacity: Demand Before/After DSM



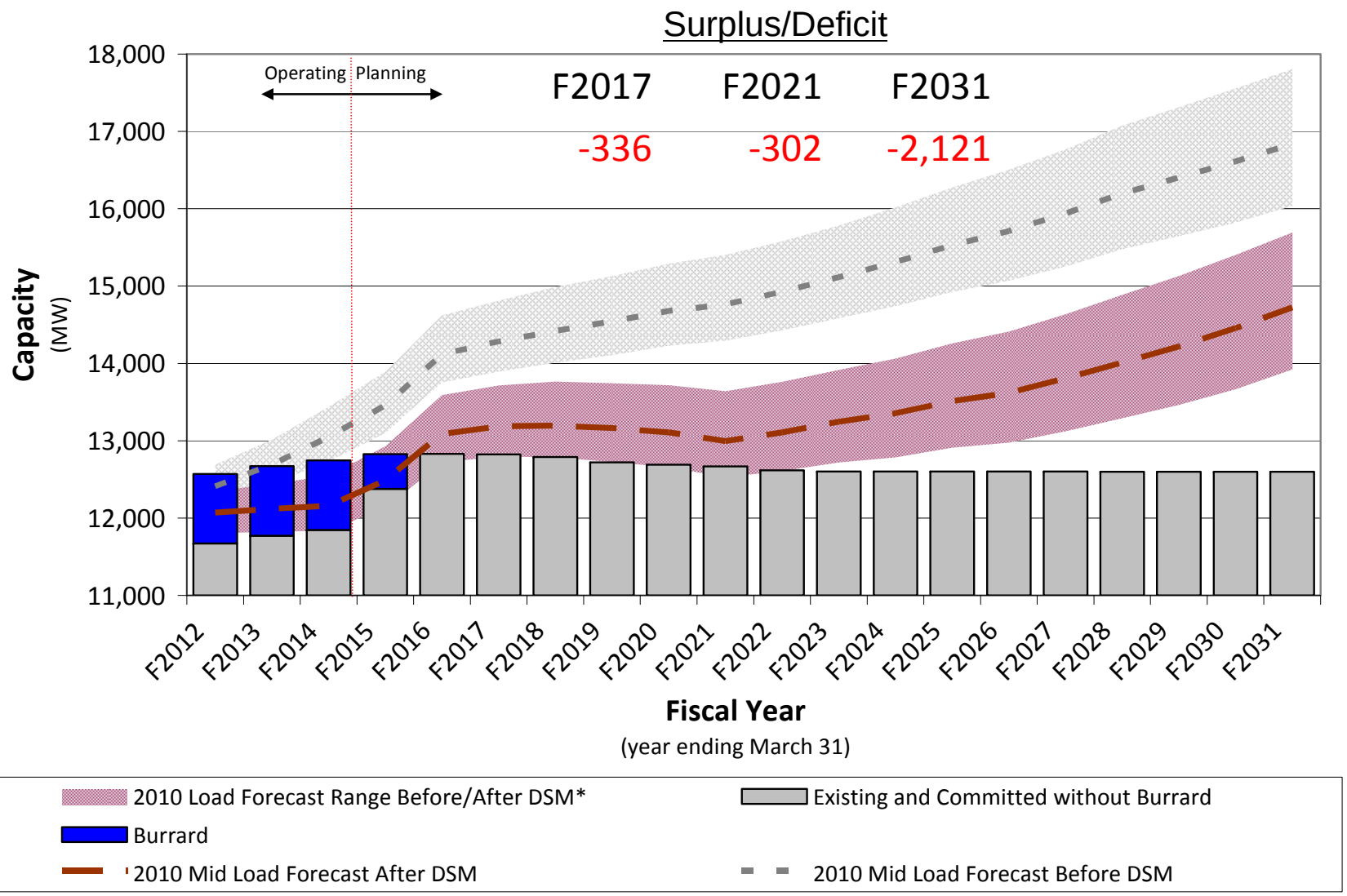
* Draft Load Forecast Range

Capacity: Existing & Committed without Burrard



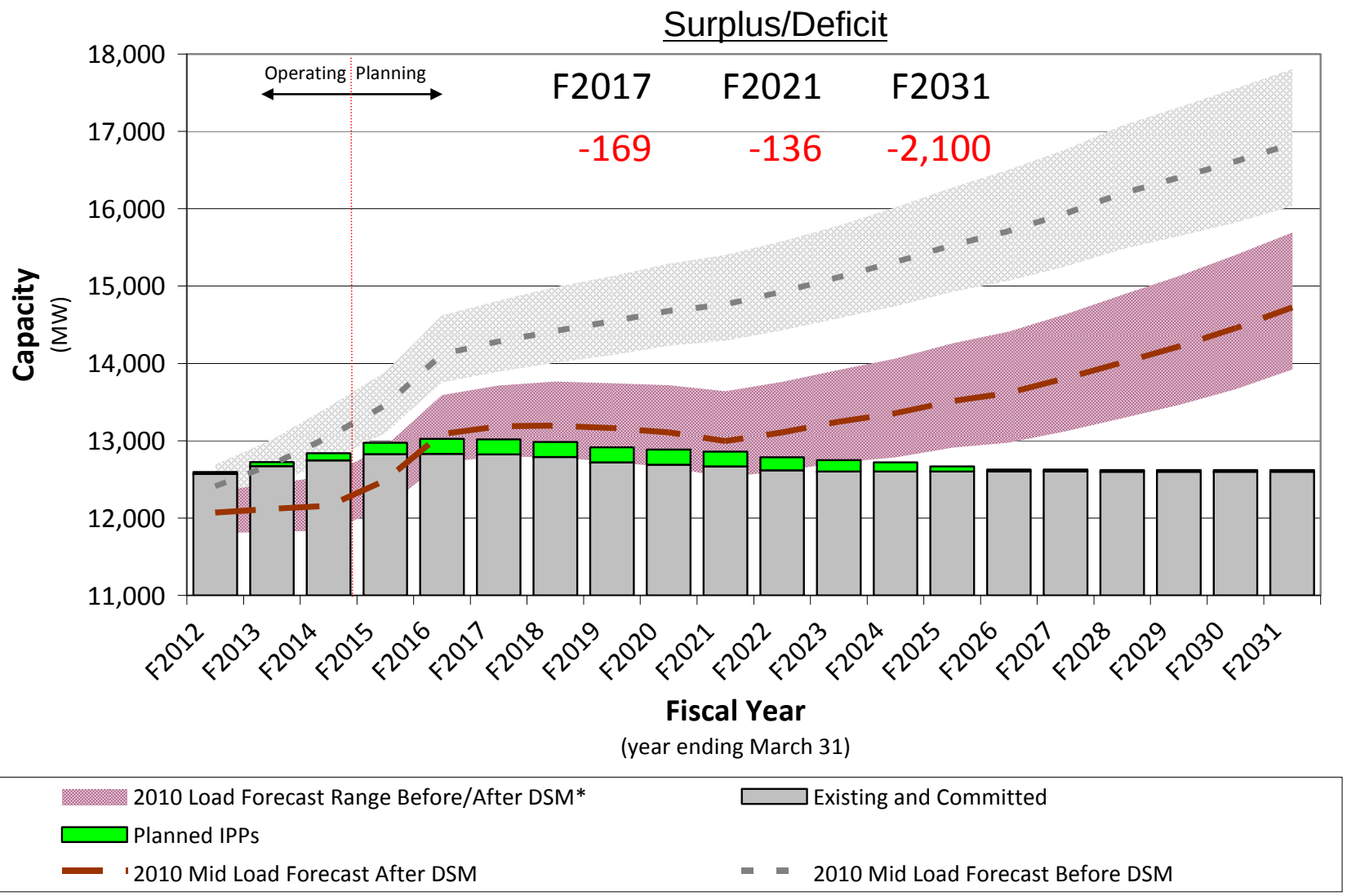
* Draft Load Forecast Range

Capacity: Existing & Committed with Burrard



* Draft Load Forecast Range

Capacity: + Planned IPPs



* Draft Load Forecast Range

Key Load Resource Balance Uncertainties

- Load Forecast
- DSM Deliverability
- IPP Deliverability
- Transmission

BC hydro
FOR GENERATIONS

QUESTIONS?

BC hydro
FOR GENERATIONS

Risk Framework

Basil Stumborg

BC hydro

FOR GENERATIONS

Risk Framework Introduction

- Risk Framework – definition
  - The process by which Hydro will incorporate uncertainty into the comparison of options.
- Risk Framework will cover
  - Uncertainty analysis
    - Quantitative
    - Qualitative
- Comparing Options
  - Portfolio analyses – to inform policy choices
  - Including financial and non-financial impacts
  - Less certain and more certain impacts

BC hydro
FOR GENERATIONS

Risk Framework Introduction

- Goals of the Risk Framework
  - Identify and characterize key uncertainties
    - Using quantitative methods where possible
  - Separate probability judgments, impacts from value judgments
  - Help describe tradeoffs clearly
  - Link analysis to
    - Near term decisions
    - Future decisions (milestones and off-ramps)
  - Help inform contingency plans
    - Under what circumstances
    - Relative likelihoods

BC hydro
FOR GENERATIONS

Risk Framework Introduction

- Today's presentation will focus on
  - What are the key uncertainties
  - What framework will be used to incorporate them?
  - How will options be compared when impacts are
    - Financial
    - Non-Financial
    - Uncertain
  - There are no results to be shared yet
    - Presentation is conceptual only

BC hydro
FOR GENERATIONS

Risk Framework – Identifying Key Uncertainties

- Size of the gap to be filled
  - Load growth uncertainty
  - DSM performance risk

BC hydro
FOR GENERATIONS

Risk Framework – Characterizing Key Uncertainties

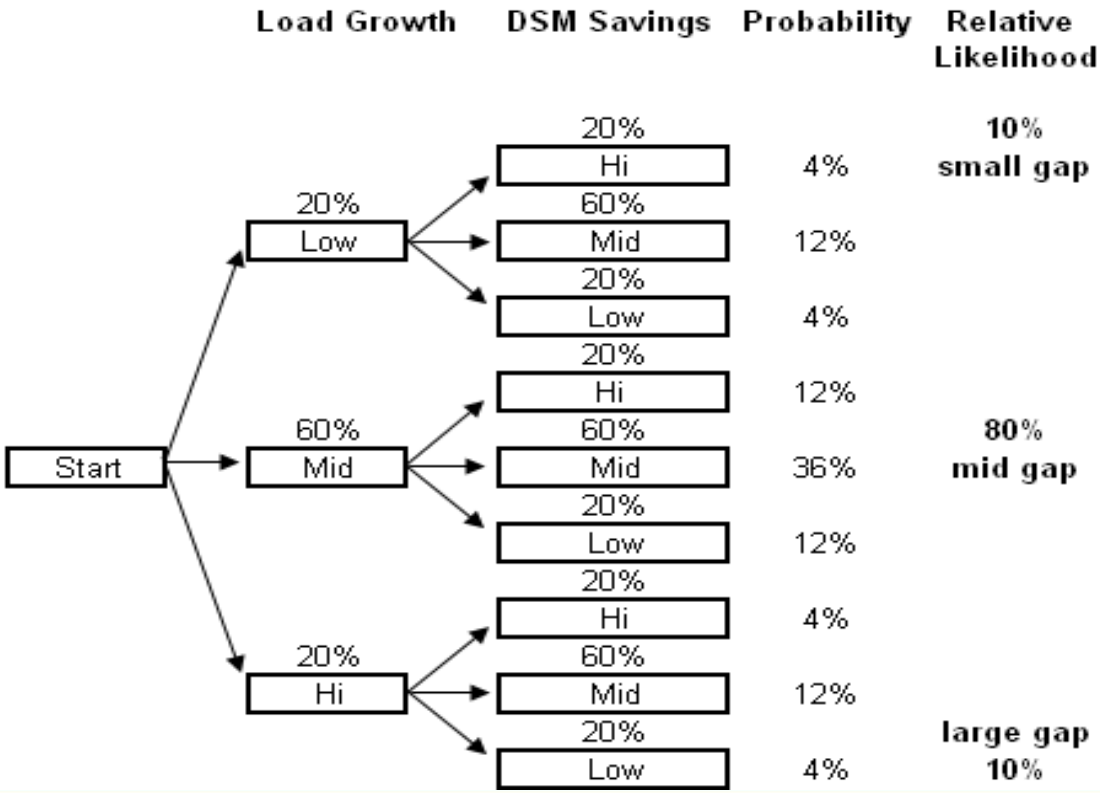
- Load growth uncertainty
  - Driven by many factors (see David Ince's presentation)
  - Monte Carlo analysis – shows distribution of possible outcomes
  - Distribution to be discretized: Hi, Mid, Low

- DSM savings uncertainty
  - Each DSM portfolio made up of Rates, Codes and Standards, Programs
  - Bottom up probability assessment run through Monte Carlo analysis
  - Top down assessment to apply professional judgment
  - Final distribution to be discretized: Hi, Mid, Low
  - BC Hydro is also looking to do a jurisdictional comparison and employ other assessment tools

BC hydro
FOR GENERATIONS

Risk Framework – Characterizing Key Uncertainties

- Size of the gap
  - Will be given as “hi/mid/low”
  - Changes for each DSM option
  - Used as a backdrop for IRP questions



BC hydro
FOR GENERATIONS

Risk Framework – Net Gap Uncertainty

- Size of the gap, and uncertainty around this affects
  - Amount of DSM to be relied on
  - Calls for power – timing and volume
  - Site C – next stage
  - Transmission requirements
  - Contingency resource plans

BC hydro
FOR GENERATIONS

Risk Framework – Identifying Key Uncertainties

- Market conditions
  - Driven by a number of factors
    - Global growth trends
    - US policy on renewables, GHGs
    - GHG offset costs
    - Natural gas costs
    - Electricity prices (outside of B.C.)
    - Renewable Energy Credit (REC) prices

BC hydro
FOR GENERATIONS

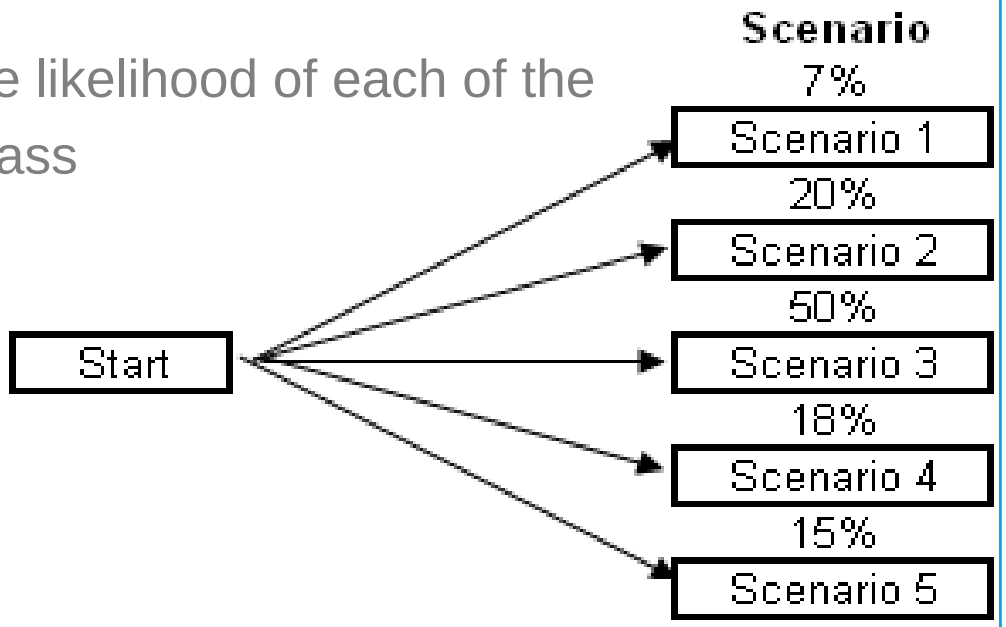
Risk Framework – Characterizing Key Uncertainties

- This is a large number of variables
- These variables are interrelated in complex ways
- Building a full probability tree
  - Very detailed
  - Might not add clarity to analysis
- Current approach – scenario analysis
- A small number of *scenarios* being developed

BC hydro
FOR GENERATIONS

Risk Framework – Characterizing Key Uncertainties

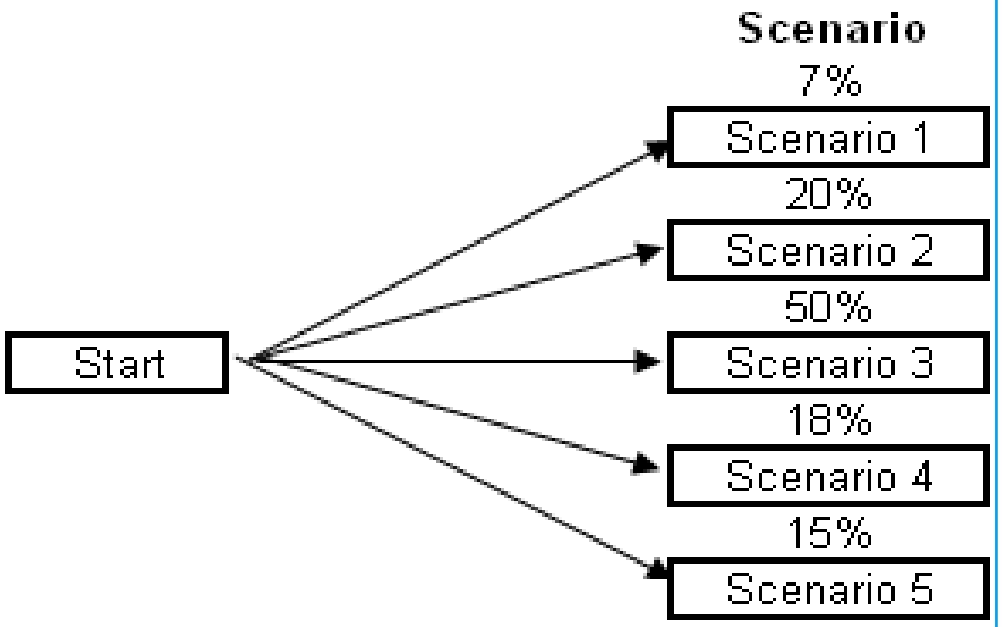
- Goals of the scenarios are to
  - Cover a wide range of 'how the world might evolve'
  - Provide a range of prices for key inputs (GHG offset, gas, electricity, RECs)
  - Small in number – for easier analysis and communication
  - Represent plausible combinations of factors (internally consistent)
  - Demonstrate the relative likelihood of each of the scenarios coming to pass



BC hydro
FOR GENERATIONS

Risk Framework – Characterizing Key Uncertainties

- What this might influence
  - The value of surplus energy
  - Export market
  - Marketing of clean energy outside of B.C.
  - All of which may inform on costs, resource comparisons

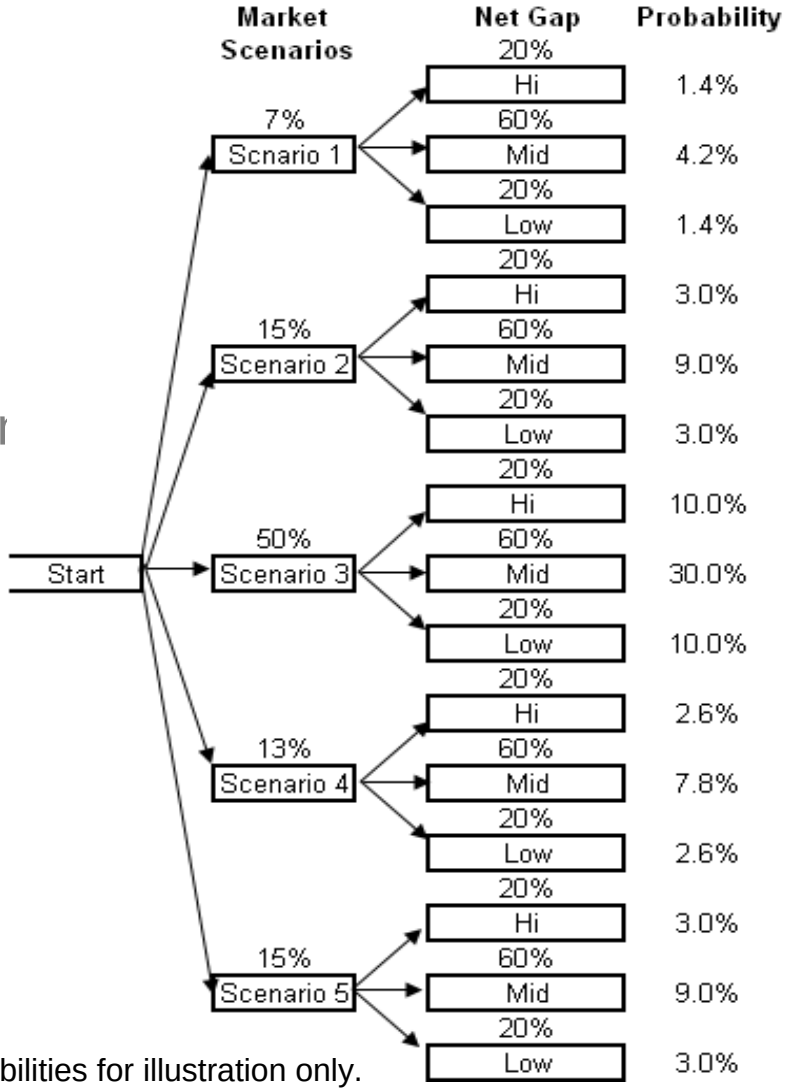


BC hydro
FOR GENERATIONS

Probabilities for illustration only

Risk Framework – Putting uncertainties together

- So for each policy question
  - Potential answers tested across a variety of futures
  - Futures characterized by a probability tree
  - Gives a range and distributio of costs as well
  - Gives an insight into dimensions of cost
    - Expected cost
    - Downside cost risk



Probabilities for illustration only.

BC hydro
FOR GENERATIONS

Risk Framework – Comparing Options

- BC Hydro has committed to looking broadly at impacts
- This includes both financial and non-financial ones
- Interest has been shown in how these comparisons will be made
- In the Resource Options Sessions
  - Hydro committed to showing comparisons using a consequence table

BC hydro
FOR GENERATIONS

Risk Framework – Comparing Options

- A Consequence Table is a matrix view that shows
  - The options considered
  - What decision objectives were used to compare the options
  - How these objectives were measures
  - Data showing how options performed against each other
- Here, options will be portfolios of resources
  - This will NOT focus on just one resource
  - A number of resources will be needed to meet demand

BC hydro
FOR GENERATIONS

Next Steps

BC hydro
FOR GENERATIONS