

The Economics of Site C And the Clean Energy Act

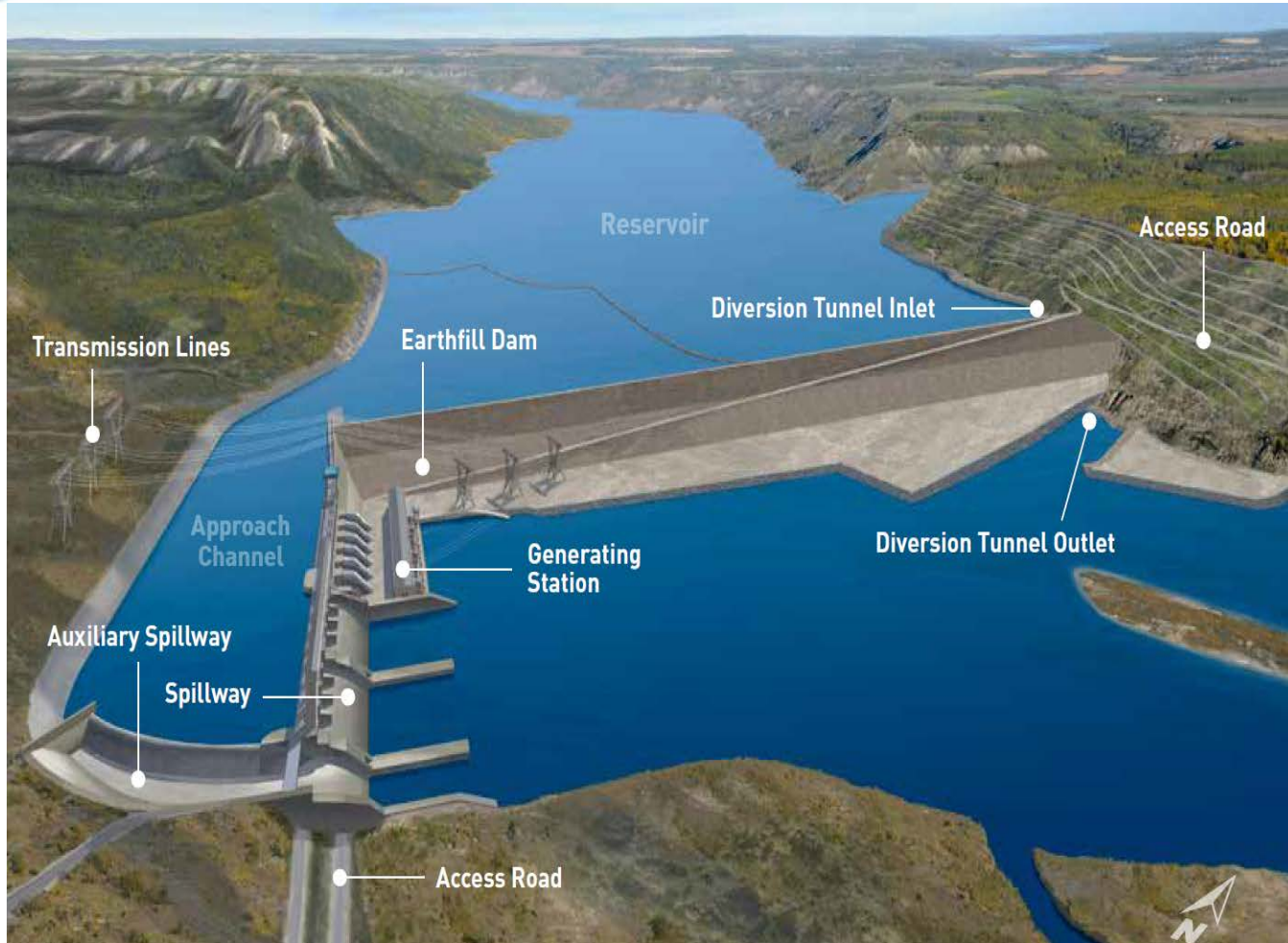
A Presentation by Dan Potts



Conclusion

As a Result of the Construction of Site C, the Acquisition of Renewable Energy Required Under the Terms of the Clean Energy Act, and Generous IPP Contracts, BC Hydro will Acquire 14,700 GWh of Electric Power at a Cost that is \$1,270 Million per Year higher than the Market Value. This amount is 26% of BC Hydro's domestic revenues.

Artist Rendering of Site C



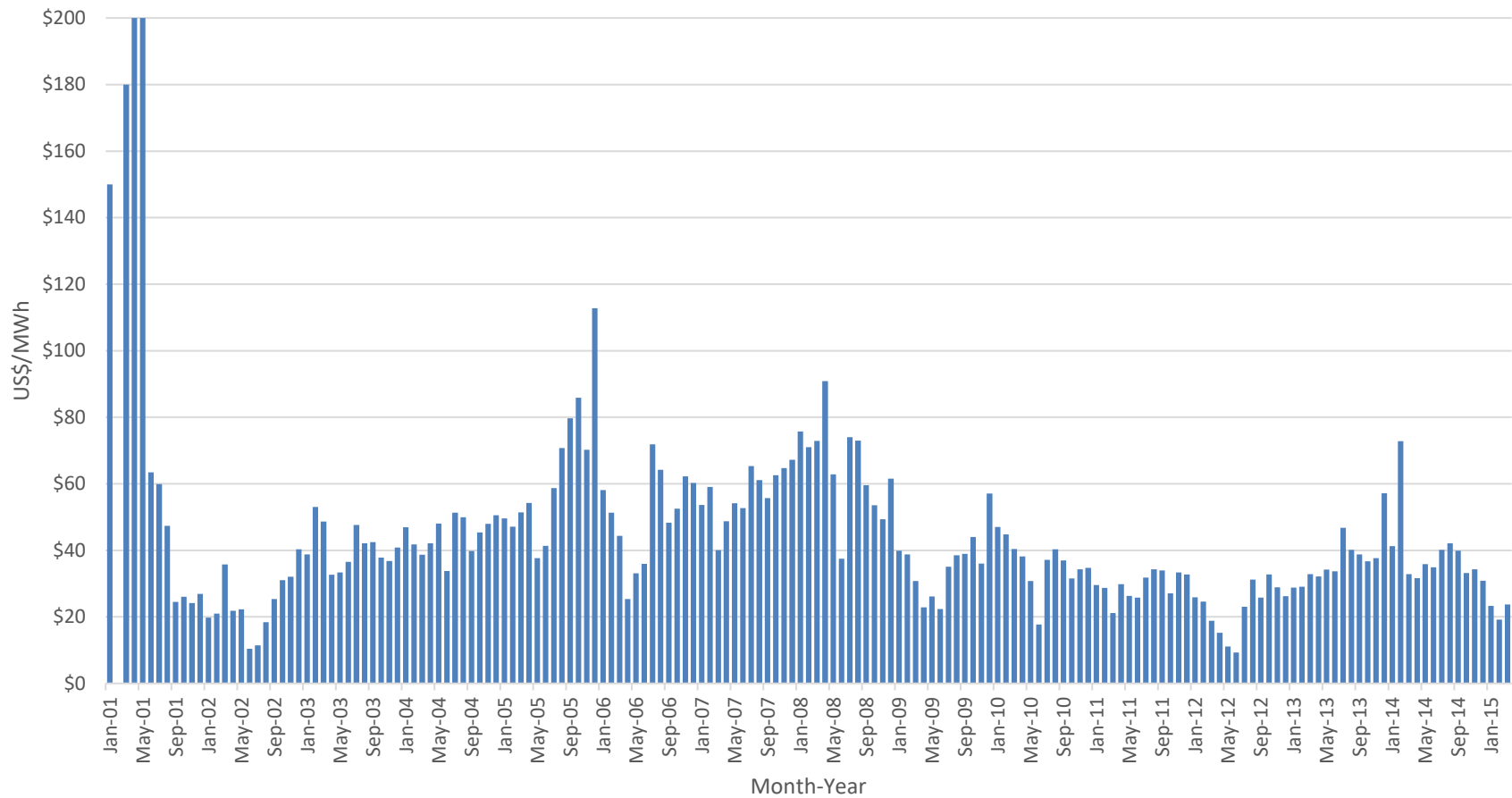
List of Hydro Dams on Peace and Columbia River

Hydro Dams	Capacity (MW)	Completion Date
W.A.C. Bennett	2,876	1968
Mica	1,805	1973
Peace Canyon	700	1980
Revelstoke Canyon	2,480	1984
Keenleyside (Arrow Lakes)	185	2002

Important Power Supply Changes

- **Creation of power trading hubs**
- **Powerex – BC Hydro Power Trader**
- **Efficient Low Cost Gas Turbines**
- **Availability of large amounts of shale gas**
- **Low and stable Natural Gas Prices**

Monthly Average Mid-C Price

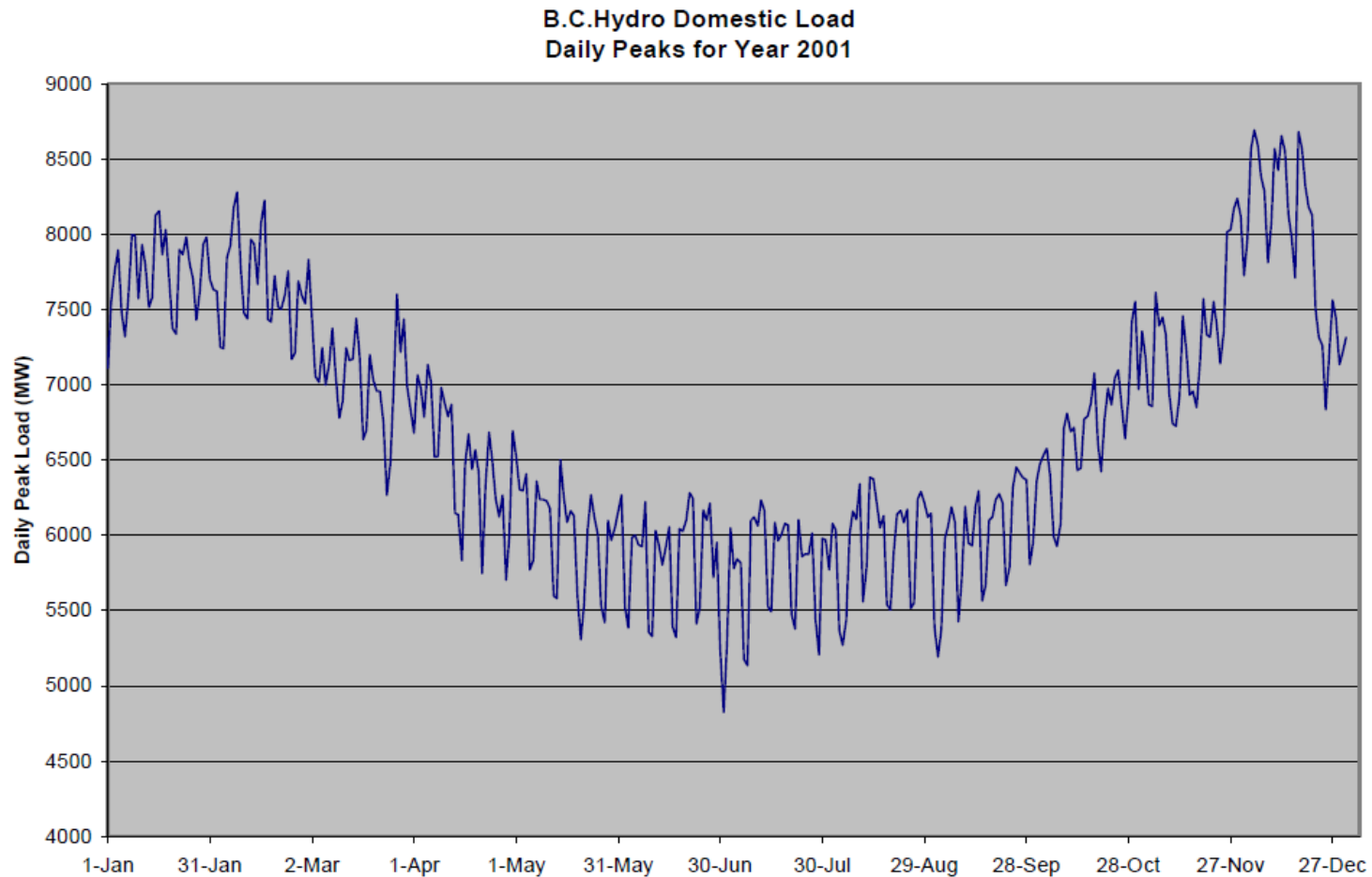


Source: U.S. Energy Information Administration Wholesale Electricity Historical Price, <http://www.eia.gov/electricity/wholesale/#history>

Development of North American Natural Gas Generating Capacity

- Large amounts of generating capacity has been installed to meet peak demands
- Significant spare capacity is available almost all of the time.
- This capacity will come on line if market price exceeds marginal operating cost

BC Hydro Domestic Load Variation

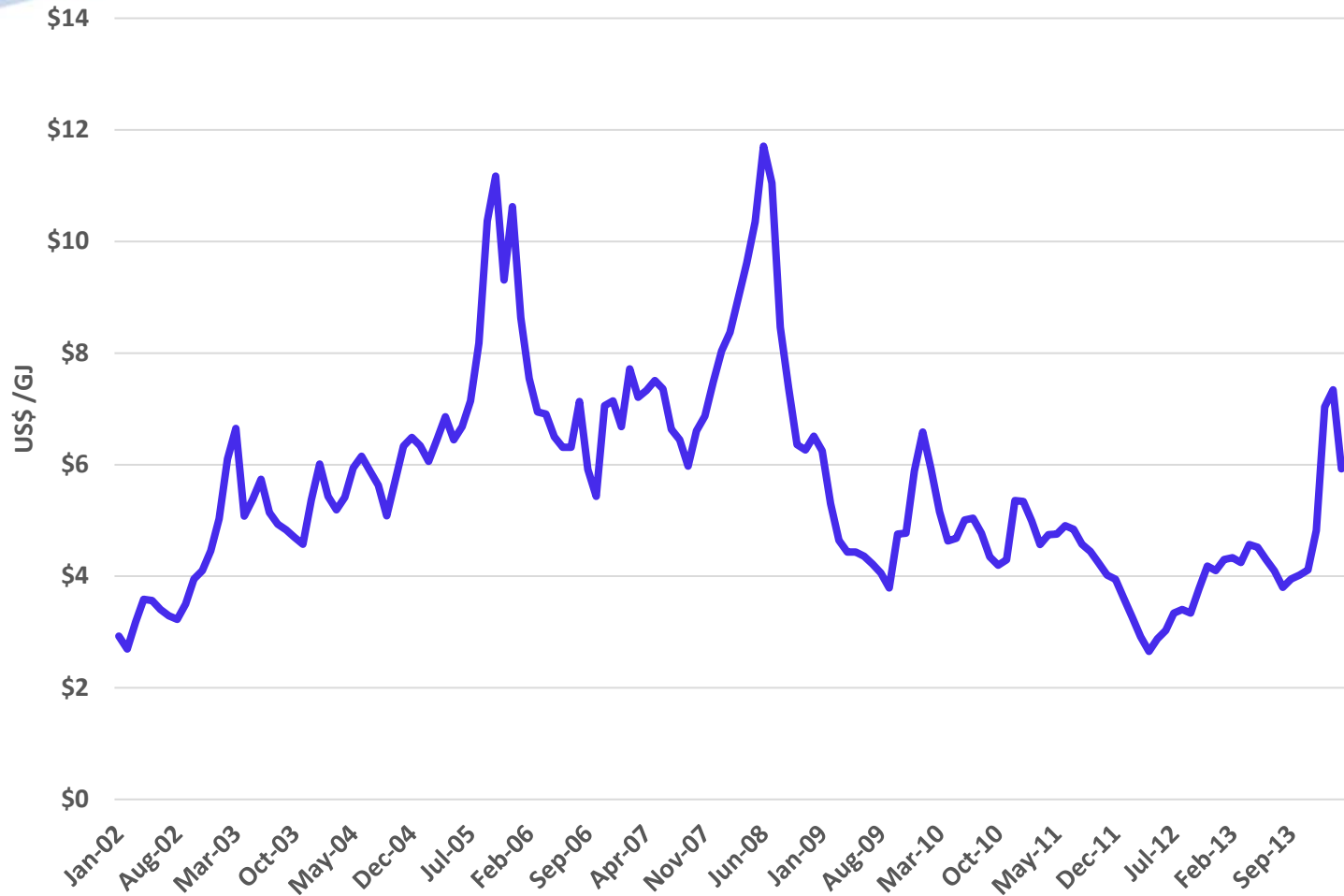


Source: BC Electric Market Overview – Central Asia Delegation, 30 January 2013 Presentation

Market Price Determination

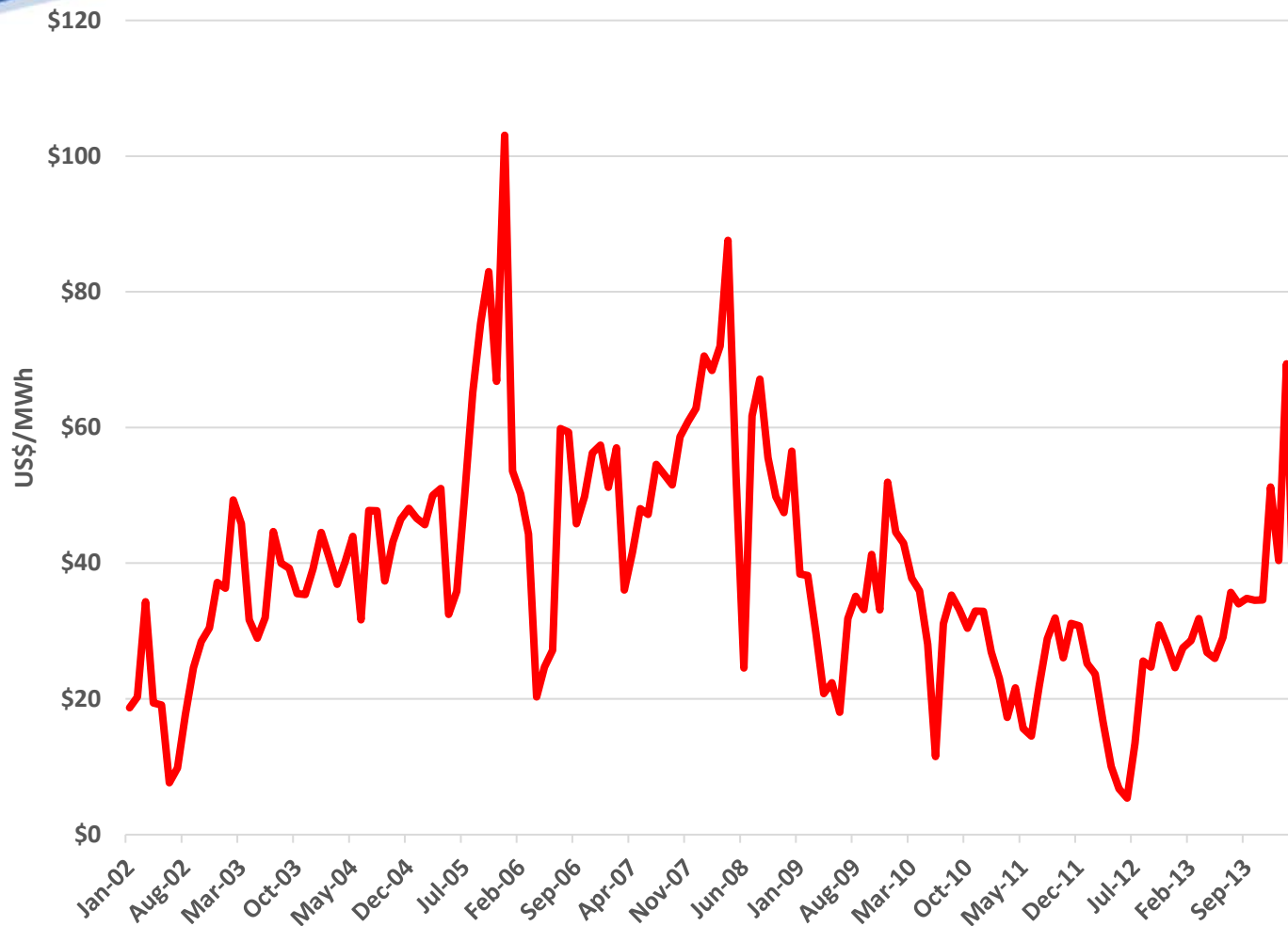
- Capital cost of these plants has already been paid by ratepayers
- Marginal cost is fuel cost
- 7 gigajoules of natural gas will generate one megawatt hour of electricity
- $\text{Market Price} = \text{Heat Rate} \times \text{Cost of Natural Gas}$

US Natural Gas Price for Electric Power



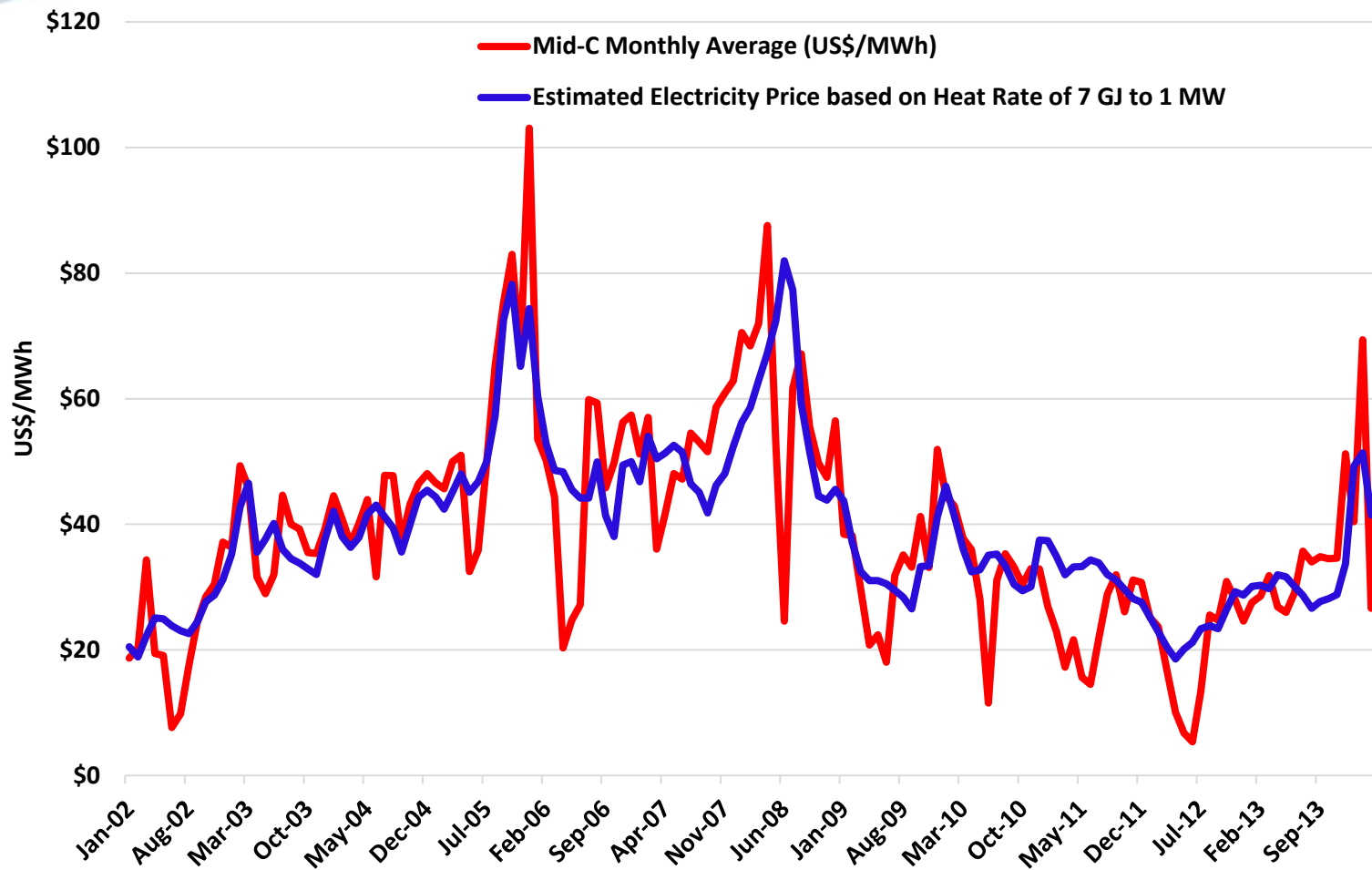
Source: US Department of Energy, Energy Information Administration, US Natural Gas Electric Power Price

Monthly Weighted Average Mid-C Prices

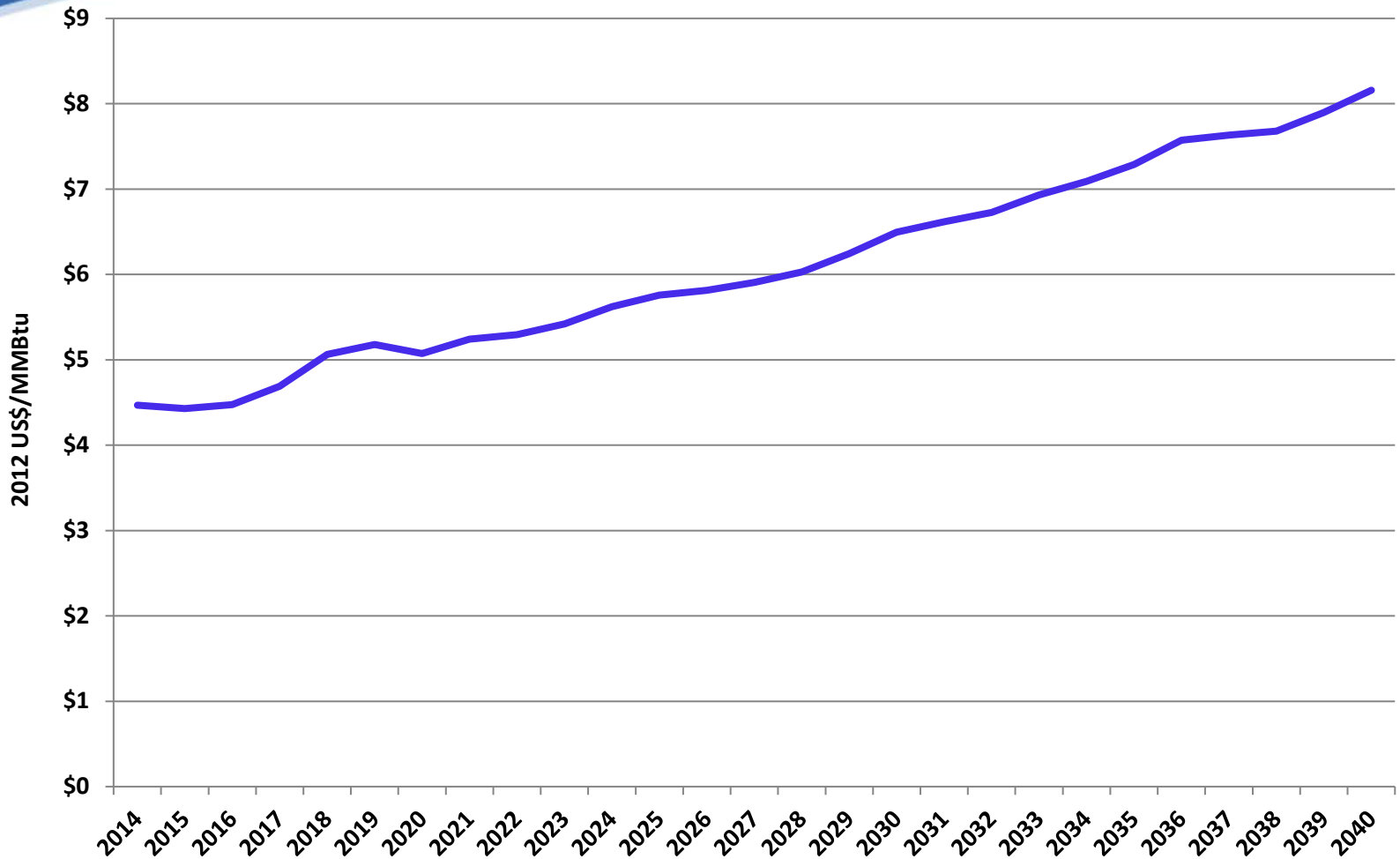


Source: Calculation based on actual Daily Mid-C Non Firm Index

Mid-C vs Estimated Electricity Price based on Heat Rate of 7 GJ to 1 MWh

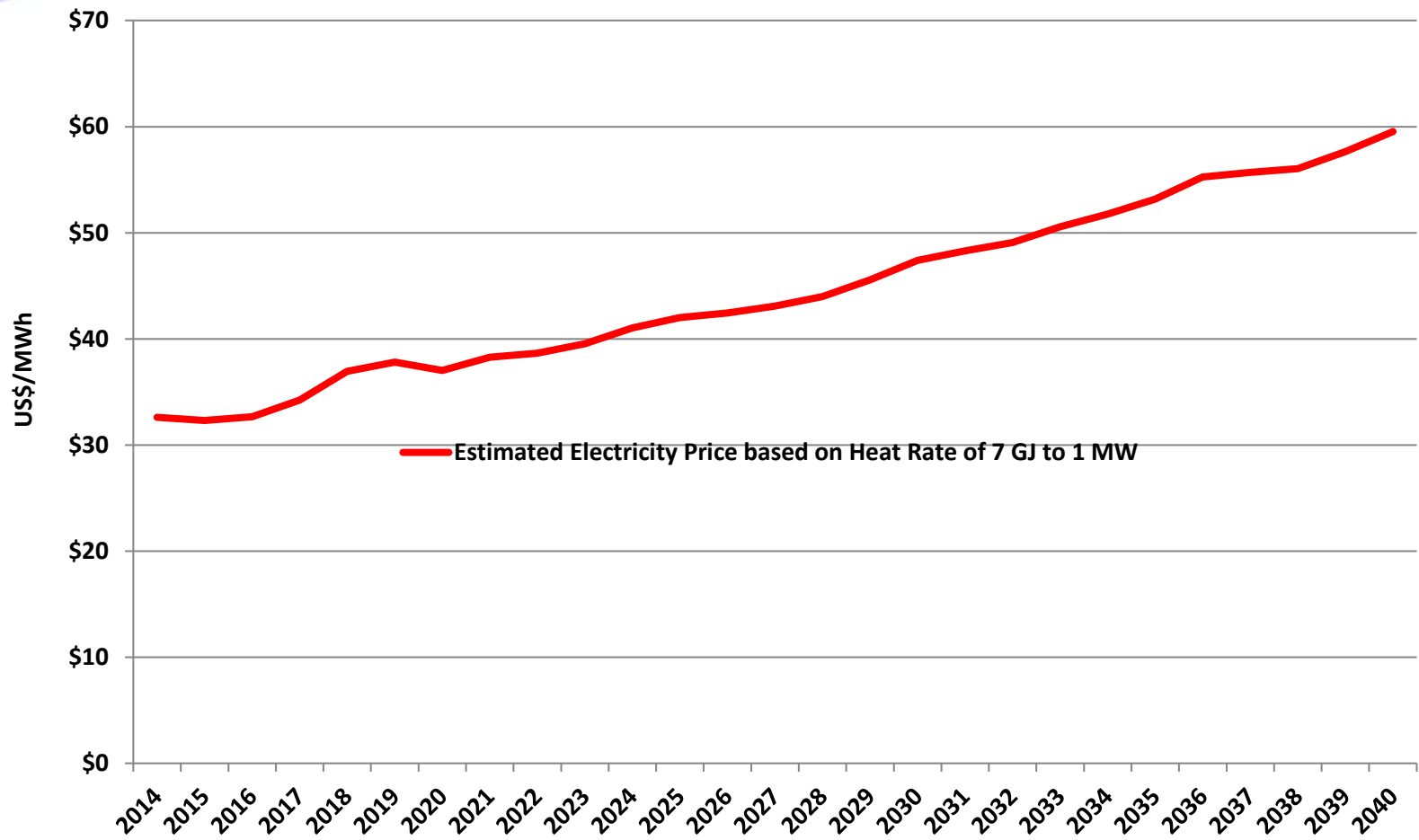


EIA Forecast Natural Gas Prices



Source: US Department of Energy, Energy Information Administration, Annual Energy Outlook 2014, US Natural Gas Electric Power Price

Forecast Electricity Price: Natural Gas Price x Heat Rate of 7 GJ to 1 MWh



Investment Decision Criteria

The Cost of the Product Produced
should be Less than the Expected
Market Price, *but...*

Keep the lights on...

Follow the rules...

Site C Cost – Latest Update

December 16, 2014 – BC Government Backgrounder

	Cost Per MWh
Cost Before Changes	\$83
Reduction in Provincial Take	-27
Capital Cost Revisions	+4.75
Updated Site C Cost To Ratepayers	\$58 - \$61

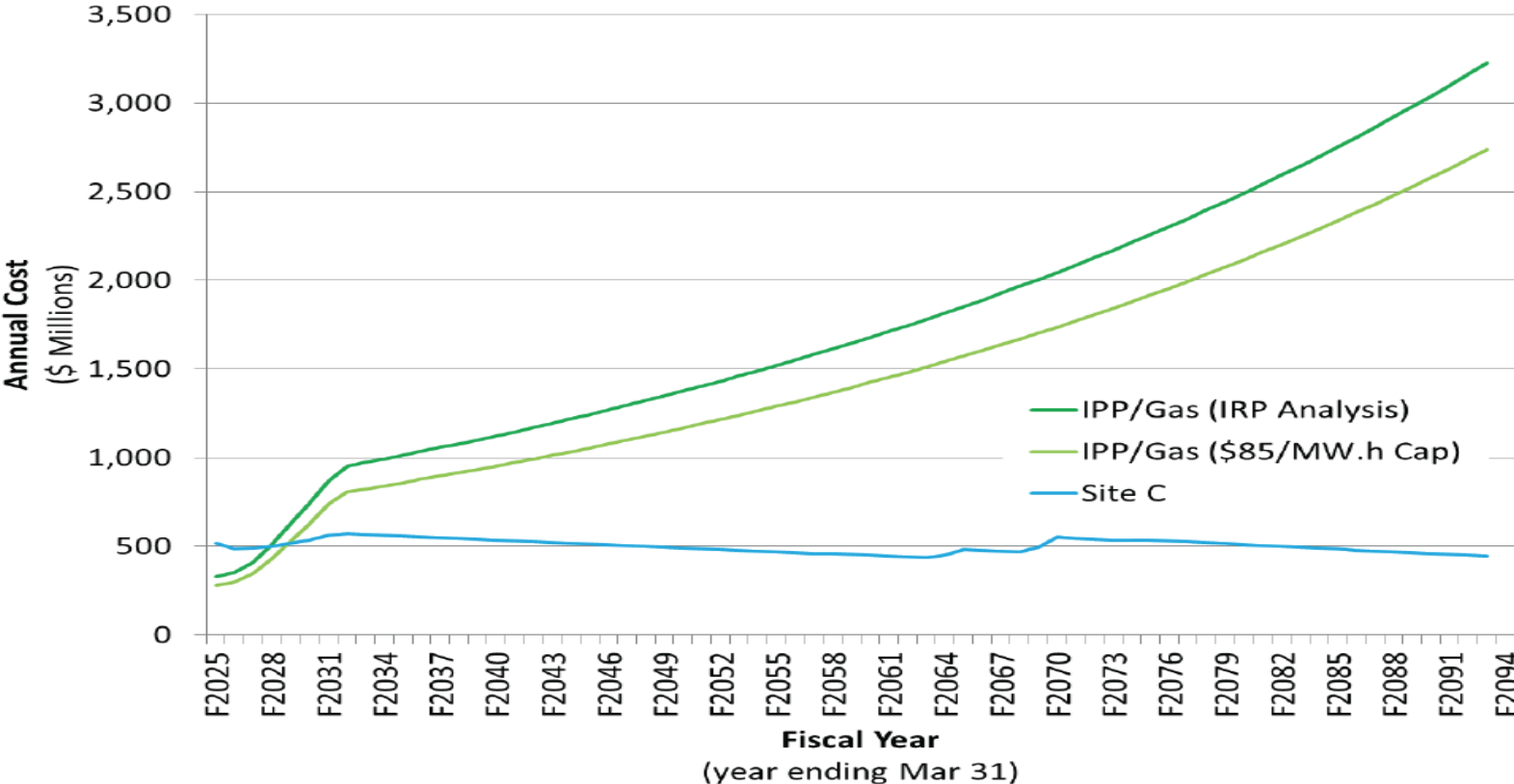
Levelized Energy Cost (LEC)

$$\text{LEC} = \frac{\sum_{t=1}^n \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^n \frac{E_t}{(1+r)^t}}$$

Where

- **LEC** = Average lifetime Levelized electricity generation cost
- I_t = Investment expenditures in the year t
- M_t = Operations and maintenance expenditures in the year t
- F_t = Fuel expenditures in the year t
- E_t = Electricity generation in the year t
- r = Discount rate
- n = Life of the system

Annual Cost to Ratepayers Millions Per Year



Site C Cost Actually \$100/Mwh

- Provincial Published Cost /MWh is Levelized Electricity Generation Cost
- Published Nominal Cost is \$500 Million per Year
- \$500 Million Divided by 5200 GWh is \$96.15/MWh
- 50% Higher than Provincial LEC

Site C Summary

- **Market price of electric power is determined by price of natural gas**
- **Site C cost is Approximately \$100+/MWh**
- **In 2024 Market price likely \$40/MWh**
- **Site C power will cost \$300 million per year more than Expected Market Value**

Clean Energy Act

Quote from Vancouver Sun Article of October 24, 2014; Statement of Co-Author John Axsen:

“The Clean Energy Act had a huge effect. It is very important public policy and nobody knows its there. No one is resisting it, nobody is talking about it, and arguably, that’s perfect”

Clean Energy Act

- **93% Renewable – Eliminates Natural Gas**
- **Self sufficiency Requirement Eliminates Planned Market Purchases.**
- **Burrard Thermal Unavailable**

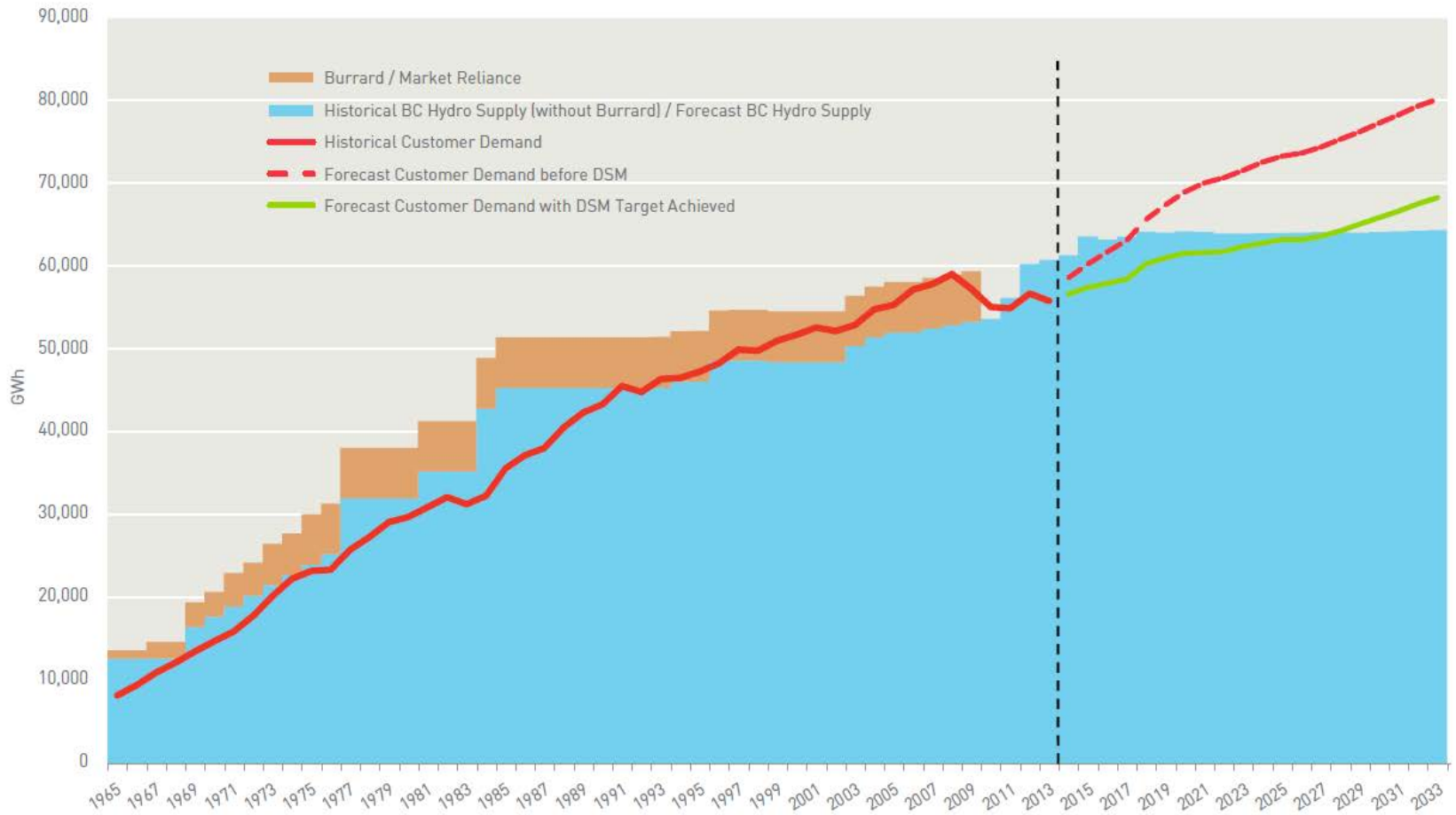
FY 2014 BC Hydro Annual Report

- **Energy Costs Higher than 2013**
- **Lower Water Flows, Higher Thermal Generation, Higher Cost Gas and Electric Purchases, and**
- **More IPP's Achieve Commercial Operation**

FY 2014 BC Hydro Annual Report – IPP Power Cost

Fiscal Year	Cost \$Millions	GWh Purchased	Average Cost \$/MWh
2014	825	11,025	74.82
2013	*775	10,675	72.59
Difference	50	350	142.85

BC Hydro Supply and Demand



Savings With Burrard Thermal

- 6,000 GWh/year
- Replaced with IPP Contracts
- Price at least \$100/MWh over market
- Cost will exceed market value by \$600 million/year

Committed Purchases Under Existing Contracts

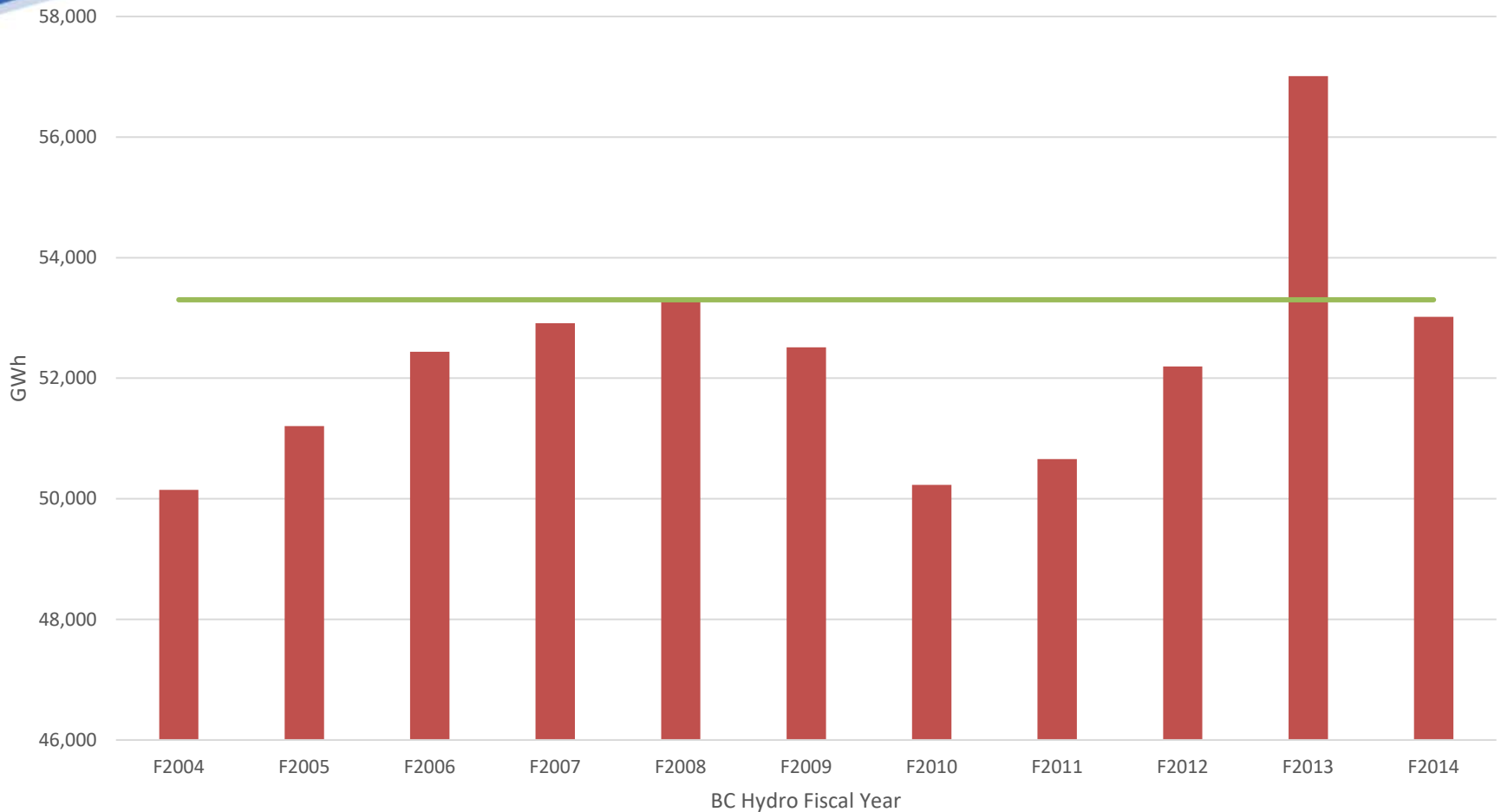
- **32 Existing Contracts**
- **Capacity – 1,380MW**
- **Energy 5,116 GWh/year**
- **Significant Loss to Attrition**
- **3,700 GWh/year will achieve commercial operation**
- **Cost will exceed market value by \$370 million/year**

Economic Summary

Site C and the Energy Act

- **Power from Site C will cost \$300 million/year more than market value**
- **Burrard Replacement - \$600 Million/year**
- **Pending Contracts - \$370 million/year**
- **Total - \$1,270/year**
- **26% of BC Hydro Annual Revenues**

Total Metered Consumption Domestic of BC Hydro's Customers from F2004 to F2014



GHG Reductions- Economics

- **Site C and Renewable Projects are Low Carbon**
- **Natural Gas Generation – 0.5 Ton CO₂ per MWh**
- **Compared to Market Price, Site C GHG Reductions cost \$120/Ton**
- **IPP Contracts GHG Reductions Cost \$200/Ton**
- **Hardly a Good Buy**

Canadian Entitlement

- 4540 GWh Energy
- 1320 MW Capacity

Year	2010	2011	2012	2013
Revenue \$Millions	168	136	110	89
\$/MWh	37	30	24	20

Recommendations

- **Return Burrard Thermal to Resource Stack**
- **Delay Site C until Financially Attractive**
- **Modify the Clean Energy Act**
- **Use Low Cost Market Supply to Manage BC Hydro to achieve Economic Efficiency**
- **Restore the Mandate “Reliable, Low Cost Electric Power, for Generations”**

Prepare For

- **Rapidly Rising Rates for Electric Power**
- **Loss of a key Competitive Advantage**
- **Little Growth and Likely Loss of Electric Power Intensive Industry**
- **Reduced Growth of Jobs and Economy**
- **Less Prosperity in BC**
- **Reduced ability to Provide Needed Infrastructure and Public Services**

Thank You

- **QUESTIONS?**