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Direct Testimony Presentation
Public Session

Power Resource Planning & Economic Evaluation, Business Case & Risk Assessment, Transmission Economics, Export Contracts, Financial Modeling, Wind

Presented by: **La Capra Associates, Inc.**
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John Athas, Principal Consultant
Mary Neal, Consultant

Presented to: **Manitoba Public Utilities Board NFAT Panel**

April 7, 2014

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AGENDA

I. Scope Of Work

II. Overview of The Economics of Preferred Development Plan

III. Alternative Development Plans

IV. Economic Uncertainty Analysis

V. Pathways – Decision Framework

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I. SCOPE OF WORK

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LCA Scope of Work - Categories

1. **Power Resource Planning and Economic Evaluation**
2. **Business Case and Risk Assessment**
3. **Transmission Economics**
4. **Review of MH's Export Contracts**
5. **Financial Modeling**
6. **Wind**

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LCA Scope of Work – 3 Phases

1. **Initial Filing (late January)**
    - Based on information produced through late December
2. **Supplemental Filing (Feb 28)**
    - Incorporated additional filed information and model data
3. **March Addendum Analysis**
    - Updated for new information introduced in hearings

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LCA Filed Evidence – Phase 1 & 2 SOW

Initial Main Report

Technical Appendices:

1. Resource Planning**
2. Generation Alternatives**
3. Alternative Resource Plans
4. Environmental Issues & Policy**
5. Hydrological Risk**
6. Export Markets**
7. Export Contracts**
8. Transmission Economics**
9. Economic Analysis**
10. Financial Analysis

Supplemental Main Report **

Technical Appendices:

3. Alternative Resource Plans B **
7. Export Contracts B**
9. Economic Analysis B**
10. Financial Analysis B

** denotes reports with Public and CSI Versions

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LCA Filed Evidence – Phase 1& 2 Key Findings

- MH's economic case for the Preferred Development Plan (PDP or Plan 14) is marginal and requires a very long-term perspective.
- MH's year of need is very conservative
- MH's cost assumptions for alternatives were high
- MH's alternative development plans were too limited
- MH's choice of plans considers only the 78 NPV metric
- MH's uncertainty analysis did not compare plans on like assumptions
- MH had not demonstrated the need for the U.S. transmission
- MH assume very little cost uncertainty for Conawapa

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Phase 3 – March Addendum Analysis

1. Two Key Changes Introduced in March

- Updated Keeyask and Conawapa Costs
- Level 2 DSM adopted

2. LCA Supplemental Analysis

- Updated All Economic Analysis with new capital costs (App 9 A & B)
- Limited review of recently filed DSM cases and additional new data

3. Our Direct Evidence Focuses on Current Info

- Changes have material impact on LCA's findings from Phases 1&2

II. THE PREFERED DEVELOPMENT PLAN OVERVIEW OF THE ECONOMICS

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Understanding the Changes in the MH Case for the PDP

- MH continues to seek authorization to proceed with the PDP
- MH's case for the PDP has changed materially since the NFAT Submission
  - Also since LCA filed its reports
- With the Recent developments, a full update of the PDP economics is not available
- We have assembled our best understanding of the current PDP economics:
  - Using MH's current information and assumptions only (no LCA adjustments)
  - Estimating composite changes from MH's analysis of individual changes

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Stepping through the Changes in MH's PDP Economics

1. **Review the Starting Point – NFAT Submission**

2. **Review the Set of Changes Since the NFAT Submission**

3. **Our Direct Evidence Focuses on Current Info**

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MH's Reference Case Values

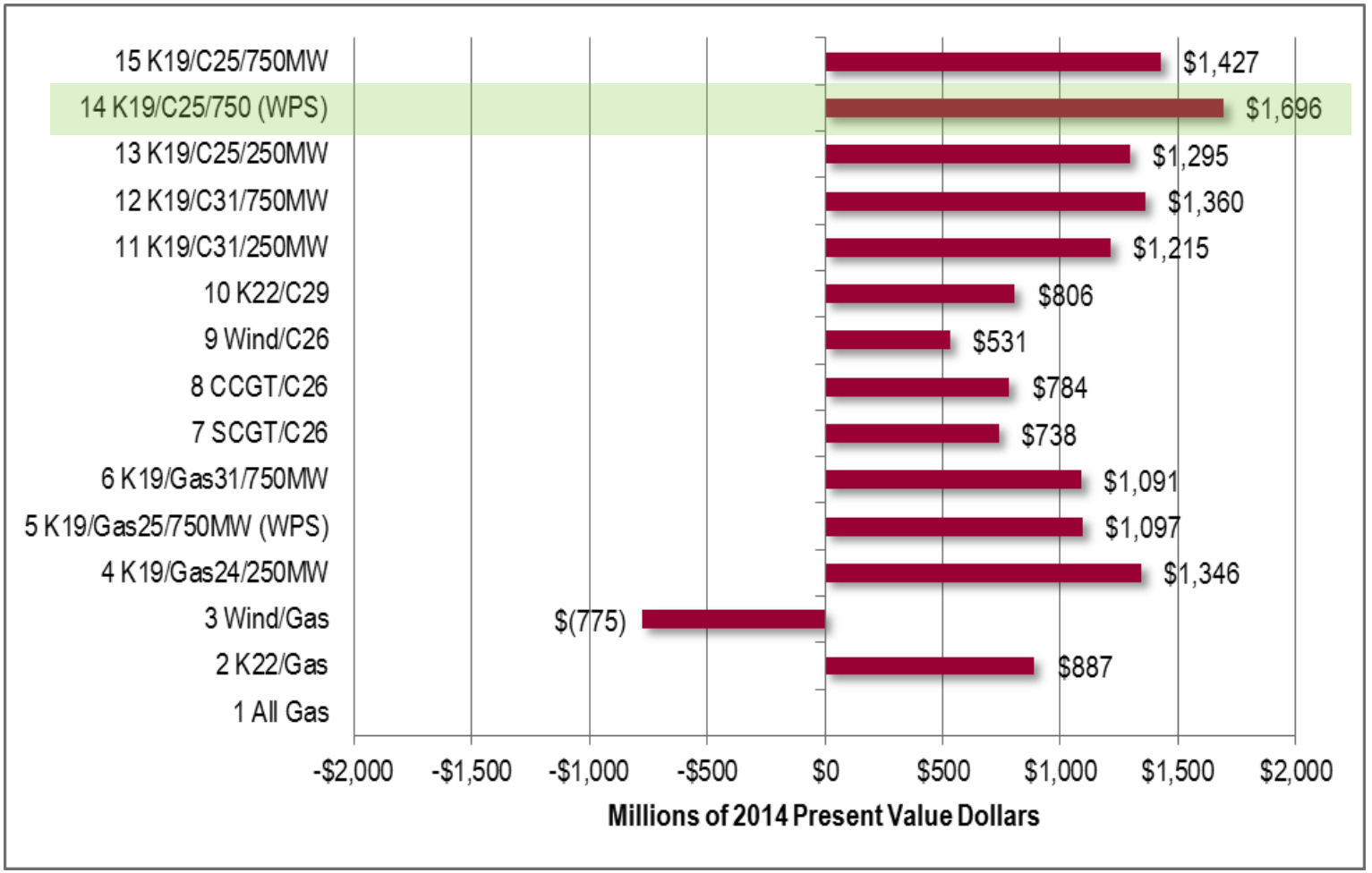

Figure 9-4: Development Plans – Benefits to Manitoba Hydro (Relative to All Gas) – Millions of 2014 Present Value Dollars. (page 9A-18)

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MH's Ref Case: NPV of Benefits and CapEx

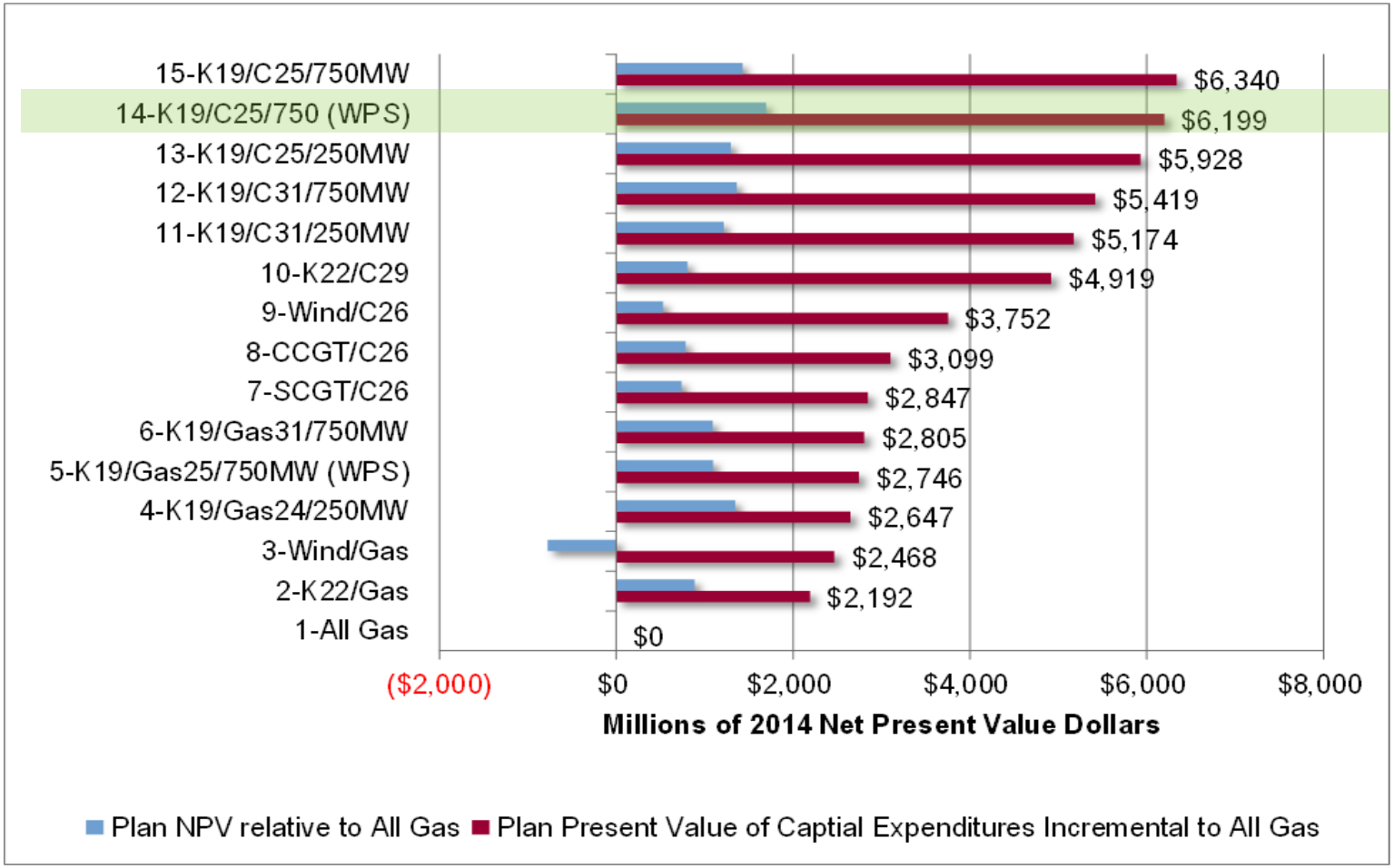

Figure 9-5: Present Value of Invested Capital and NPV of Costs for each Plan through 78 Years Relative to All Gas - Millions of 2014 Present Value Dollars* (page 9A-23) (revised 3/31/2014)

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MH's Reference Case – Provincial View

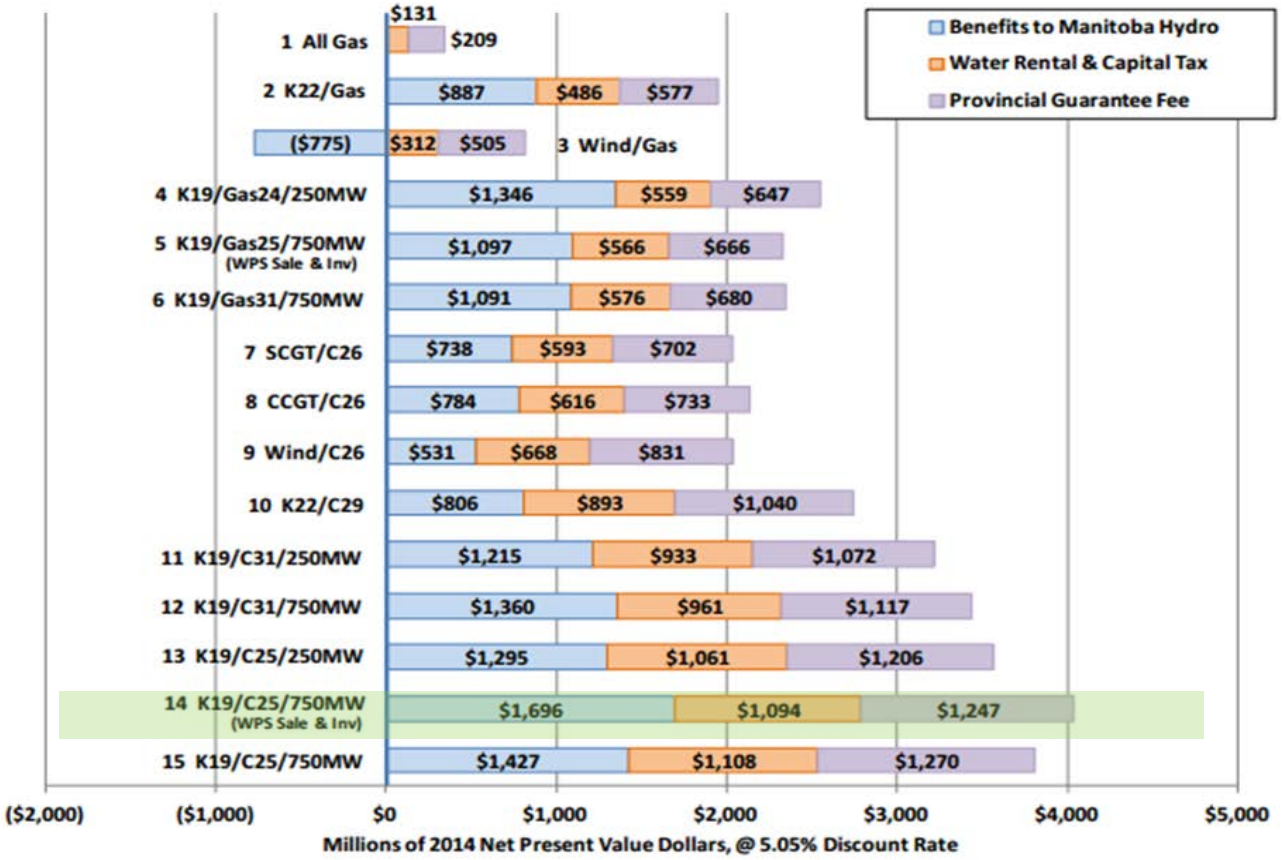

Figure 9-75: Resource Plan Economic Benefits after 78 year to the Province of Manitoba as filed in the NFAT application by Manitoba Hydro – Millions of 2014 Present Value Dollars (page 9A-132)

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What We Have Learned About MH's PDP Changes

- MH advocates expected value basis for decision making
- New cost estimates for Keeyask, Conawapa, and U.S. Transmission
- Conawapa deferred one year
- Lower Load Forecast
- Level 2 DSM added
- No WPS investment in the US Transmission Line
- New WPS contracts
- Updated 2013 Assumptions (discount rates, energy prices, etc.)

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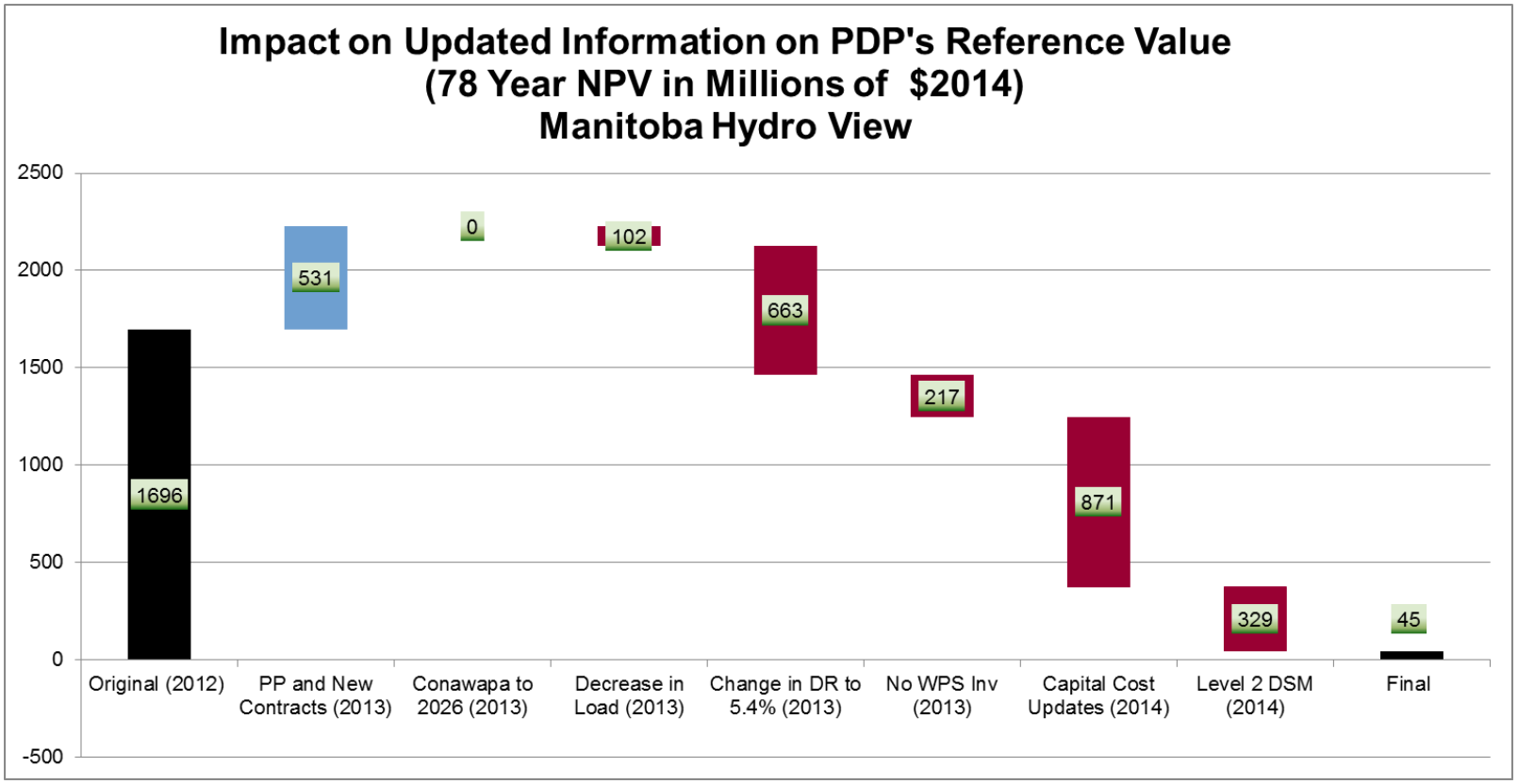
MH's Reference Case



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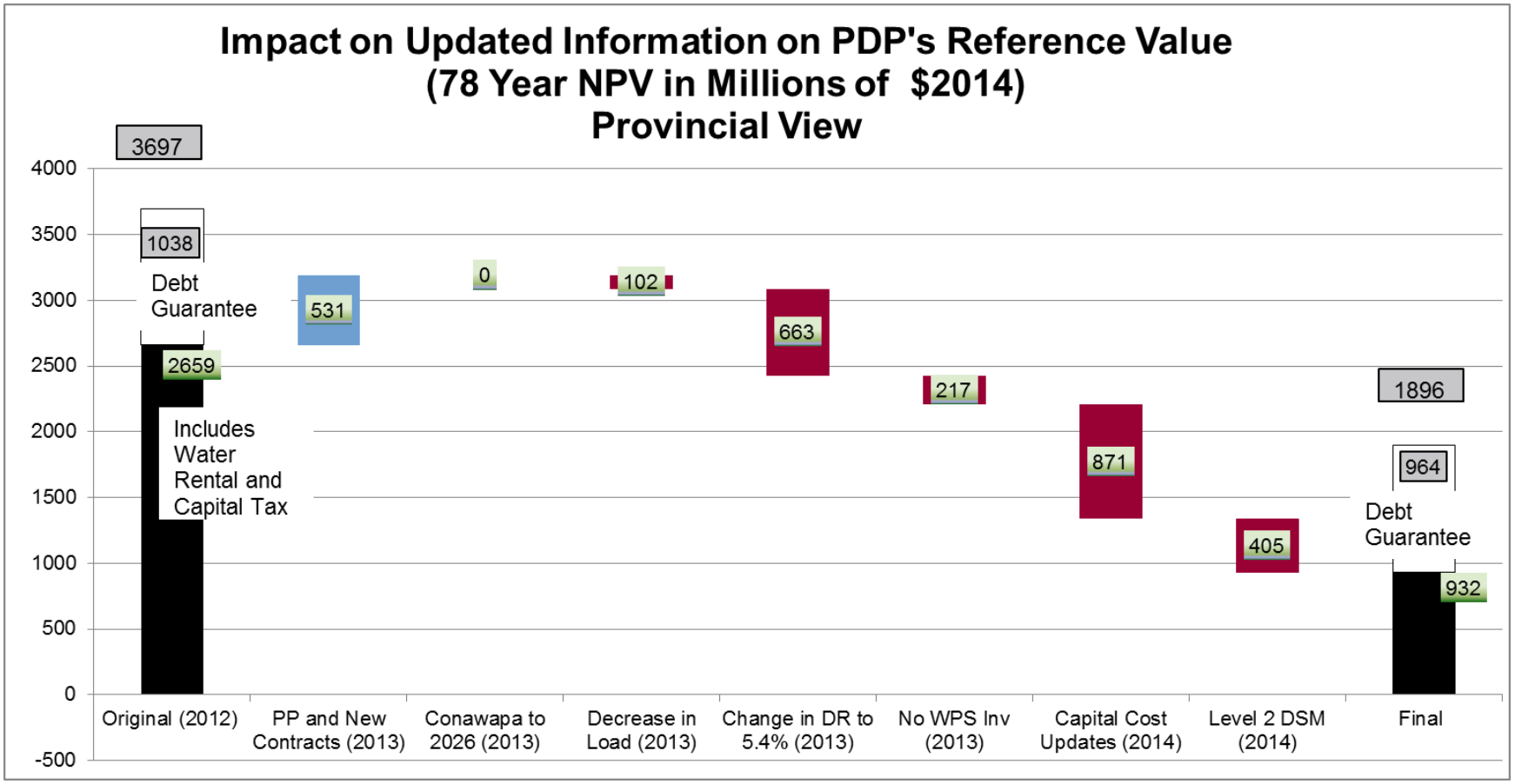
MH's Reference Case: Provincial Perspective



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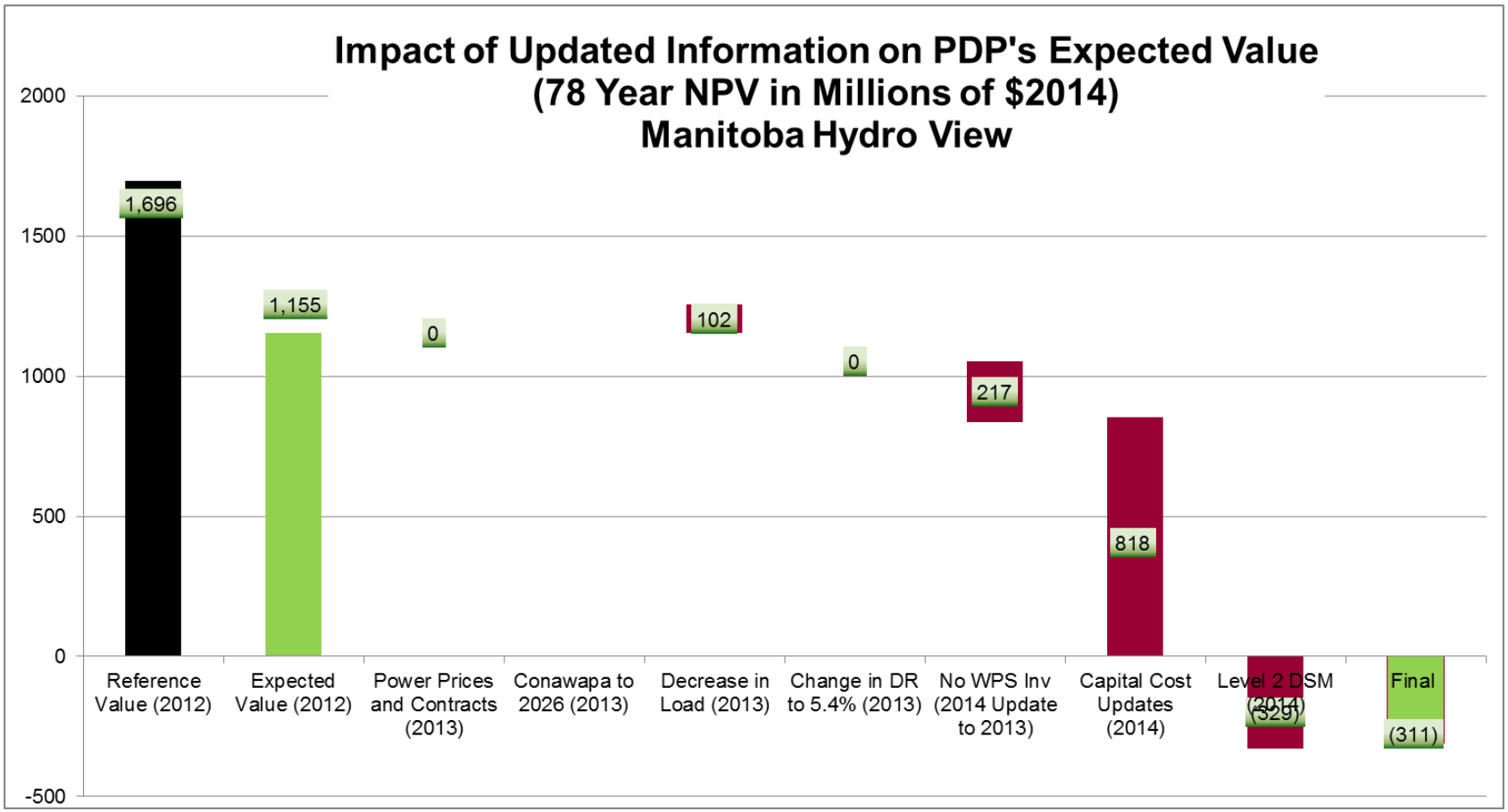
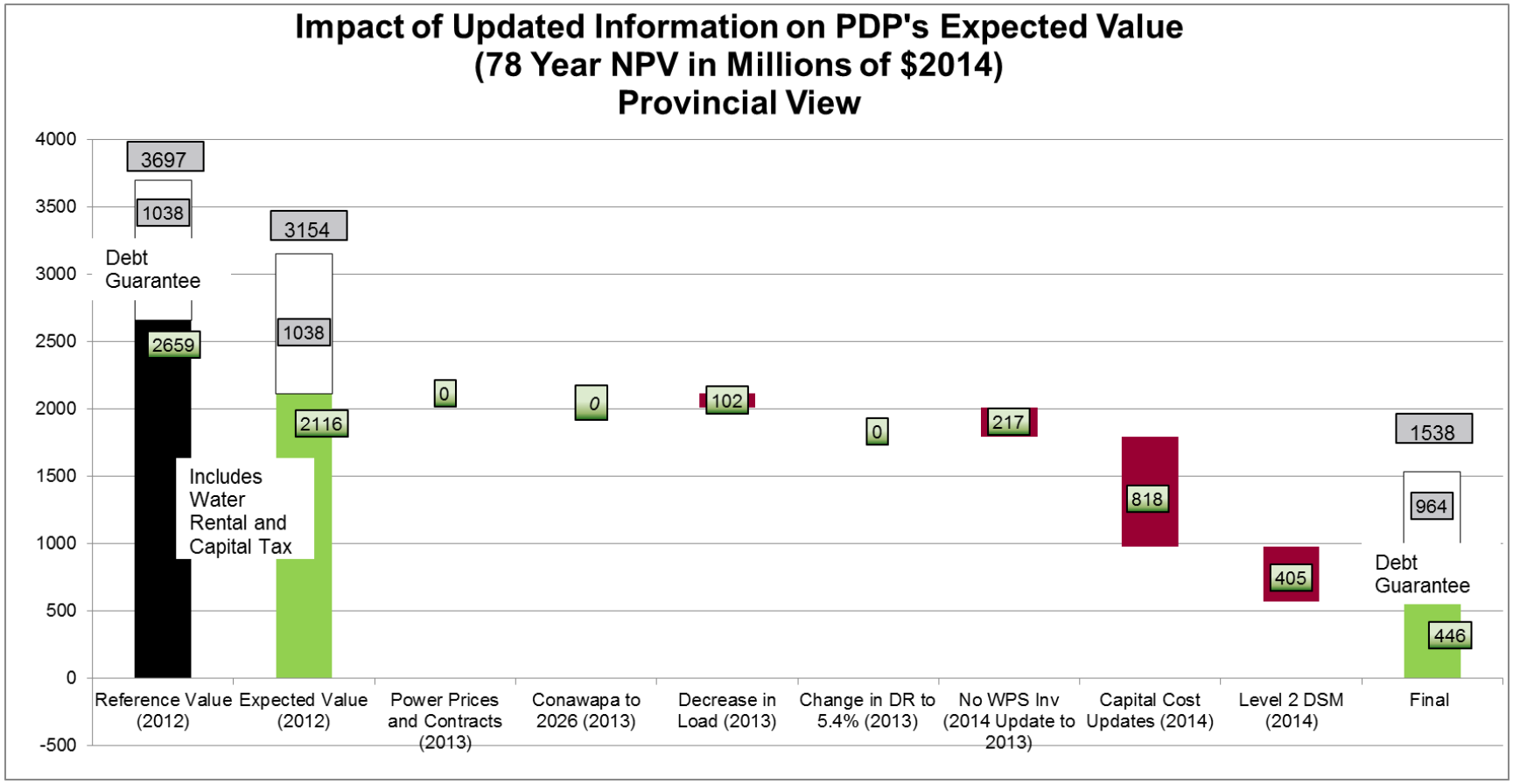
MH's Expected Value



MH's Expected Value: Provincial Perspective



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What We Have Learned About MH's PDP Economics

- **Manitoba Hydro Perspective:**
  - Reference case assumptions – PDP is virtually the same as All Gas
    - $1.7 Billion to $45 million - $1.65 Billion decline
  - Expected Value Basis – the PDP is now ~$500 M less than All Gas
    - $1.155 Billion to ($311) Million - $1.46 Billion decline
- **Province of Manitoba Perspective:**
  - Reference case – benefits all from Water Rental, Capital Tax, and Guarantee Fee
  - Expected Value Basis – most of the benefit is the Guarantee Fee

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III. ALTERNATIVE DEVELOPMENT PLANS

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Alternative Development Plans - Overview

1. Changes in PDP Bring Added Focus to the Alternatives

- The Hydro Plan Economics Have Changed
- Alternative Development Plans can be Improved and Expand

2. In this Section:

- Metrics to Compare Economic Performance of the Plans
- Natural Gas Plan issues
- LCA "No Generation" Plan – DSM, Fuel Switching, & Imports
- Wind Plan Issues
- Alternative Plans featuring hydropower
- DSM as an element of all plans

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Metrics for Comparing Alternative Plans

1. **MH's Economics Analysis is Reported using 78 Year NPV**
   - Additional Metrics display more characteristics of plan performance
   - Decision Makers can differ on their view of intertemporal effects
   - An aid to understanding the degree of reliance on long-term forecasts
2. **LCA's Economic Analysis Built in Several Metrics**

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LCA Alternative Development Plan Metrics

Plans	78 Year CPV of Total Capital	78 NPV	50 CPV	35 CPV	20 CPV	78 Year IRR	Break Even Year (All Gas) Base Case
2 K22/Gas	$2,192	$887	$477	($191)	($1,394)	6.63%	2051
3 Wind/Gas	$2,468	($775)	($845)	($908)	($814)	N/A	N/A
4 K19/Gas24/250MW	$2,647	$1,346	$917	$254	($1,076)	7.10%	2043
5 K19/Gas25/750MW (WPS)	$2,746	$1,097	$694	$161	($1,302)	6.69%	2044
6 K19/Gas31/750MW	$2,805	$1,091	$657	($21)	($1,323)	6.62%	2048
7 SCGT/C26	$2,847	$738	$178	($686)	($2,508)	5.99%	2059
8 CCGT/C26	$3,099	$784	$174	($716)	($2,633)	5.99%	2059
9 Wind/C26	$3,752	$531	($62)	($1,031)	($2,777)	5.67%	2064
10 K22/C29	$4,919	$806	($112)	($1,501)	($4,247)	5.71%	2064
11 K19/C31/250MW	$5,174	$1,215	$264	($1,087)	($4,041)	6.04%	2059
12 K19/C31/750MW	$5,419	$1,360	$365	($1,119)	($4,182)	6.62%	2058
13 K19/C25/250MW	$5,928	$1,295	$374	($1,019)	($3,899)	5.94%	2058
14 K19/C25/750 (WPS)	$6,199	$1,696	$714	($766)	($3,887)	6.15%	2054
15 K19/C25/750MW	$6,340	$1,427	$445	($1,032)	($4,117)	5.96%	2057

Reference Case - 2012 Assumptions

Figure 9-21: Summary- CPVs as Compared to All Gas Plan at the End of Various Periods, Break-Even Year, and 78 Year IRR - Millions of 2014 Present Value Dollars. (page 9A-48, revised March 31, 2014 see Errata)

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Limitations in MH's Consideration of Alternative Plans

1. **MH Measures Economic Benefits vs. its All Gas Plan (Plan 1)**
2. **Issue: Is Plan 1 the Best Configuration of Gas Generation?**
3. **Issue: Are there other Options to consider?**
   - DSM, Fuel Switching, Imports
4. **Issue: Are the Other Non-Hydro Plans the Best?**
   - Wind-Gas Plan
5. **Issue: Are other Hydro-based Plans Better Now?**
   - Alternative timing and combinations of Keeyask and/or Conawapa

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Plans Based on Natural Gas Generation

- **We tested the All Gas Plan (Plan 1) & an All Combined Cycle Plan**
  - All Combined Cycle Case (CCGT) a supplemental case conducted by MH
  - CCGTs (3 added units) substituted for all SCGTs in the All Gas Plan
- **Observations:**
  - As configured, All Gas and CCGT very similar on economics
  - CCGT Plan showed higher exports in all water conditions (results in CSI)
  - Results point to a third case with 5-6 CCGTs that could perform better
  - The CCGT showed interaction with storage to increase on-peak exports
  - These cases show import limitations a factor in the economics

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Example of CCGT Performance in Gas Plans

CCGT Capacity Factors – ALL CCGT Case

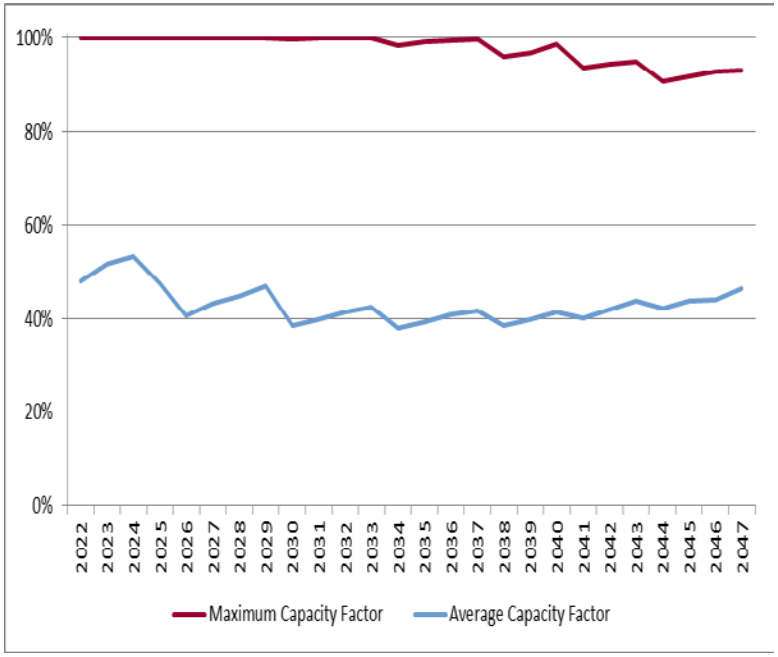

Figure 3-10: Maximum and average capacity factor of CCGT units in the CCGT Plan (page 3B-6)

CCGT Capacity Factors – ALL Gas Case

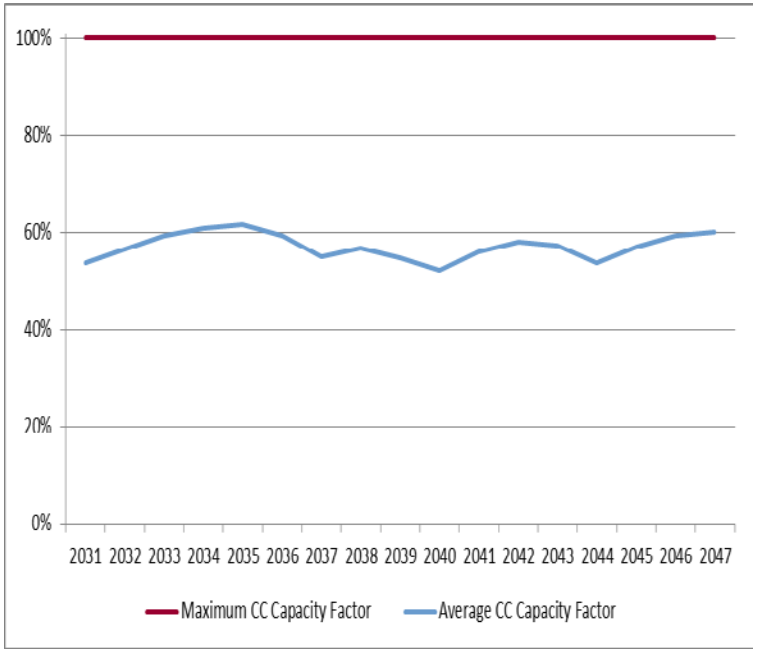

Figure 3-12: Maximum and average capacity factor of CCGT units in the All Gas Plan (page 3B-7)

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Example of SCGT & Import Interaction

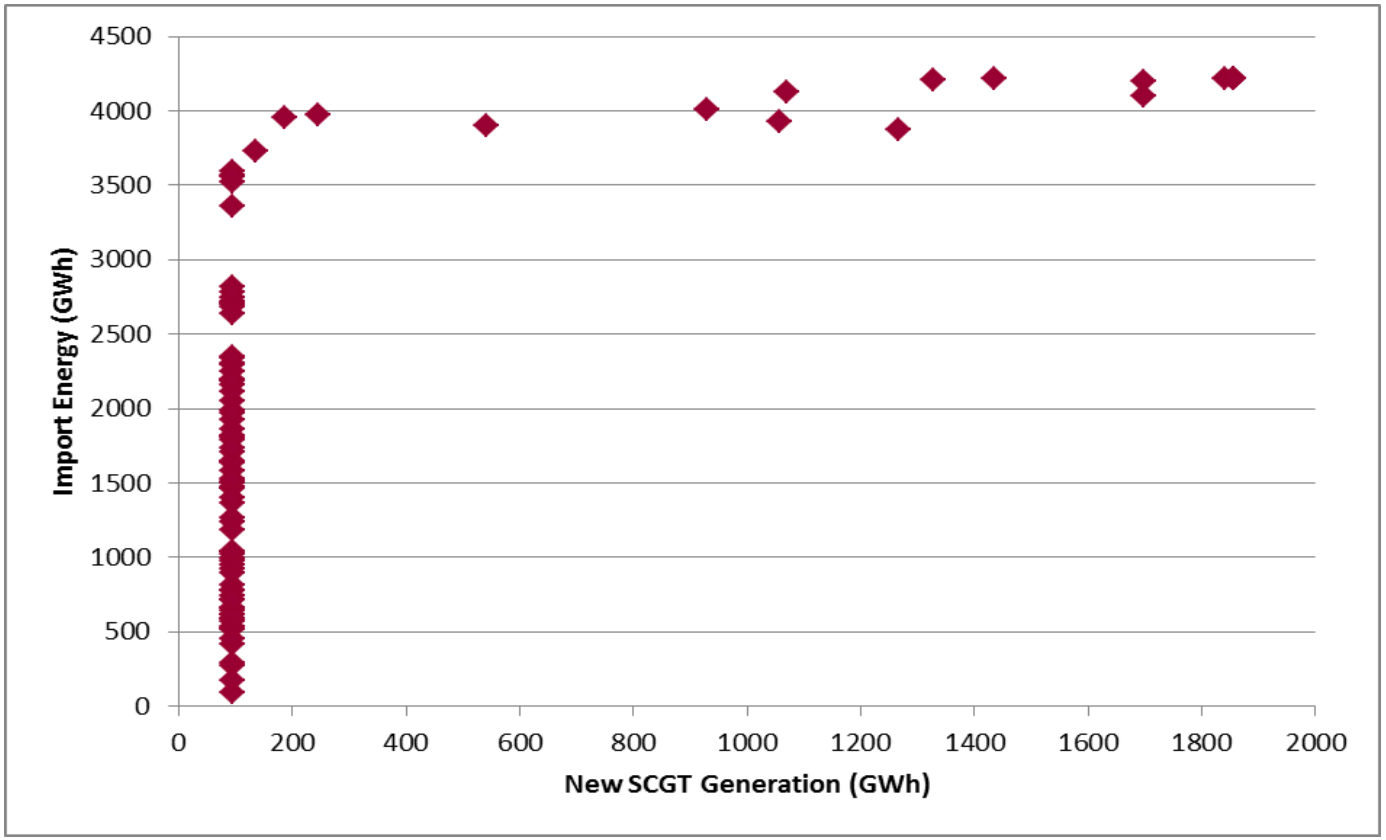

Figure 3-19: Import energy vs. generation from the new SCGT units in the All Gas Plan (2022) (page 3B-14)

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Plan Based on DSM, Fuel Switching, Imports

- **MH Prepared a "No Generation" Case at LCA's Request**
  - DSM at 150% of Reference Case Assumptions
  - Fuel Switching Program to mitigate electric space heat load growth
  - 750 MW transmission in 2029 (100% MH cost)
  - Increase in the reliance on imports to 20% (from 10%) in planning criteria
  - Capacity charge added to firm up imports
- **Purposes for the "No Gen" Case:**
  - All 15 MH Plans included added Gen and reference DSM and Load forecast
  - Add a case to illustrate an approach to an deferral of MH Generation adds
  - Add a test of demand side and import options

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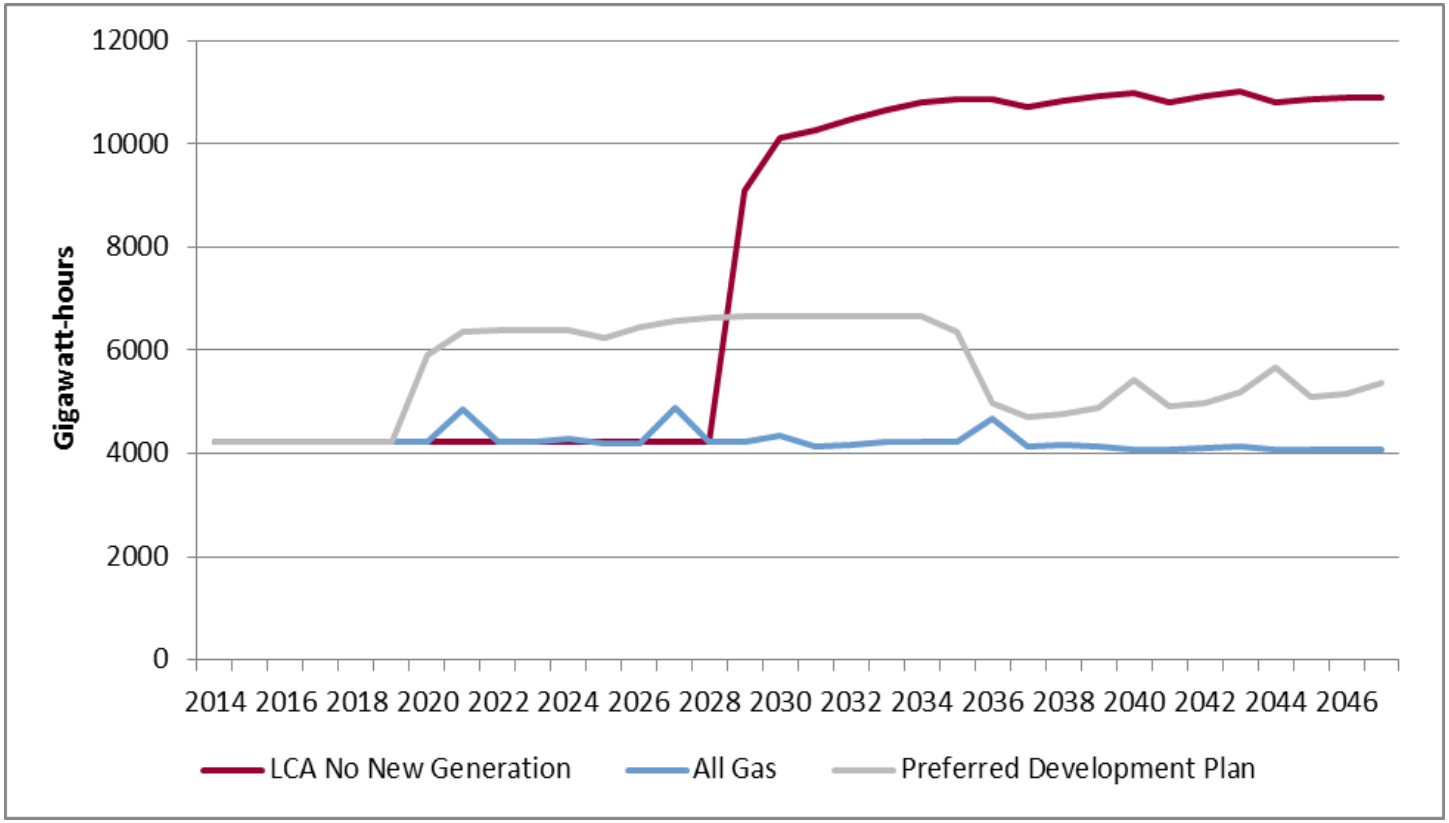
Illustration of Import Limits in "No Gen" Plan



Reference Case - 2012 Assumptions

Figure 3-23: Maximum annual import quantities across development plans; (page 3B-22)

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Illustration of Thermal Gen in "No Gen" Plan

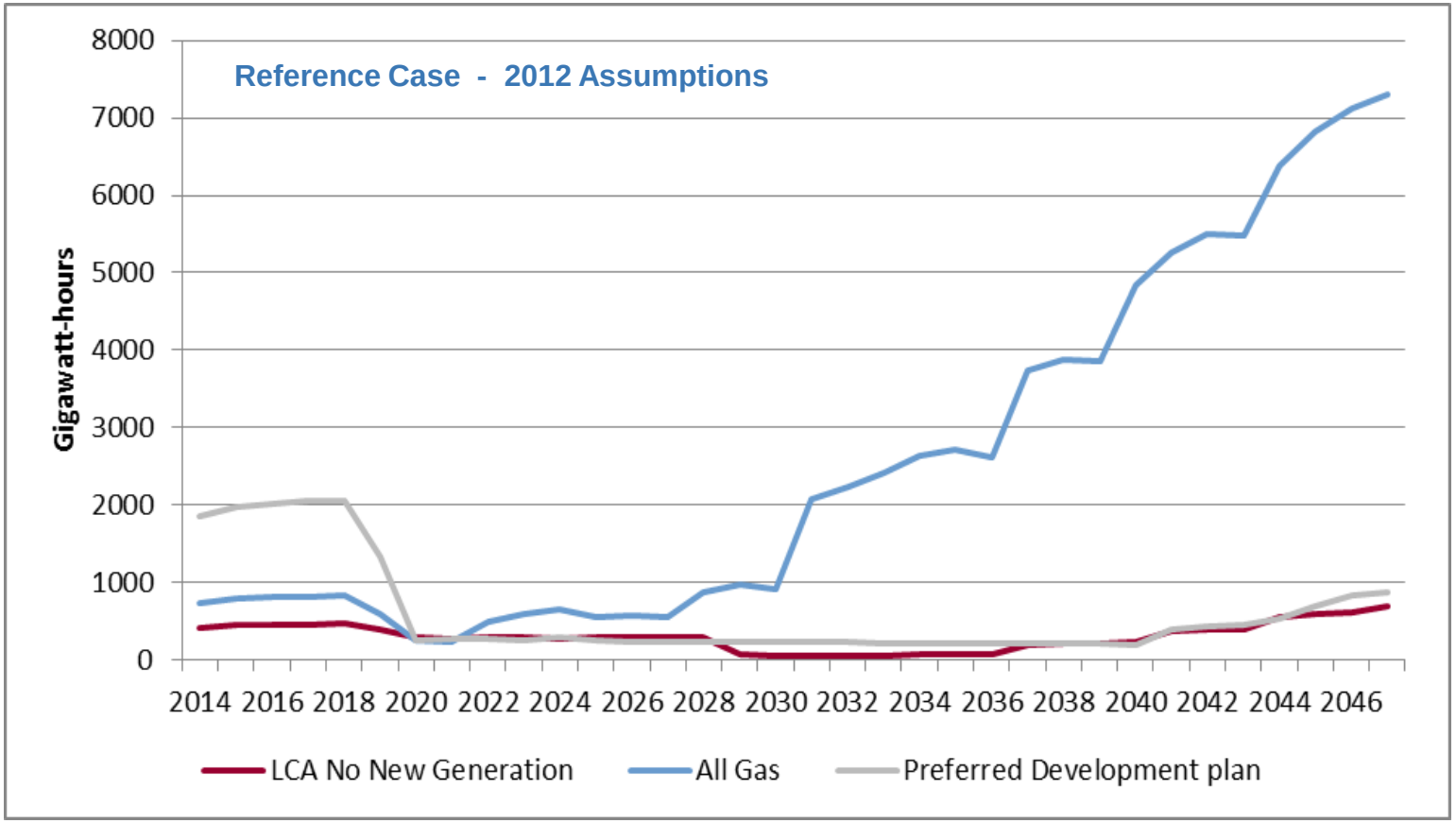

Figure 3-25: Average annual thermal generation across development plans; (page 3B-24)

Comparative Performance of "No Gen" Case

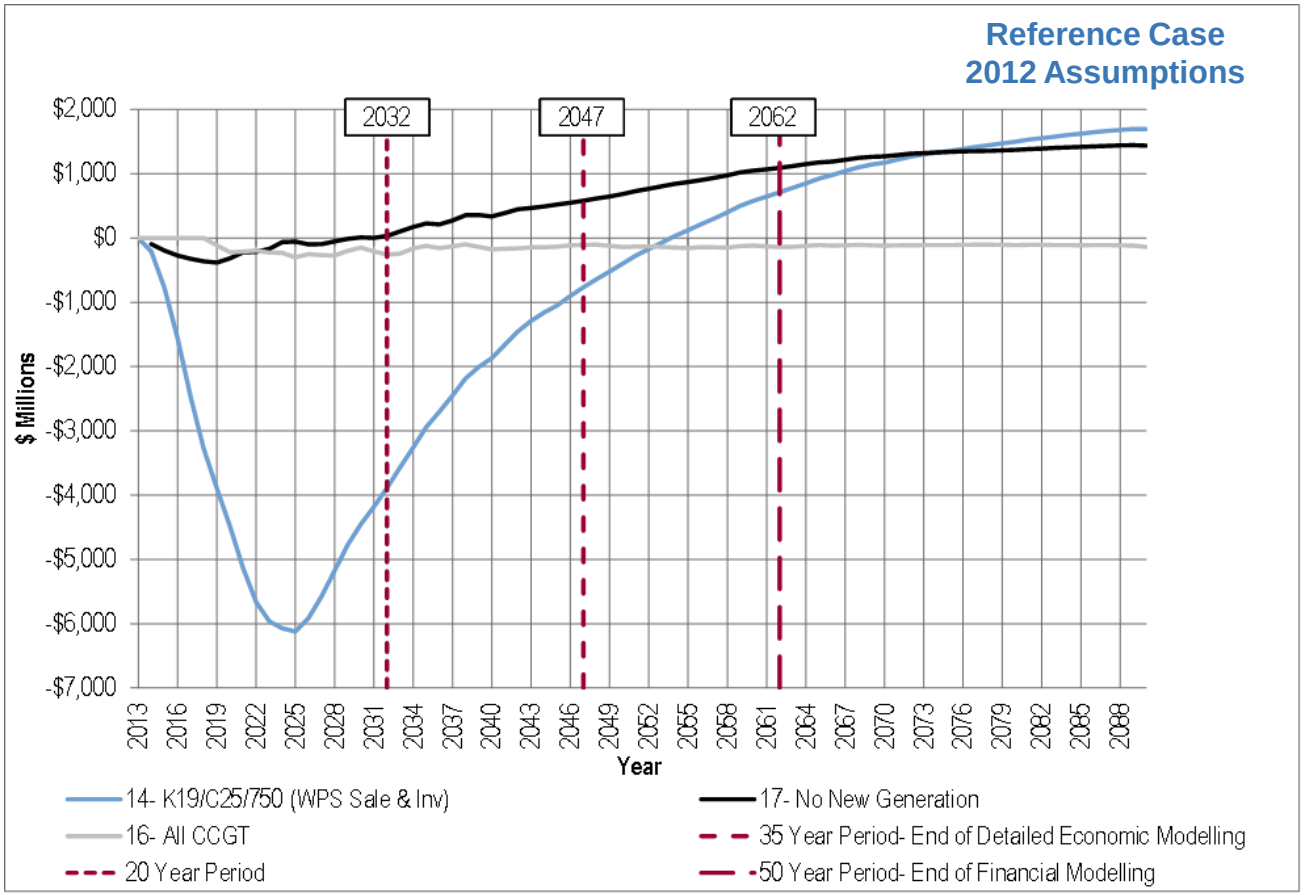

Figure 9-93: LCA Alternative Plans and Preferred Development Plan Relative to the All Gas Plan - Millions of 2014 Present Value Dollars; (page 9B-22))

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Observations on "No Gen" Case Results

- **DSM and Fuel Switching deferred year of need to 2029**
- **Illustrates the Potential Drought Hedge value of increased import limits**
- **Illustrates the impact of DSM and imports on MH thermal generation**
- **While a "hypothetical" plan, the results point to potential for added elements to other plans, such as increased import capability and DSM**

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Plan Based on Wind

- **We tested the Sensitivity of the Wind/Gas Plan (Plan 3)**
  - MH's assumptions on wind are not consistent with current conditions
  - MH's does not include any improvement in wind costs over time
- **Observations:**
  - MH's Wind Assumptions overstate Plan 3 costs by as much as $1.2 B NPV
  - Under 2012 Ref Assumptions, Plan 3 becomes lower cost than All Gas Plan
  - Alternative Wind/Gas Combinations may improve upon Plan 3

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Illustration of Wind Assumption Sensitivity

Assumptions

Input	Manitoba Hydro	LCA
Capital Costs	$2400	$1750
Capacity Factor	40%	43%
Lifetime	20 years	25 years
Cost Decline Over Time	None	1%/yr to 2032

Change in Cost of Plan vs PDP

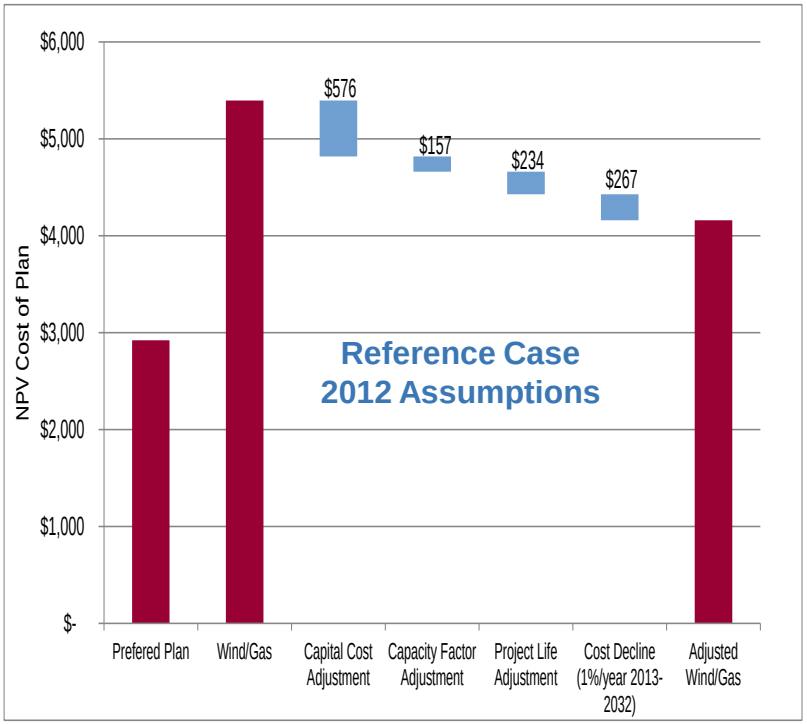

Figure 3-3: Wind Cost Assumptions for Sensitivity Analysis, (3A-28)
Figure 3-4: Impact of Wind Cost Changes on Wind Gas Development Plan NPV; (page 3A-29)

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Wind Cost Sensitivity vs. All Gas Plan

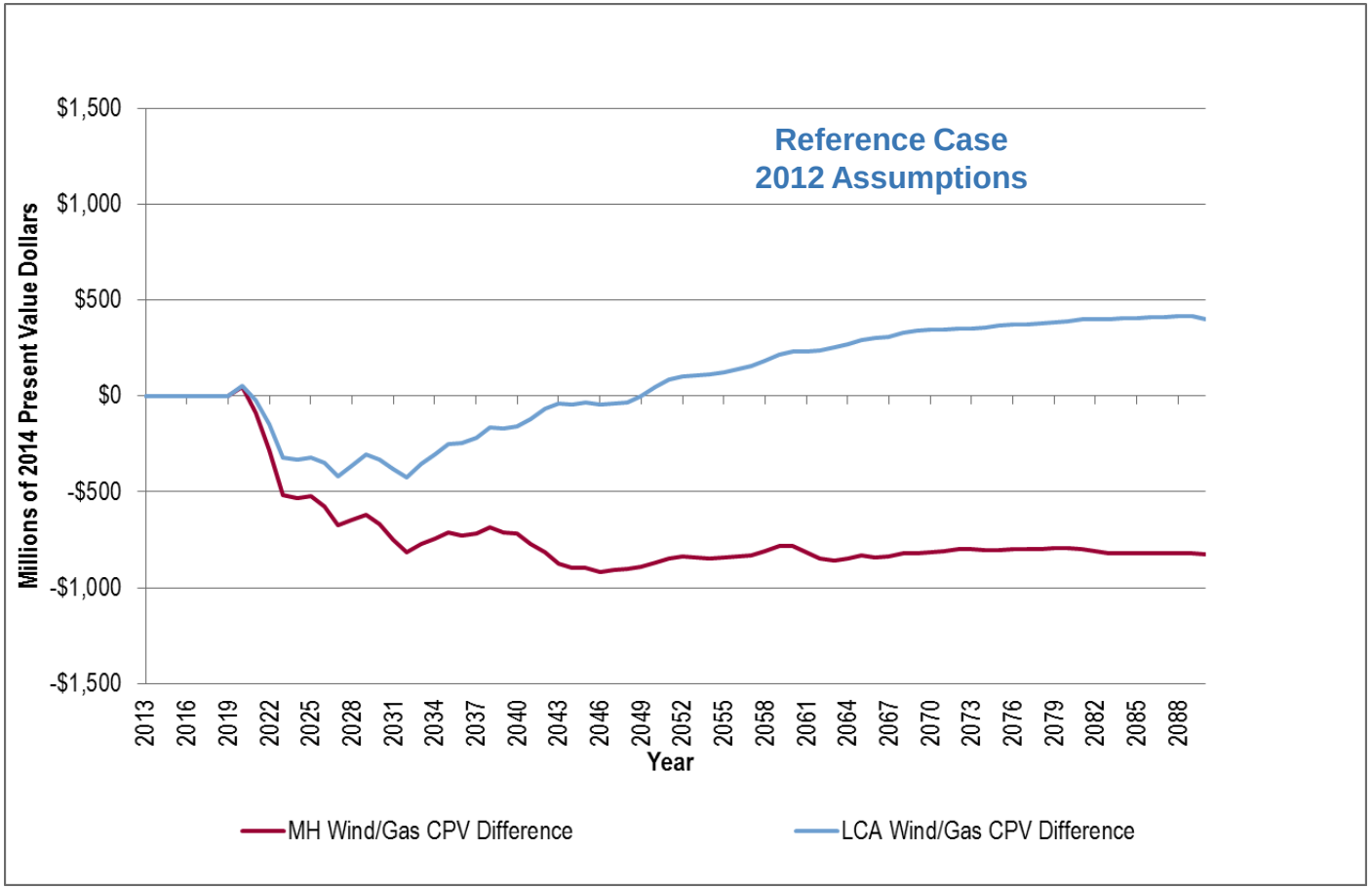

Figure 3B-30: Cumulative present value difference, MH and LCA wind assumptions (Wind/Gas minus All Gas), (page 3B-31)

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Alternative Hydro-Based Plans

- **We Tested the Sensitivity of the Timing of Keeyask in Plan 2**
  - "Plan 2A" constructed using model results from Plan 1 and Plan 2
  - This Plan adds gas generation first, then Keeyask (CT22/CT25/K28/Gas)
  - Approximates a 5 year delay of Keeyask from Plan 2
- **Observations:**
  - On 2012 Ref/Ref/Ref Basis, NPV cost of Plan 2 and 2A are the same
  - Indicates benefits of Keeyask in Plan 2 are preserved in a delay case
  - Additional issues that would need consideration:
    - Updating for all new information
    - Costs of delay of Keeyask construction

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Level 2 DSM inclusion in all Plans

- **MH offered DSM Portfolio Results in Hearings**
  - Level 2 DSM (4x reference) proved economic in all plans tested
  - Impacts are not uniform, All Gas improves more than PDP
- **Observations:**
  - LCA just recently received the case results details, have not reviewed
  - Year of Need is materially affected with this level of DSM
  - LCA "No Gen" Case include 1.5x reference levels, this is more DSM
  - Lack of DSM consideration in the 15 Development Plans is a limitation

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Observations on Alternative Development Plans

1. **The Alternative Plans Used to test PDP are Suboptimal**
   - All Gas results inflate PDP value
   - Omission of DSM has bearing on the results
   - There are better non-hydro alterative portfolios than those tested
2. **The Range of Alternative Development Plans is Limited**
   - There is a broader set of options, timing and combinations to consider
3. **Current Information poses a material change**
   - Updated Information brings more options into economic parity with PDP

IV. ECONOMIC UNCERTAINTY ANALYSIS

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Economic Uncertainty Analysis - Overview

1. **Uncertainties Inherent in the Case**
2. **Metrics Issues**
3. **Methodology Issues**
4. **Discussion of Some of the Results**

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Uncertainties Inherent in this Case

- **The time dimension**
  - 78 Years is a very long planning horizon
- **Inputs**
  - Many inherently uncertain factors – capital costs, fuel, load, regulation, etc.
- **Methodology**
  - Models cannot capture all considerations or represent all 78 years
- **Perceptions**
  - Perceptions of uncertainties and probabilities are judgments, not data

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The Value of Metrics with Decision Making with Uncertainty

- **Expected Value NPV Over the Investment Life Is Important**
  - Limitations addressed with additional looks
- **Internal Rate Of Return (IRR)**
  - Helpful to put perspective on the scale of benefit to the cost
- **Cumulative Present Value (CPV)**
  - Insight into the timing of costs & benefits over study period
  - Visibility on the exposure to reliance on "out years" benefits
  - Not an alternative to NPV, rather a supplement

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Decision Making with Uncertainty – Methodology Issues

- **MH's Featured S-Curve Approach**
  - Shows Absolute Cost results less a constant (Plan 1 Ref-Ref-Ref)
- **LCA's Featured S-Curve Approach**
  - Comparative Analysis of two or more cases across all branches
  - How the Plans perform given same inputs
- **It is instructive to see both sets of information**
- **Regrets Analysis vs. Regrets Decision Criterion**
  - Both MH and LCA approaches show opportunity and regret information
  - Presentation of these results do not equate to a decision criterion

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Decision Making Criteria

- **Expected Value (EV) Decision Criterion**
  - MH's argues that EV results (78 year NPV) is the proper criterion
- **Not all Decision Makers are EV-based**
  - Risk Averse decision criterion are often considered in large $ situations
  - Many approaches to use the results of uncertainty analysis
  - LCA's approach is simply to offer information that allows the Panel Choice
- **The Uncertainty Analysis is informative to Decision Making**
  - Not All uncertainties are Shown (e.g., load uncertainty)
  - Probabilities are judgments, not data
  - Methodology limitations are also a consideration

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Illustration of the LCA Uncertainty Analysis – Part 1

- **Compare PDP to All Gas**
  - First, using MH 2012 assumptions
  - Second, updated for new capital costs (no other updates included)
  - Third, Provincial Perspective including updated capital costs
- **Comparison Shown**
  - Difference between All Gas and PDP using same input assumptions (27 cases)
- **Metrics Shown**
  - 78 Year NPV difference across 27 Cases
  - Cumulative PV (CPV) for study years 20, 35, and 50

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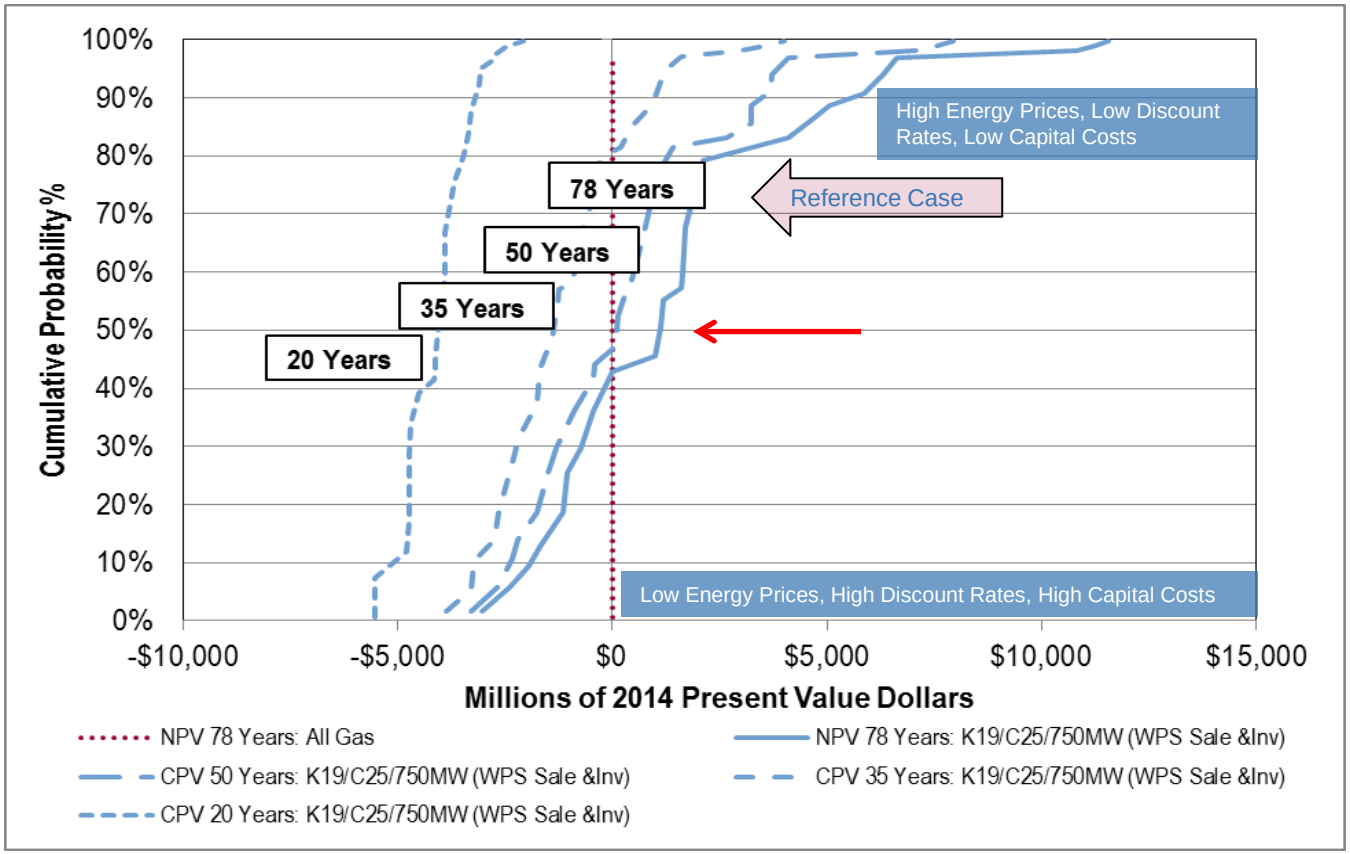
Uncertainty Example: PDP vs. All Gas



MH 2012 Assumptions – LCA Methodology

Figure 9-29: Probability Distributions of the Preferred Development Plan having Higher Costs than the All Gas Plan – Millions of 2014 Present Value Dollars; (page 9A-69)

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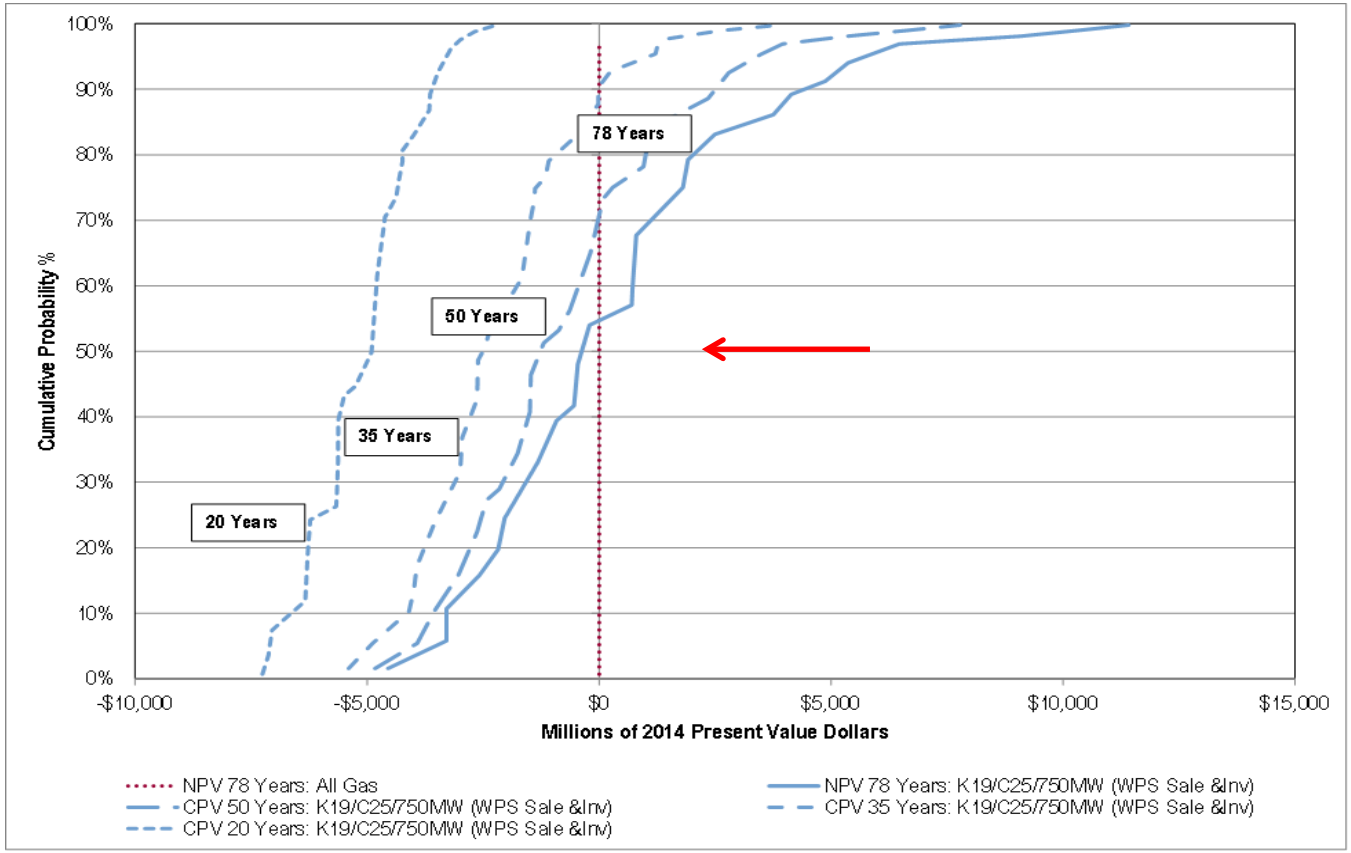
Prior Example with Updated Capital Cost (78 Yr)



MH 2012 Assumptions – Updated Capital Costs – LCA Methodology

Figure 9-29U: Probability Distributions of Plan 14 Preferred Development Plan having Higher Costs than the All Gas Plan-Millions of 2014 Present Value Dollars (page 9U-7).

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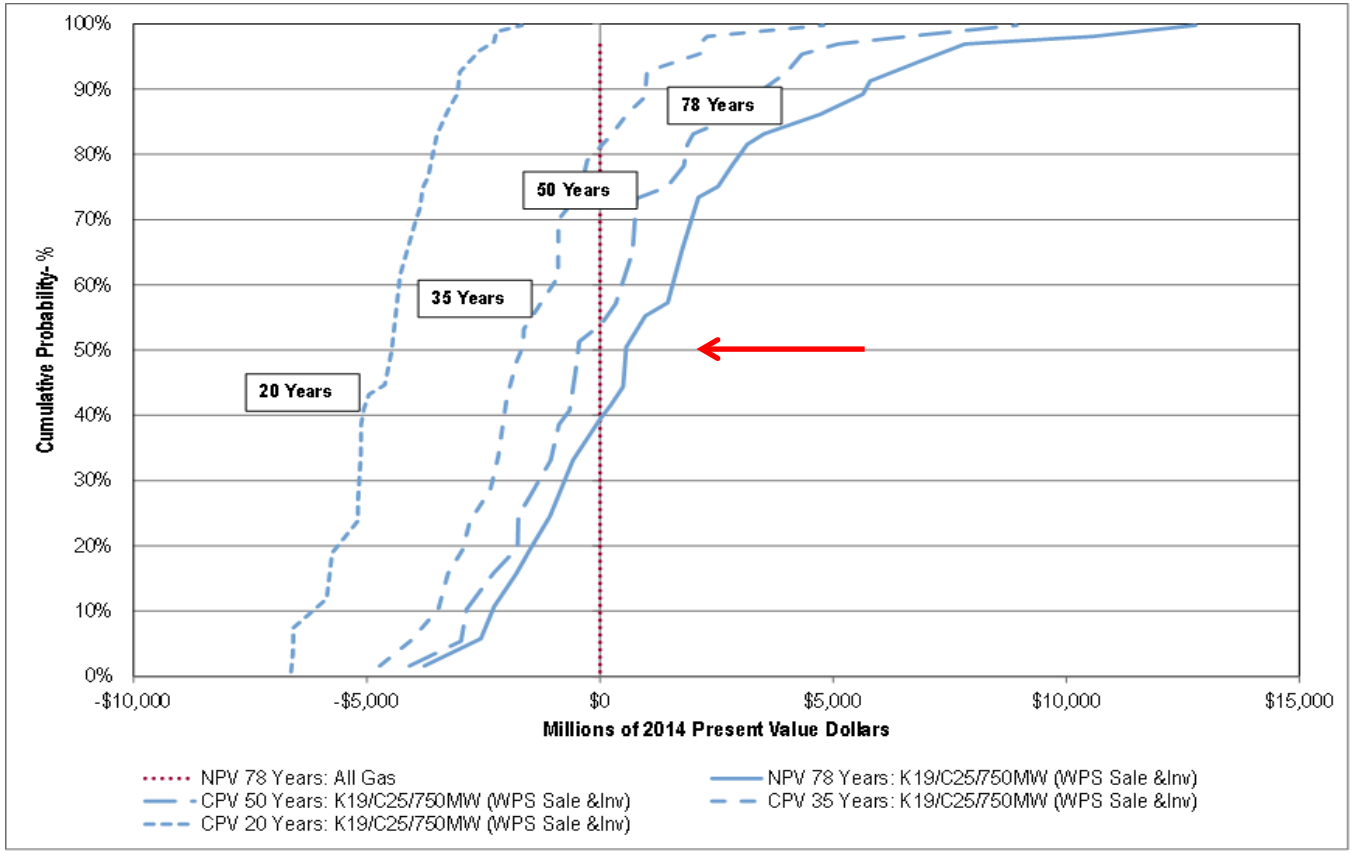
Prior Example – Provincial Perspective



MH 2012 Assumptions – Updated Capital Costs – LCA Methodology
Water Rental and Capital Tax Revenues Included

Figure 9-80U: Probability Distributions of Plan 14 Preferred Development Plan having Higher Costs than the All Gas Plan after 78 Years from the Province of Manitoba Perspective by eliminating LCA view of Intra-provincial transfers – Millions of 2014 Present Value Dollars(page 9U-18)

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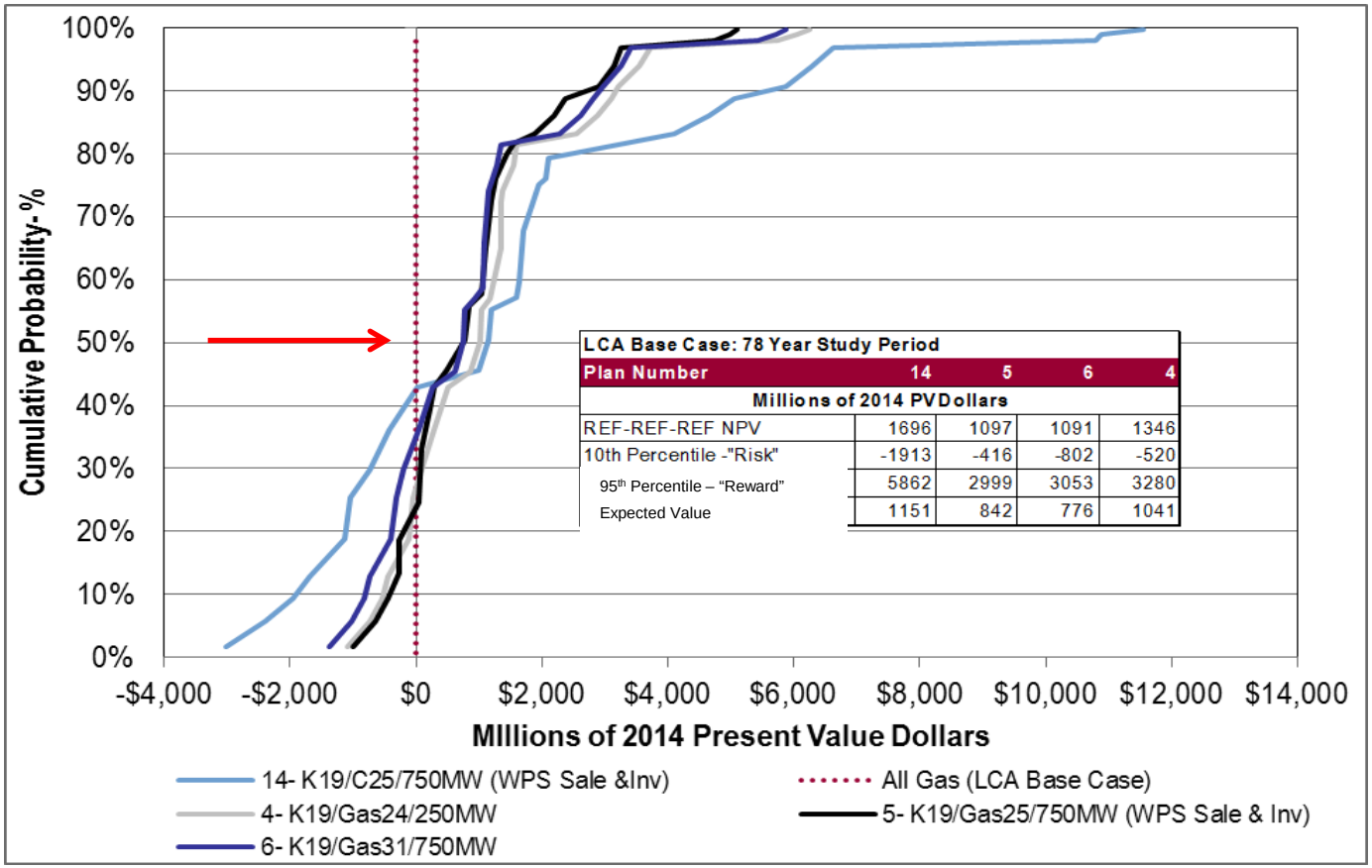
Illustration of the LCA Uncertainty Analysis – Part 2

- **Compare PDP and Plans 4, 5, and 6 to All Gas**
  - First, using MH 2012 assumptions
  - Second, updated for new capital costs (no other updates included)
  - Plans 4, 5, and 6 are variants of Keeyask only, no Conawapa
- **Comparison Shown**
  - Difference between All Gas and Each Plan using same input assumptions
- **Metrics Shown**
  - 78 Year NPV difference across 27 Cases
  - Added Info Text Box: Reference Case, Expected Value, Reward/Regret

Uncertainty Example: Plans 4,5,6 and 14 vs All Gas (78 Yr)



LCA Base Case: 78 Year Study Period				
Plan Number	14	5	6	4
Millions of 2014 PVDollars				
REF-REF-REF NPV	1696	1097	1091	1346
10th Percentile -"Risk"	-1913	-416	-802	-520
95th Percentile – "Reward"	5862	2999	3053	3280
Expected Value	1151	842	776	1041

MH 2012 Assumptions – LCA Methodology

Figure 9-34: Probability Distribution of Selected Plans Compared having higher costs than the All Gas Plan after 78 Years using the LCA Methodology – Millions of 2014 Present Value Dollars (page 9A-77)

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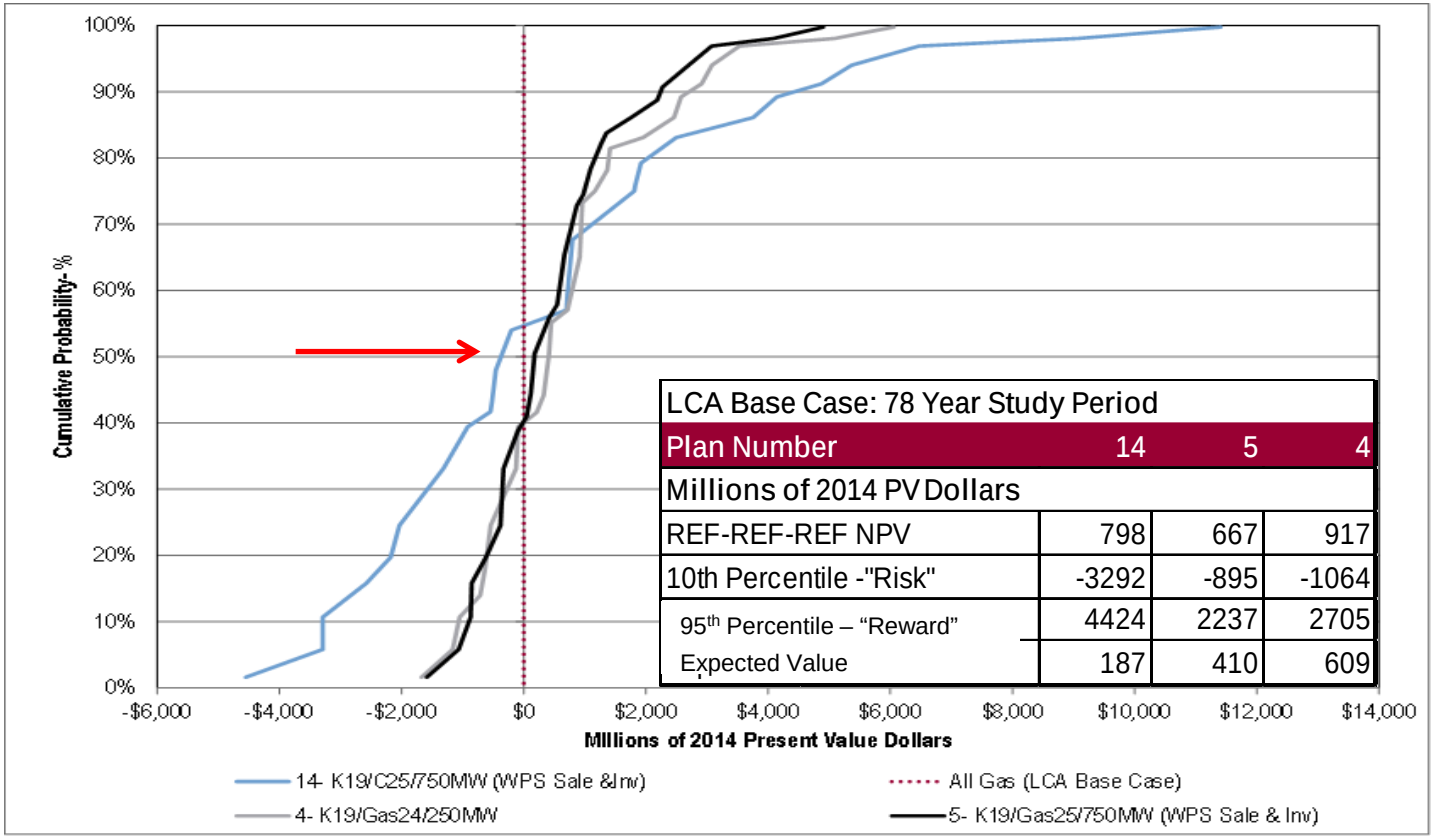
Prior Example with Updated Capital Cost (78 Yr)



LCA Base Case: 78 Year Study Period			
Plan Number	14	5	4
Millions of 2014 PV Dollars			
REF-REF-REF NPV	798	667	917
10th Percentile -"Risk"	-3292	-895	-1064
95th Percentile – "Reward"	4424	2237	2705
Expected Value	187	410	609

MH 2012 Assumptions – Updated Capital Costs – LCA Methodology

Figure 9-34: Probability Distribution of Selected Plans Compared having higher costs than the All Gas Plan after 78 Years using the LCA Methodology – Millions of 2014 Present Value Dollars (page 9A-77)
Plan 6 was not provided with Updated Capital Costs.

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Illustration of the LCA Uncertainty Analysis – Part 3

- **Sensitivity Analysis on Uncertain Parameters**
  - Continuation of PDP, Plans 4, 5, 6 Example
- **Sensitivity Analysis on Uncertain Parameters**
  - First, Discount Rates – 4.5% / 5.5% / 7.5% (MH: 3.35/5.05/6.5)
  - Second, Energy Price Probabilities – 40% /50 % /10 % (low/ref/high)
    - More weight on low case vs MH's assumptions (30/55/15)
  - Third, Capital Costs of Keeyask and Conawapa
    - Low: set to 2012 Reference Case Assumptions
    - Reference: 2012 Reference Case Assumptions +20%
    - High: 2012 High Case Assumptions +20%

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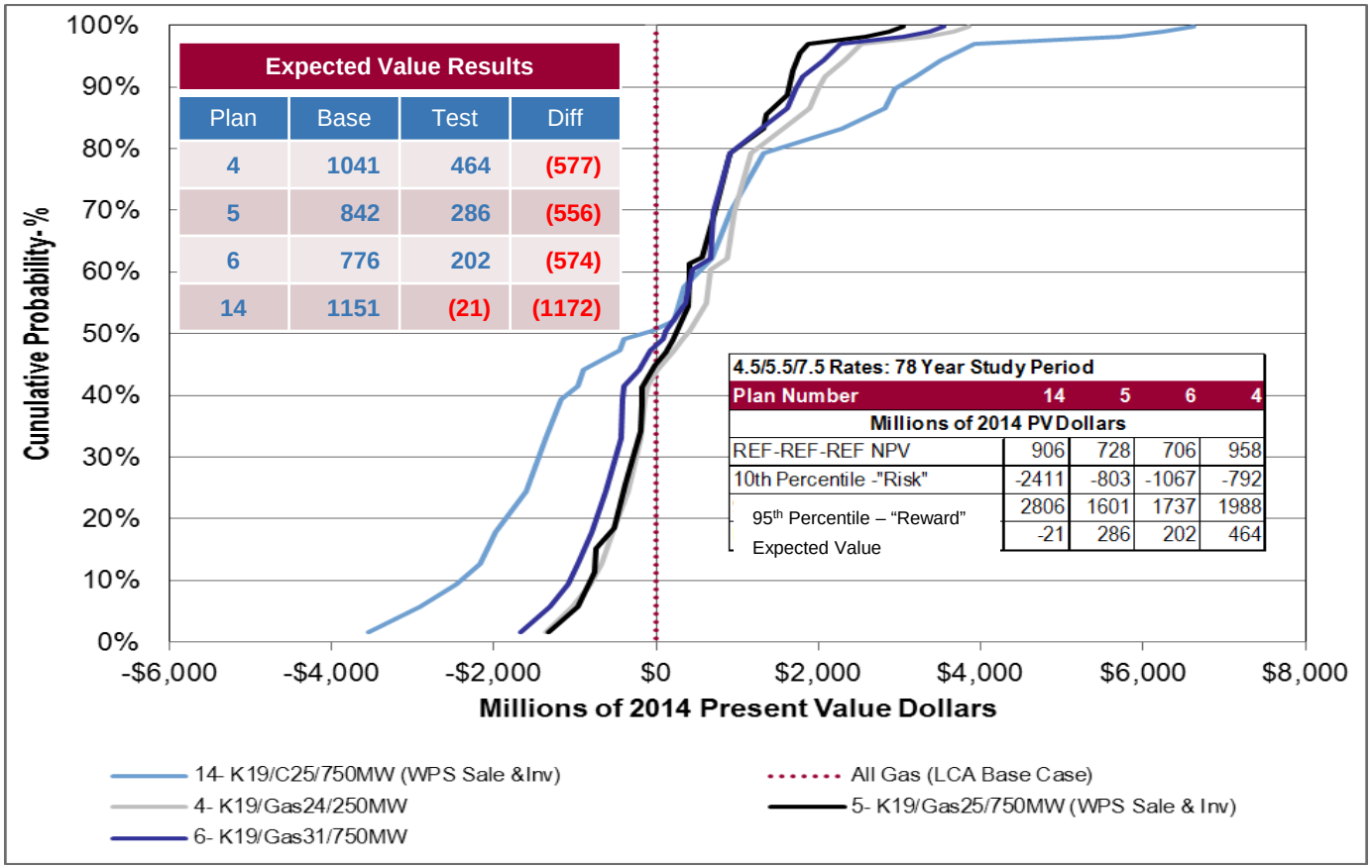
Discount Rate Sensitivity Case - 4.5 / 5.5 / 7.5



MH 2012 Assumptions – LCA Methodology

Figure 9-42: The Impact of LCA Discount Rates on the Probability Distributions of the Selected Development Plans having Higher Costs than the All Gas Plan after 78 years – Millions of 2014 Present Value Dollars; (page 9A-89). March 31, 2014 revised version of this figure.

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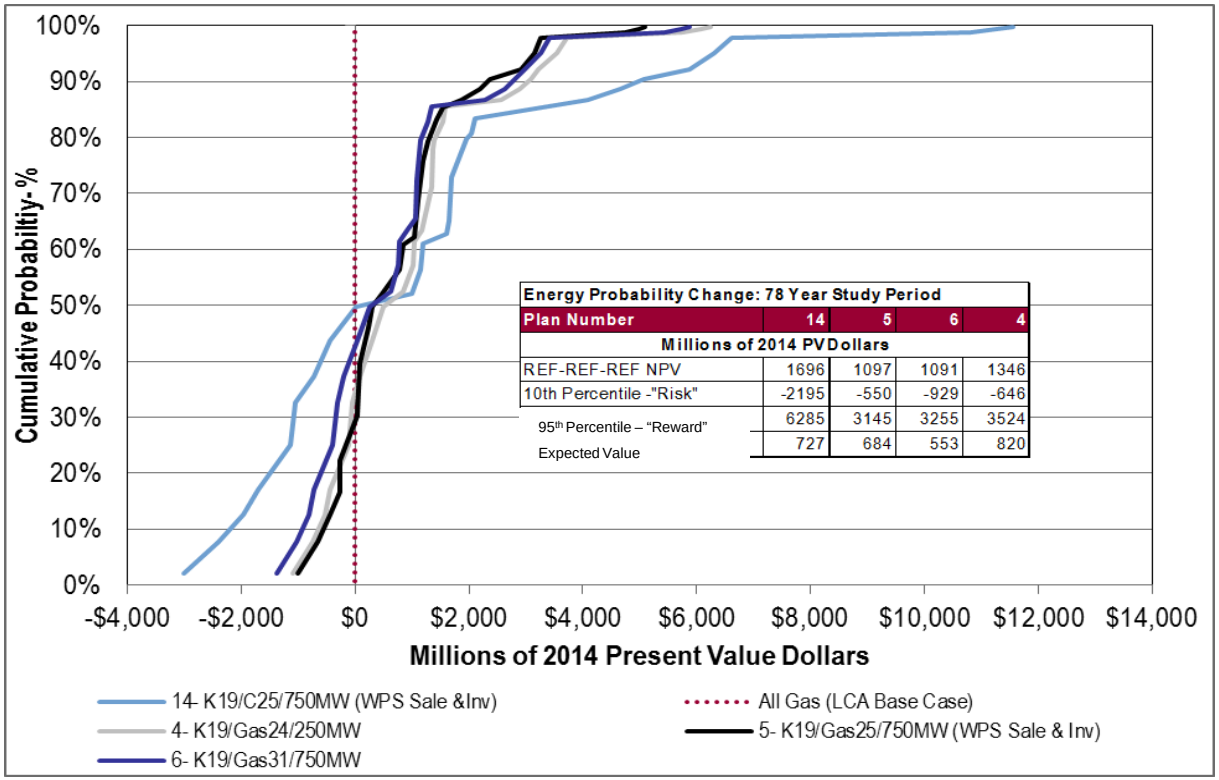
Energy Price Probabilities Sensitivity



Energy Probability Change: 78 Year Study Period				
Plan Number	14	5	6	4
Millions of 2014 PVDollars				
REF-REF-REF NPV	1696	1097	1091	1346
10th Percentile -"Risk"	-2195	-550	-929	-646
95th Percentile – "Reward"	6285	3145	3255	3524
Expected Value	727	684	553	820

Expected Value Results

Plan	Base	Test	Diff
4	1041	820	(221)
5	842	684	(158)
6	776	553	(223)
14	1151	727	(424)

Probabilities

Plan	Low	Ref	High
MH	35%	55%	15%
Test	40%	50%	10%

MH 2012 Assumptions – LCA Methodology

Figure 9-56: The Impact of the assumed change in Energy Price Probabilities on the Probability Distributions of the Selected Development Plans having Higher Costs than the All Gas Plan after 78 years – Millions of 2014 Present Value Dollars; (page 9A-106). March 31, 2014 revised version of this figure.

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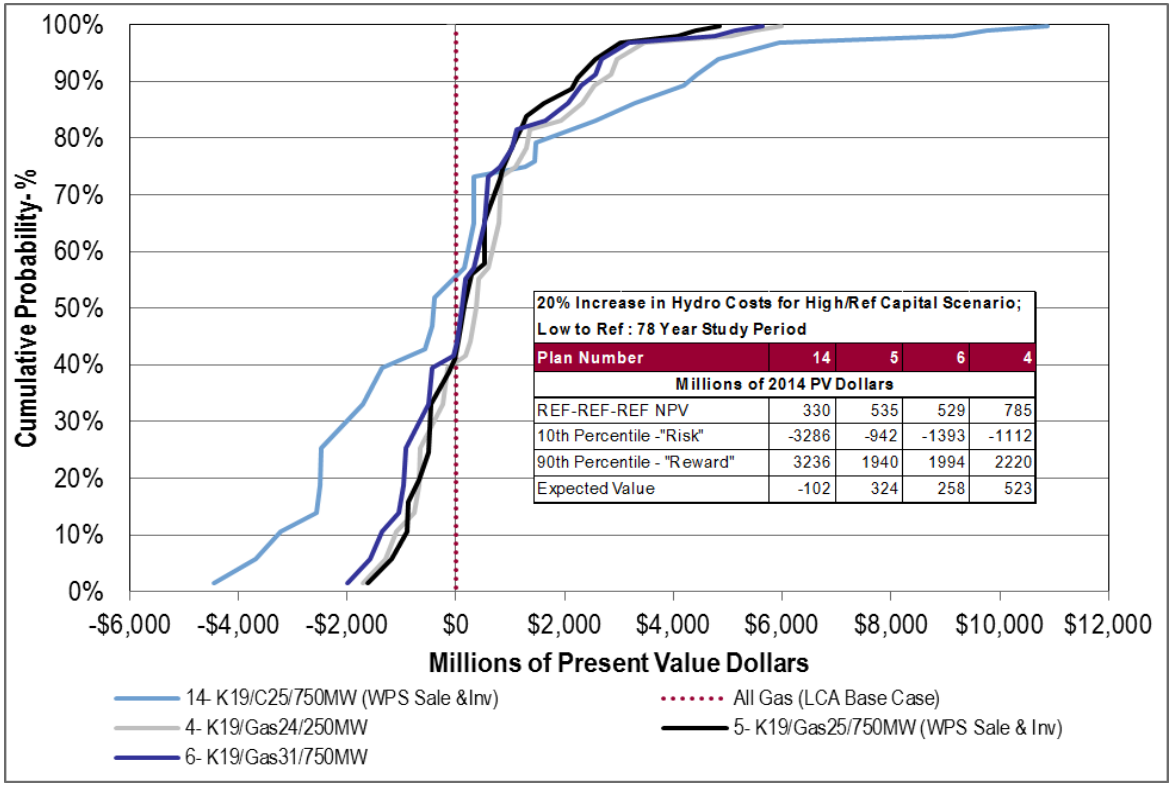
Capital Cost Sensitivity – Ref/20/20



20% Increase in Hydro Costs for High/Ref Capital Scenario; Low to Ref : 78 Year Study Period

Plan Number	14	5	6	4
Millions of 2014 PV Dollars				
REF-REF-REF NPV	330	535	529	785
10th Percentile -"Risk"	-3286	-942	-1393	-1112
90th Percentile - "Reward"	3236	1940	1994	2220
Expected Value	-102	324	258	523

Expected Value Results			
Plan	Base	Test	Diff
4	1041	523	(518)
5	842	324	(518)
6	776	258	(518)
14	1151	(102)	(1253)

MH 2012 Assumptions – LCA Methodology

Figure 9-68: The Impact of Higher Capital Costs for the Keeyask G. S. and Conawapa G. S. in all Scenarios on the Probability Distributions of Selected Development Plans having Higher Costs than the All Gas Plan after 78 years – Millions of 2014 Present Value Dollars: (page 9A-120). March 31, 2014 revised version of this figure.

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Additional Sensitivities

- **These tests are a sample of those included in the LCA Materials**
  - Technical Appendix 9A has more
  - Technical Appendix 9B includes additional sensitivities and quartile analysis
  - Supplemental filing updates many of these with updated capital cost

- **LCA Model has been provided to allow others to test sensitivities**

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Uncertainty Analysis for New Cases

- **LCA Wind Case**
  - LCA adjustments to MH Wind Case applied to All Plan 3 Scenarios
  - LCA and MH wind cases included in comparison
- **All Combined Cycle Gas (CCGT) Case**
  - Full uncertainty analysis on 2012 Assumptions run by MH
- **"No Generation" Case**
  - Full uncertainty analysis on 2012 Assumptions run by MH
- **PDP with Updated Capital Costs (all other assumptions 2012)**

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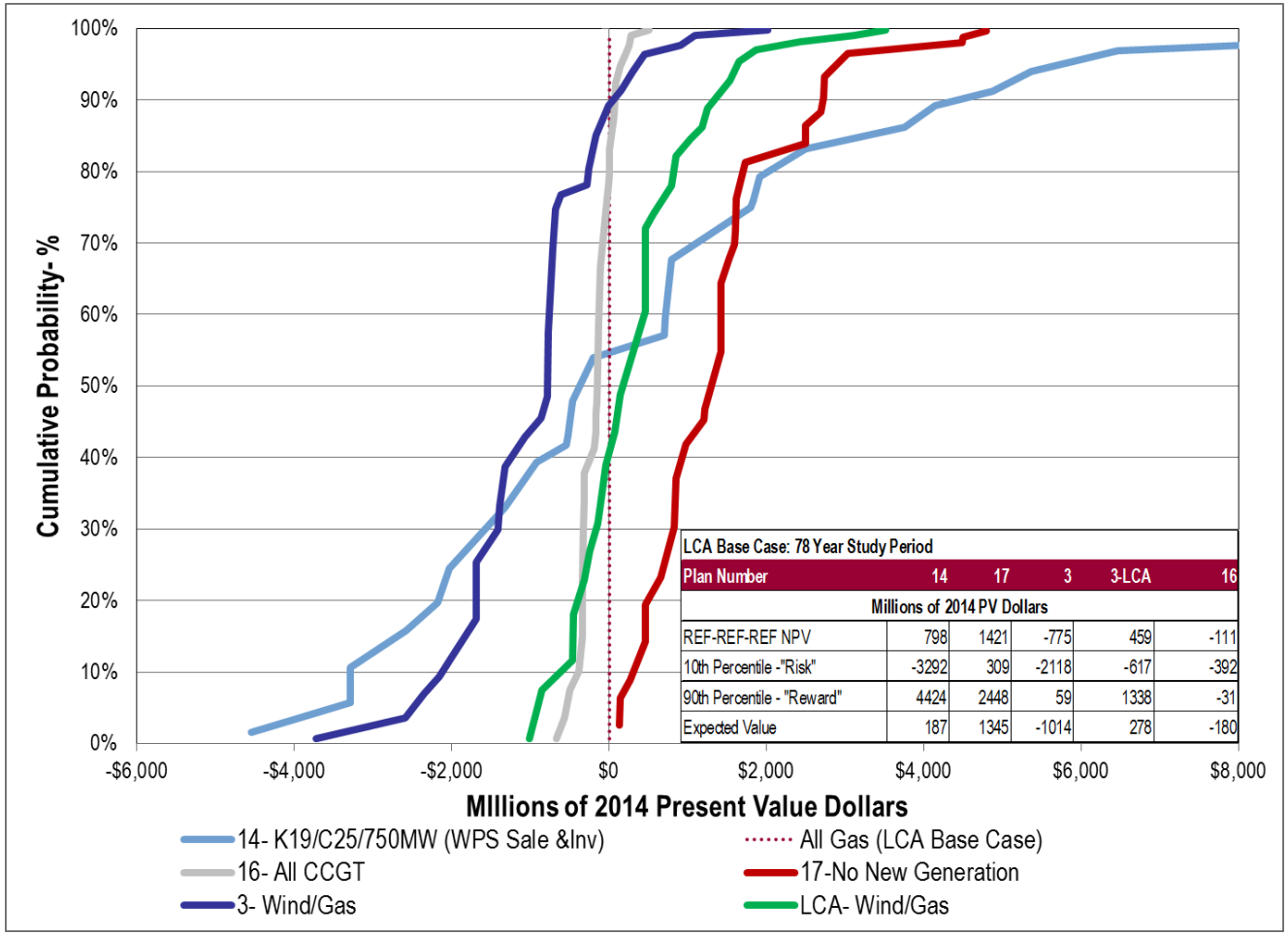
New Cases Compared to PDP and Plan 3



LCA Base Case: 78 Year Study Period

Plan Number	14	17	3	3-LCA	16
Millions of 2014 PV Dollars					
REF-REF-REF NPV	798	1421	-775	459	-111
10th Percentile -"Risk"	-3292	309	-2118	-617	-392
90th Percentile - "Reward"	4424	2448	59	1338	-31
Expected Value	187	1345	-1014	278	-180

MH 2012 Assumptions – Updated Capital Costs – LCA Methodology

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Observations from the Uncertainty Analysis

1. **The Analysis Illustrates the Range of Uncertainty**
   - Cases with Positive EV can also have high probability of negative outcome
2. **Important Add to Expected Value and Reference Case Results**
   - Uncertainty is large and differs materially among ADPs
3. **Uncertainty Analysis for Full Update to Current Information is not Complete**
   - LCA recently received information on cases with Level 2 DSM
   - Most uncertainty analysis available is based on 2012 Assumptions

V. PATHWAYS – DECISION FRAMEWORK

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Pathways – Decision Framework - Overview

1. **Pathways Concepts and Methodology**
2. **Pathway Options**
3. **Analysis of MH's Preferred Pathway**

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Pathway Concepts

- **Alternative Development Plans are Illustrative Portfolios**
  - Mixture of near term choices with longer term hypotheticals
- **MH's Pathways Concept is a Good Approach to Near Term Decisions**
  - Focus on decisions needed now on next investments/actions
  - Consider timing and extent of needs and lead time of options
- **For needs beyond those met by the options chosen, all options are open**
  - One gas/hydro/wind does not require all gas/hydro/wind.
  - Some options may be mutually exclusive or limited in time

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Pathway Methodology

- **Analysis for Path Decision to Focus on Path, not the Development Plan**
  - Comparison of alternative path options with common longer term assumptions on additional resources
- **Considerations Include:**
  - Economic comparison of alternative paths – next addition
  - Longevity of the solution, time before next additions are needed
  - Flexibility to respond to new information or changes in the markets
- **The "Learnings" Process**
  - Follow-on decisions to be made with then-current information
  - Planning for choice can be contingent on those outcomes

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MH's Pathways Today

Short List: Three Pathways

1	Gas 2023 only for domestic load	Later gas generation or hydro
2	Keeyask 2023 only for domestic load	Later gas generation or Conawapa
3	Keeyask 2019, 250 MW interconnection, MP 250 MW Sale, 125 MW NSP extension,	Later Conawapa or gas generation
4	Keeyask 2019, 750 MW Interconnection, MP 250 MW Sale, 125 MW NSP extension,	Later Conawapa or gas generation
5	Keeyask 2019, 750 MW Interconnection, MP 250 MW Sale, 125 MW NSP extension, 308 MW WPS Sale	Later Conawapa or gas generation

250 MW Interconnection now hypothetical, likely not viable

308 MW WPS now signed, clearly beneficial with 750 MW line

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Additional MH Pathway Inputs

- **Level 2 DSM for All Paths**
  - MH estimate: moves Year of Need
    - for Dependable Energy to 27/28 or later
    - For Winter Capacity to 31/32
- **No need to make a commitment to Conawapa at this time**
- **WPS 308 MW Contract Contingent on Conawapa**
  - Keeyask and 4th turbine in Conawapa CP

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Pathway Inputs – Additional Insights from Analysis

- **Transmission Value as Import and Export Enabler**
  - All plans with transmission adds show import and export value
- **Limited Economics for Advancing Hydro**
  - Defer cases show similar NPVs to Advance cases
- **Mix of resources can offer value**
  - Mixing transmission or DSM with any of the ADPs could enhance value

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Pathways

Path	First Resource	2nd Resource	Notes
1	DSM Level 2	Advance Keeyask, MP250, 750 MW Transmission	MH Path 5: Differs from MH by removing WPS 308 MW Contract
2	DSM Level 2	Keeyask 2023	MH Path 2
2a	DSM Level 2	K23/250 MW Transmission	
3	DSM Level 2	Keeyask 2028	Defer until year of need
3a	DSM Level 2	K28/250 MW Transmission	
4	DSM Level 2	New Gas Capacity 2028	No generation commitment needed now
5	DSM Level 2	750 MW Transmission	
6	DSM Level 2	250 MW Transmission	250 Import Capacity
7	DSM Level 2	Wind 2028/Gas 2030	

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Pathways Economic Analysis

- **Current Economic Analysis has Not Been Developed**

- **Indicators of Value From Work Done to Date**
  - 2012 Assumptions with Updated Capital Cost for Some Plans
  - 2013 Reference Case Updates for Some Plans
  - DSM Level 2 analysis for Some Plans (just in)
- **The Following Is a Summary of What we Do have**

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Preferred Path vs Alternative Paths

Available Information on the Pathway Plans:

- 2012 Reference Case Assumptions
- Updated Capital Costs Cases

Plans	Compared to All Gas						
	78 CPV of Total Capital	78 NPV	50 CPV	35 CPV	20 CPV	Break Even Year	Approximated 78 Year IRR
2 K22/Gas	$2,502	$489	$81	($584)	($1,781)	2059	5.9%
3 LCA Wind/Gas	$1,274	$459	$236	($41)	($422)	2049	8.2%
4 K19/Gas24/250 MW	$2,957	$917	$489	($170)	($1,493)	2050	6.4%
5 K19/Gas25/750 MW (WPS	$3,056	$667	$267	($263)	($1,720)	2053	6.0%
8 CCGT/C26	$3,489	$403	($204)	($1,091)	($2,999)	2067	5.5%
14 K19/C25/750 (WPS)	$6,899	$798	($180)	($1,653)	($4,759)	2065	5.6%

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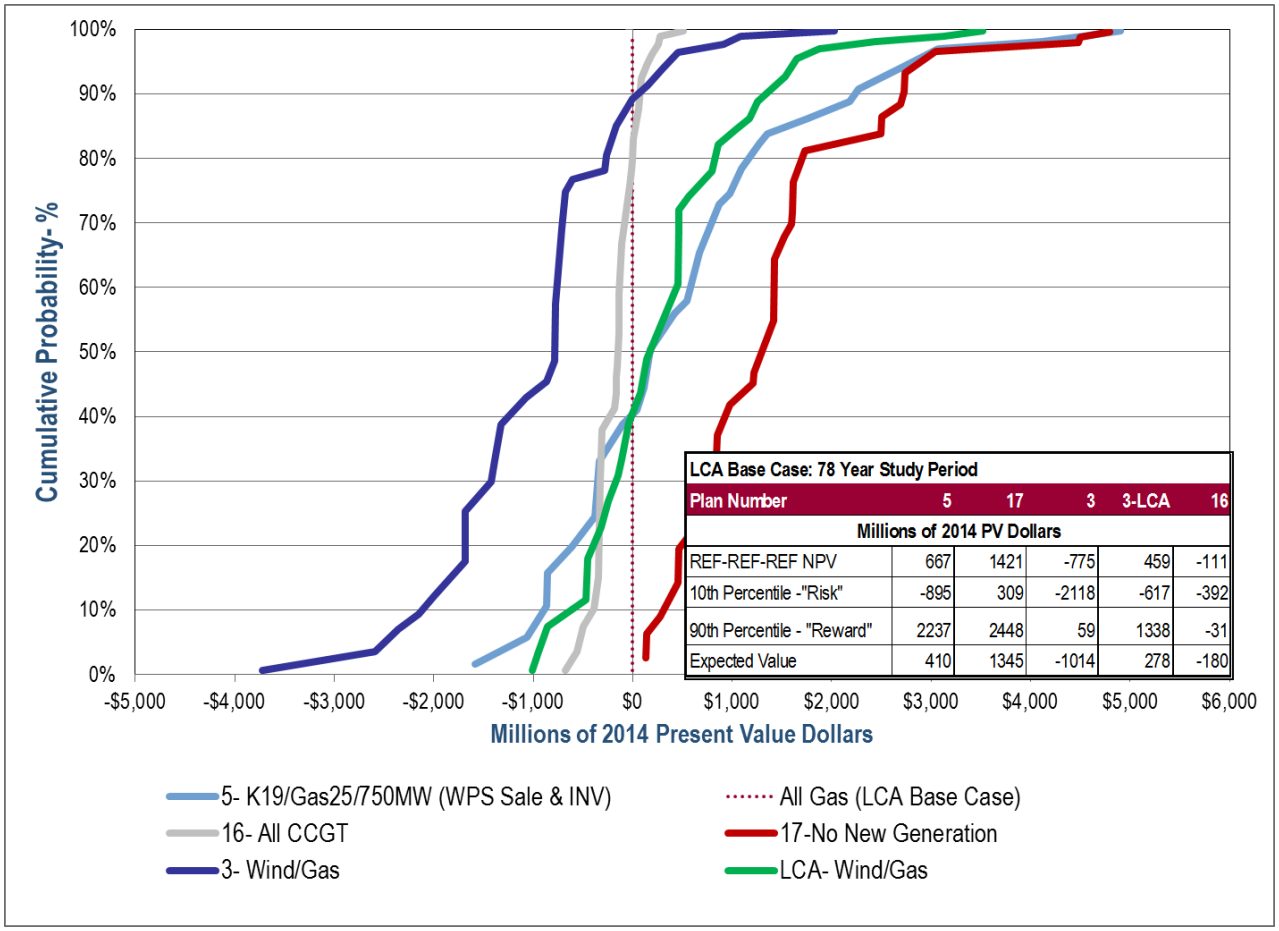
Plans 3, 5, 16 and 17



LCA Base Case: 78 Year Study Period

Plan Number	5	17	3	3-LCA	16
Millions of 2014 PV Dollars					
REF-REF-REF NPV	667	1421	-775	459	-111
10th Percentile -"Risk"	-895	309	-2118	-617	-392
90th Percentile - "Reward"	2237	2448	59	1338	-31
Expected Value	410	1345	-1014	278	-180

MH 2012 Assumptions – Updated Capital Costs – LCA Methodology

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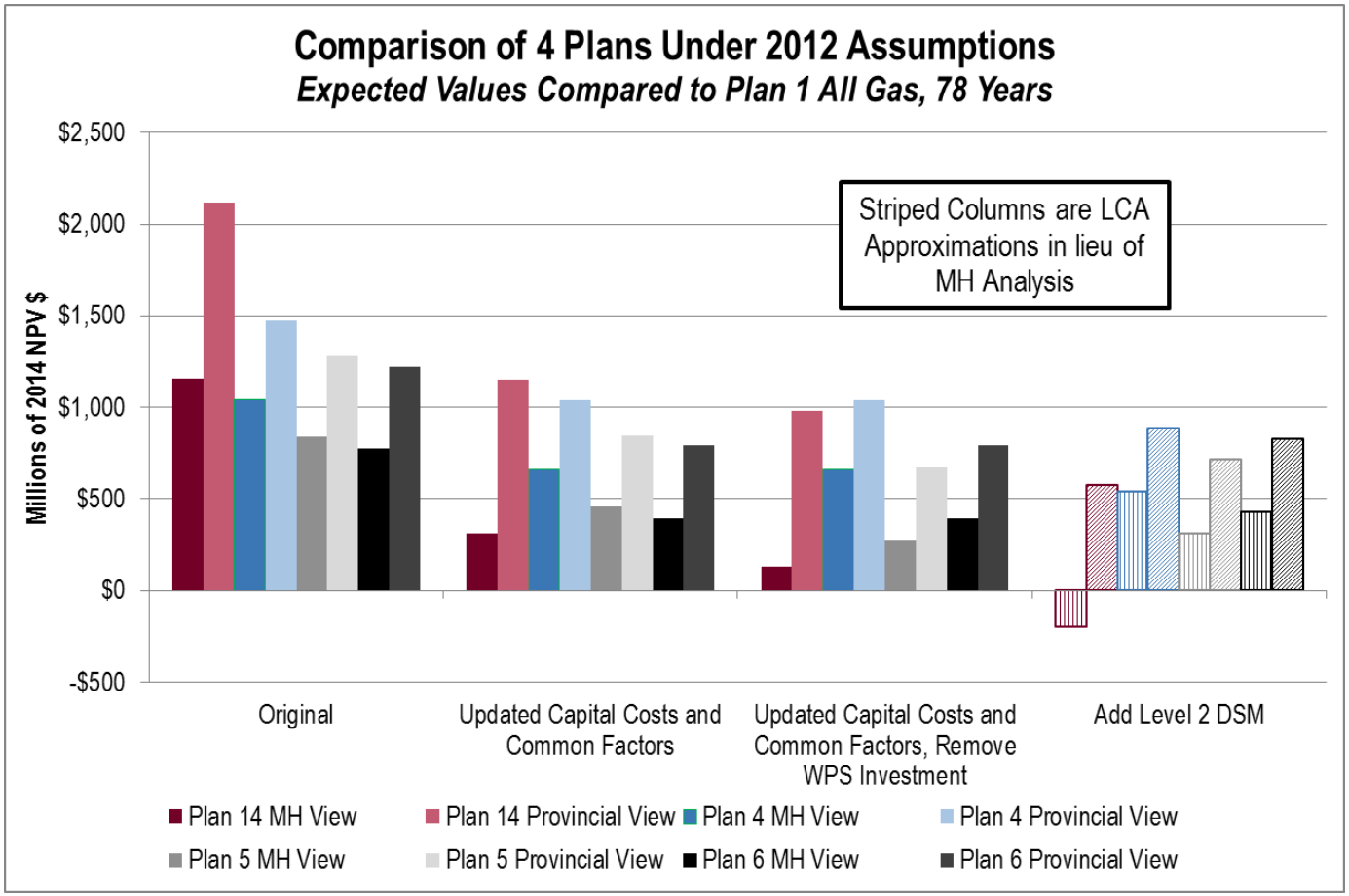
MH and Provincial Views Changes



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Observations on Pathways

1. DSM Level 2 Changes The Starting Point for All Pathways
2. Changes in the Case Materially Alter the Hydro-Based Paths
3. Several New Alternative Pathways To Consider
4. Economic Analysis Available Does not Reflect All New Information

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End of Presentation

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