**VOLUME 4**

**Index – MIPUG Book of Documents**

**Manitoba Hydro's Needs For and Alternatives To (NFAT) Review**

**March 12-13, 2014**

| Tab # | Description | Sources |
|---|---|---|
| 1 | a) Comparison of Economic Summaries between All Gas and PDP plans for the varying discount rate scenarios<br>b) Probabilistic Analysis Figures 2.7.1 and 2.7.2 | a) Manitoba Hydro NFAT Business Case Submission, Appendix 9.3: Economic Evaluation Documentation; pages 496, 499, 502, 99, 144, 189, 91, 136, 181. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/appendix_09_3_economic_evaluation_documentation.pdf<br>b) Ibid. Pages 67 and 68. |
| 2 | a) NFAT Transcript - March 3, 2014 Excerpts | a) NFAT Transcript March 3, 2014, Direct examination of Mr. Scott Thomson, pages 84-85; Cross-examination with Mr. Ed Wojcynski, pages 283-289; and Cross-examination with Mr. Ed Wojcynski, pages 313-314. Available online: http://www.pub.gov.mb.ca/nfat/pdf/hearing/march_3_2014.pdf |
| 3 | a) Manitoba Hydro Rebuttal Evidence | a) Manitoba Hydro Rebuttal Evidence, February 28 2014, page 119 of 145. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/rebuttal/nfat_rebuttal_evidence_redacted.pdf |
| 4 | a) Manitoba Hydro Exhibit #95<br>b) Appendix 9.3 on capital costs | a) Manitoba Hydro Exhibit #95, March 10, 2014, pages 20, 144, 123, 107-108, 129-130 and 147. Available Online: http://www.pub.gov.mb.ca/nfat_hearing/NFAT%20Exhibits/MH-95.pdf<br>b) Manitoba Hydro NFAT Business Case Submission, Appendix 9.3: Economic Evaluation Documentation; pages 34-35. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/appendix_09_3_economic_evaluation_documentation.pdf |

| Tab # | Description | Sources |
|---|---|---|
| 5 | a) Total Capital Cost of Plans | c) Data from Manitoba Hydro NFAT Business Case Submission, Appendix 9.3: Economic Evaluation Documentation; pages 93-137. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/appendix_09_3_economic_evaluation_documentation.pdf |
| 6 | a) MIPUG/MH I-7 | a) Manitoba Hydro NFAT Round I IRs. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/new/mipug_round_1_responses.pdf |
| 7 | a) NFAT Transcript - March 4, 2014, Excerpt on DSM Levels.<br>b) MH Rebuttal Evidence - Comparison of Energy Savings Projections by DSM Level | a) NFAT Transcript March 4, 2014, Direct examination of Mr. Lloyd Kuczyk, page 471. Available online: http://www.pub.gov.mb.ca/nfat/pdf/hearing/march_4_2014.pdf<br>c) Manitoba Hydro Rebuttal Evidence, page 29. Available Online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/rebuttal/nfat_rebuttal_evidence_redacted.pdf |
| 8 | a) MIPUG/CAC_GAC-008a on Hydro Quebec | a) MIPUG/CAC_GAC-008a from NFAT Hearing |
| 9 | a) 5 Year Drought Net Revenue Comparison for 2034/35<br>b) Variation of Flow Related to Net Income for 2013-14 and source file. | a) Data from MIPUG/MH I-007(a) from NFAT Hearing<br>b) From 2012/14 General Rate Application, MIPUG Exhibit #6: Book of Documents, Tab 28, page 535 - 537 (with data from MH Exhibit #56 from 2012/14 GRA). |
| 10 | a) NFAT Business Case Chapter 12 – DSM Sensitivity | a) NFAT Business Case Submission, Chapter 12: Economic Evaluation – 2013 Update, pages 17 and 18. Available online: http://www.hydro.mb.ca/projects/development_plan/bc_documents/nfat_business_case_chapter_12_economic_evaluation_2013_update_on_selected_development_plans.pdf |
| 11 | a) NFAT Transcript – March 10, 2014 Excerpt on economic evaluation | a) NFAT Transcript, March 10, 2014, Direct examination of Ms. Joanne Flynn, pages 1353 - 1357. Available online: http://www.pub.gov.mb.ca/nfat/pdf/hearing/march_10_2014.pdf |

| Tab # | Description | Sources |
|---|---|---|
| 12 | a) Appendix 10.5 from 2012/13 and 2013/14 GRA – Curtailable Rate Program Report – Summary of Curtailable Credit Data<br>b) Appendix 10.4 from 2012/13 and 2013/14 GRA – Curtailable Rate Program Options | a) Manitoba Hydro 2012/13 and 2013/14 General Rate Application, Appendix 10.5: Curtailable Rate Program Report April 1, 2011 to March 31, 2012. Page 3. Available online: http://www.hydro.mb.ca/regulatory_affairs/electric/gra_2012_2013/appendix_10_5.pdf<br>b) Manitoba Hydro 2012/13 and 2013/14 General Rate Application, Appendix 10.4: Curtailable Rate Program Proposed Terms and Conditions. Page 14. Available online: http://www.hydro.mb.ca/regulatory_affairs/electric/gra_2012_2013/appendix_10_4.pdf |
| 13 | a) Author's version: Forecasting Long-Run Electricity Prices | a) Author's version: Forecasting Long-Run Electricity Prices by Dr. Gregory Hamm and Dr. Adam Borison, Stratelytics. June 30, 2006. Available online: http://www.stratelytics.com/wp-content/uploads/2012/08/Long_Run_Electric_Prices_20060630-post.pdf |

# TAB 1

Needs For and Alternatives To

## APPENDIX 9.3

# Economic Evaluation Documentation

**TABLE 406**
**Comparison of Economic Summaries**
**NFAT 2012 (Present Value $2014)**

| | |
|---|---|
| **Energy Price** | **Reference** |
| **Discount Rate** | **Reference** |
| **Capital Cost** | **Reference** |

| | | | | Relative to All Gas | | |
|---|---|---|---|---|---|---|
| **Development Plan** | **Revenue** | **Cost** | **Net** | **Revenue** | **Cost** | **Net** |
| K19/C25/750MW (WPS Sale &Inv) | 6348 | 9269 | -2921 | 8872 | 7176 | 1696 |
| K19/C25/750MW | 6262 | 9452 | -3191 | 8786 | 7359 | 1427 |
| K19/Gas25/750MW (WPS Sale & INV) | 1948 | 5469 | -3521 | 4472 | 3376 | 1097 |
| K19/C31/750MW | 5116 | 8374 | -3257 | 7641 | 6281 | 1360 |
| K19/Gas31/750MW | 2011 | 5537 | -3527 | 4535 | 3445 | 1091 |
| K19/C25/250MW | 5428 | 8751 | -3323 | 7952 | 6658 | 1295 |
| K19/Gas24/250MW | 1859 | 5130 | -3271 | 4383 | 3037 | 1346 |
| K19/C31/250MW | 4493 | 7895 | -3402 | 7017 | 5802 | 1215 |
| All Gas | -2524 | 2093 | -4617 | - | - | - |
| Wind/Gas | -57 | 5336 | -5393 | 2468 | 3243 | -775 |
| K22/Gas | 855 | 4585 | -3730 | 3379 | 2492 | 887 |
| K22/C29 | 3757 | 7568 | -3811 | 6281 | 5475 | 806 |
| SCGT/C26 | 1344 | 5223 | -3879 | 3868 | 3130 | 738 |
| CCGT/C26 | 1691 | 5524 | -3834 | 4215 | 3431 | 784 |
| Wind/C26 | 2322 | 6409 | -4087 | 4847 | 4316 | 531 |

**TABLE 409**
**Comparison of Economic Summaries**
**NFAT 2012 (Present Value $2014)**

| | |
|---|---|
| **Energy Price** | **Reference** |
| **Discount Rate** | **Low** |
| **Capital Cost** | **Reference** |

| | | | | Relative to All Gas | | |
|---|---|---|---|---|---|---|
| **Development Plan** | **Revenue** | **Cost** | **Net** | **Revenue** | **Cost** | **Net** |
| K19/C25/750MW (WPS Sale &Inv) | 8397 | 10731 | -2333 | 13902 | 7599 | 6304 |
| K19/C25/750MW | 8284 | 10939 | -2654 | 13789 | 7807 | 5983 |
| K19/Gas25/750MW (WPS Sale & INV) | 1117 | 6599 | -5482 | 6622 | 3467 | 3155 |
| K19/C31/750MW | 6864 | 10066 | -3202 | 12369 | 6934 | 5435 |
| K19/Gas31/750MW | 1370 | 6740 | -5370 | 6875 | 3608 | 3267 |
| K19/C25/250MW | 7036 | 10113 | -3076 | 12541 | 6981 | 5561 |
| K19/Gas24/250MW | 1208 | 6308 | -5100 | 6713 | 3176 | 3537 |
| K19/C31/250MW | 5873 | 9484 | -3611 | 11378 | 6352 | 5026 |
| All Gas | -5505 | 3132 | -8637 | - | - | - |
| Wind/Gas | -1215 | 8204 | -9419 | 4290 | 5072 | -782 |
| K22/Gas | -4 | 5864 | -5869 | 5501 | 2732 | 2768 |
| K22/C29 | 5009 | 9188 | -4179 | 10514 | 6056 | 4458 |
| SCGT/C26 | 913 | 6383 | -5470 | 6418 | 3251 | 3167 |
| CCGT/C26 | 1495 | 6769 | -5273 | 7000 | 3637 | 3364 |
| Wind/C26 | 2511 | 8095 | -5584 | 8016 | 4963 | 3053 |

**TABLE 412**
**Comparison of Economic Summaries**
**NFAT 2012 (Present Value $2014)**

| | |
|---|---|
| **Energy Price** | **Reference** |
| **Discount Rate** | **High** |
| **Capital Cost** | **Reference** |

| | | | | Relative to All Gas | | |
|---|---|---|---|---|---|---|
| **Development Plan** | **Revenue** | **Cost** | **Net** | **Revenue** | **Cost** | **Net** |
| K19/C25/750MW (WPS Sale &Inv) | 5216 | 8453 | -3237 | 6449 | 6881 | -432 |
| K19/C25/750MW | 5147 | 8622 | -3474 | 6380 | 7049 | -669 |
| K19/Gas25/750MW (WPS Sale & INV) | 2171 | 4891 | -2720 | 3404 | 3318 | 86 |
| K19/C31/750MW | 4185 | 7406 | -3221 | 5418 | 5833 | -416 |
| K19/Gas31/750MW | 2167 | 4926 | -2758 | 3400 | 3353 | 47 |
| K19/C25/250MW | 4521 | 7994 | -3473 | 5754 | 6421 | -668 |
| K19/Gas24/250MW | 2025 | 4538 | -2513 | 3258 | 2966 | 292 |
| K19/C31/250MW | 3736 | 6983 | -3247 | 4969 | 5411 | -441 |
| All Gas | -1233 | 1572 | -2805 | - | - | - |
| Wind/Gas | 409 | 3929 | -3520 | 1642 | 2357 | -714 |
| K22/Gas | 1147 | 3913 | -2767 | 2380 | 2341 | 39 |
| K22/C29 | 3076 | 6620 | -3544 | 4309 | 5048 | -739 |
| SCGT/C26 | 1434 | 4564 | -3131 | 2667 | 2992 | -325 |
| CCGT/C26 | 1674 | 4824 | -3149 | 2907 | 3251 | -344 |
| Wind/C26 | 2121 | 5485 | -3364 | 3354 | 3913 | -558 |

All Gas

TABLE 009
ECONOMIC SUMMARY
NFAT 2012

Energy Price Reference
Discount Rate Reference
Capital Cost Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 0.00 | 62.96 | 0.00 | 0.00 | 9.87 | 0.00 | 72.82 | 0.36 | 0.00 | 312.96 | 102.97 | 19.80 | 97.89 | 92.30 |
| 2015 | 0.00 | 0.00 | 0.00 | 0.00 | 9.87 | 0.00 | 9.87 | 0.41 | 0.00 | 344.96 | 101.09 | 23.52 | 102.04 | 118.31 |
| 2016 | 0.00 | 0.00 | 0.00 | 0.00 | 9.87 | 0.00 | 9.87 | 0.46 | 0.00 | 354.71 | 99.24 | 24.61 | 104.31 | 126.54 |
| 2017 | 0.00 | 0.00 | 0.00 | 0.00 | 9.87 | 0.00 | 9.87 | 0.51 | 0.00 | 373.23 | 97.67 | 25.25 | 106.21 | 144.09 |
| 2018 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.36 | 0.51 | 0.00 | 352.87 | 94.88 | 27.63 | 108.96 | 121.39 |
| 2019 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.51 | 0.00 | 344.28 | 92.94 | 24.94 | 110.41 | 115.99 |
| 2020 | 0.00 | 0.00 | 93.03 | 0.00 | 0.00 | 0.00 | 93.03 | 0.87 | 0.00 | 379.02 | 92.87 | 19.68 | 120.21 | 146.26 |
| 2021 | 0.00 | 0.00 | 119.13 | 0.00 | 9.28 | 0.00 | 128.41 | 1.40 | 0.00 | 380.91 | 91.04 | 18.54 | 130.64 | 140.70 |
| 2022 | 0.00 | 0.00 | 14.76 | 0.00 | 0.00 | 0.00 | 14.76 | 1.47 | 3.98 | 368.47 | 88.82 | 34.56 | 132.86 | 112.23 |
| 2023 | 0.00 | 0.00 | 72.30 | 0.00 | 0.00 | 0.00 | 72.30 | 1.84 | 3.98 | 353.40 | 86.63 | 42.79 | 138.93 | 85.05 |
| 2024 | 0.00 | 0.00 | 100.82 | 0.00 | 73.08 | 0.00 | 173.89 | 2.70 | 3.98 | 345.07 | 85.17 | 48.98 | 144.05 | 66.87 |
| 2025 | 0.00 | 0.00 | 14.98 | 0.00 | 0.00 | 0.00 | 14.98 | 2.77 | 7.98 | 272.52 | 84.68 | 40.97 | 130.73 | 16.14 |
| 2026 | 0.00 | 0.00 | 73.39 | 0.00 | 0.00 | 0.00 | 73.39 | 3.14 | 7.98 | 254.50 | 83.39 | 42.05 | 133.00 | -3.94 |
| 2027 | 0.00 | 0.00 | 100.23 | 0.00 | 0.00 | 0.00 | 100.23 | 3.64 | 7.98 | 237.62 | 81.53 | 42.23 | 144.53 | -30.68 |
| 2028 | 0.00 | 0.00 | 168.00 | 0.00 | 0.00 | 0.00 | 168.00 | 4.48 | 11.97 | 220.74 | 79.62 | 64.98 | 143.50 | -67.35 |
| 2029 | 0.00 | 0.00 | 220.75 | 0.00 | 0.00 | 0.00 | 220.75 | 5.58 | 11.97 | 205.27 | 78.17 | 73.98 | 147.85 | -94.74 |
| 2030 | 0.00 | 0.00 | 98.87 | 0.00 | 9.28 | 0.00 | 108.15 | 6.12 | 11.98 | 218.15 | 79.09 | 68.55 | 144.04 | -73.53 |
| 2031 | 0.00 | 0.00 | 7.27 | 0.00 | 0.00 | 0.00 | 7.27 | 6.16 | 18.90 | 235.26 | 76.69 | 121.48 | 136.86 | -99.76 |
| 2032 | 0.00 | 0.00 | 75.62 | 0.00 | 0.00 | 0.00 | 75.62 | 6.54 | 18.90 | 215.25 | 74.79 | 134.42 | 143.44 | -137.40 |
| 2033 | 0.00 | 0.00 | 103.28 | 0.00 | 61.48 | 0.00 | 164.75 | 7.36 | 18.90 | 195.29 | 73.05 | 147.50 | 148.95 | -174.22 |
| 2034 | 0.00 | 0.00 | 173.11 | 0.00 | 0.00 | 0.00 | 173.11 | 8.23 | 22.90 | 181.44 | 71.65 | 165.86 | 152.52 | -208.59 |
| 2035 | 0.00 | 0.00 | 227.45 | 0.00 | 0.00 | 0.00 | 227.45 | 9.36 | 22.90 | 170.46 | 70.76 | 175.58 | 155.46 | -231.34 |
| 2036 | 0.00 | 0.00 | 101.87 | 0.00 | 0.00 | 0.00 | 101.87 | 9.87 | 22.90 | 168.61 | 70.71 | 170.95 | 161.51 | -234.55 |
| 2037 | 0.00 | 0.00 | 167.31 | 0.00 | 0.00 | 0.00 | 167.31 | 10.71 | 29.82 | 175.62 | 68.71 | 226.64 | 147.59 | -267.33 |
| 2038 | 0.00 | 0.00 | 230.88 | 0.00 | 0.00 | 0.00 | 230.88 | 11.86 | 29.82 | 160.56 | 67.51 | 240.37 | 153.80 | -301.12 |
| 2039 | 0.00 | 0.00 | 103.41 | 0.00 | 0.00 | 0.00 | 103.41 | 12.38 | 29.83 | 155.51 | 67.44 | 243.76 | 160.62 | -316.31 |
| 2040 | 0.00 | 0.00 | 7.60 | 0.00 | 0.00 | 0.00 | 7.60 | 12.42 | 36.75 | 165.41 | 65.53 | 295.35 | 154.33 | -349.80 |
| 2041 | 0.00 | 0.00 | 163.04 | 0.00 | 0.00 | 0.00 | 163.04 | 13.23 | 36.76 | 155.40 | 63.76 | 325.47 | 162.60 | -396.42 |
| 2042 | 0.00 | 0.00 | 235.53 | 0.00 | 0.00 | 0.00 | 235.53 | 14.41 | 36.76 | 149.69 | 62.71 | 347.32 | 168.67 | -429.01 |
| 2043 | 0.00 | 0.00 | 105.49 | 0.00 | 61.48 | 0.00 | 166.97 | 15.25 | 36.76 | 150.95 | 62.68 | 352.31 | 169.86 | -433.90 |
| 2044 | 0.00 | 0.00 | 7.76 | 0.00 | 0.00 | 0.00 | 7.76 | 15.29 | 43.68 | 159.35 | 61.13 | 402.15 | 161.82 | -465.75 |
| 2045 | 0.00 | 0.00 | 35.49 | 0.00 | 0.00 | 0.00 | 35.49 | 15.46 | 43.68 | 150.63 | 59.60 | 434.69 | 169.02 | -512.68 |
| 2046 | 0.00 | 0.00 | 48.47 | 0.00 | 0.00 | 0.00 | 48.47 | 15.71 | 43.68 | 144.88 | 58.50 | 461.23 | 174.74 | -549.58 |
| 2047 | 0.00 | 0.00 | 7.35 | 0.00 | 0.00 | 0.00 | 7.35 | 15.74 | 45.13 | 135.81 | 57.64 | 480.80 | 179.61 | -582.24 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.74 | 45.13 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 9.87 | 0.00 | 9.87 | 15.74 | 45.14 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2050 | 0.00 | 0.00 | 71.22 | 0.00 | 9.87 | 0.00 | 81.09 | 15.74 | 45.14 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2051 | 0.00 | 0.00 | 97.28 | 0.00 | 9.87 | 0.00 | 107.14 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2052 | 0.00 | 0.00 | 14.76 | 0.00 | 9.87 | 0.00 | 24.62 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2053 | 0.00 | 0.00 | 72.30 | 0.00 | 0.00 | 0.00 | 72.30 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2054 | 0.00 | 0.00 | 98.74 | 0.00 | 0.00 | 0.00 | 98.74 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2055 | 0.00 | 0.00 | 14.98 | 0.00 | 0.00 | 0.00 | 14.98 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2056 | 0.00 | 0.00 | 73.39 | 0.00 | 9.28 | 0.00 | 82.67 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2057 | 0.00 | 0.00 | 100.23 | 0.00 | 0.00 | 0.00 | 100.23 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2058 | 0.00 | 0.00 | 168.00 | 0.00 | 0.00 | 0.00 | 168.00 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2059 | 0.00 | 0.00 | 220.75 | 0.00 | 54.81 | 0.00 | 275.55 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2060 | 0.00 | 0.00 | 98.87 | 0.00 | 0.00 | 0.00 | 98.87 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2061 | 0.00 | 0.00 | 7.27 | 0.00 | 0.00 | 0.00 | 7.27 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2062 | 0.00 | 0.00 | 75.62 | 0.00 | 0.00 | 0.00 | 75.62 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2063 | 0.00 | 0.00 | 103.28 | 0.00 | 0.00 | 0.00 | 103.28 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2064 | 0.00 | 0.00 | 173.11 | 0.00 | 0.00 | 0.00 | 173.11 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2065 | 0.00 | 0.00 | 227.45 | 0.00 | 9.28 | 0.00 | 236.73 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2066 | 0.00 | 0.00 | 101.87 | 0.00 | 0.00 | 0.00 | 101.87 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2067 | 0.00 | 0.00 | 167.31 | 0.00 | 0.00 | 0.00 | 167.31 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2068 | 0.00 | 0.00 | 230.88 | 0.00 | 46.11 | 0.00 | 276.99 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2069 | 0.00 | 0.00 | 103.41 | 0.00 | 0.00 | 0.00 | 103.41 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2070 | 0.00 | 0.00 | 7.60 | 0.00 | 0.00 | 0.00 | 7.60 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2071 | 0.00 | 0.00 | 163.04 | 0.00 | 0.00 | 0.00 | 163.04 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2072 | 0.00 | 0.00 | 235.53 | 0.00 | 0.00 | 0.00 | 235.53 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2073 | 0.00 | 0.00 | 105.49 | 0.00 | 0.00 | 0.00 | 105.49 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2074 | 0.00 | 0.00 | 7.76 | 0.00 | 18.27 | 0.00 | 26.03 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2075 | 0.00 | 0.00 | 35.49 | 0.00 | 0.00 | 0.00 | 35.49 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2076 | 0.00 | 0.00 | 48.47 | 0.00 | 0.00 | 0.00 | 48.47 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2077 | 0.00 | 0.00 | 7.35 | 0.00 | 0.00 | 0.00 | 7.35 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 46.11 | 0.00 | 46.11 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2080 | 0.00 | 0.00 | 71.22 | 0.00 | 0.00 | 0.00 | 71.22 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2081 | 0.00 | 0.00 | 97.28 | 0.00 | 0.00 | 0.00 | 97.28 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2082 | 0.00 | 0.00 | 14.76 | 0.00 | 0.00 | 0.00 | 14.76 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2083 | 0.00 | 0.00 | 72.30 | 0.00 | 15.37 | 0.00 | 87.67 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2084 | 0.00 | 0.00 | 98.74 | 0.00 | 9.87 | 0.00 | 108.61 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2085 | 0.00 | 0.00 | 14.98 | 0.00 | 9.87 | 0.00 | 24.84 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2086 | 0.00 | 0.00 | 73.39 | 0.00 | 9.87 | 0.00 | 83.25 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2087 | 0.00 | 0.00 | 100.23 | 0.00 | 9.87 | 0.00 | 110.10 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2088 | 0.00 | 0.00 | 15.20 | 0.00 | 0.00 | 0.00 | 15.20 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.74 | 45.15 | 143.77 | 58.58 | 458.91 | 174.45 | -548.17 |
| Salvage Value | 0.00 | 0.00 | 41.11 | 0.00 | 2.72 | 0.00 | 43.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 5.05% | 0.00 | 62.96 | 1405.03 | 0.00 | 150.53 | 0.00 | 1618.51 | 130.92 | 343.48 | 5197.15 | 1624.63 | 3260.17 | 2836.83 | -2524.47 |

Net Present Value -4617

**All Gas**

**TABLE 054**
**ECONOMIC SUMMARY**
**NFAT 2012**

**Energy Price** Reference
**Discount Rate** Low
**Capital Cost** Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 0.00 | 61.86 | 0.00 | 0.00 | 9.69 | 0.00 | 71.56 | 0.36 | 0.00 | 307.53 | 101.19 | 19.46 | 96.20 | 90.70 |
| 2015 | 0.00 | 0.00 | 0.00 | 0.00 | 9.69 | 0.00 | 9.69 | 0.41 | 0.00 | 338.97 | 99.34 | 23.11 | 100.27 | 116.26 |
| 2016 | 0.00 | 0.00 | 0.00 | 0.00 | 9.69 | 0.00 | 9.69 | 0.45 | 0.00 | 348.56 | 97.52 | 24.18 | 102.50 | 124.35 |
| 2017 | 0.00 | 0.00 | 0.00 | 0.00 | 9.69 | 0.00 | 9.69 | 0.50 | 0.00 | 366.75 | 95.97 | 24.82 | 104.37 | 141.59 |
| 2018 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 0.35 | 0.50 | 0.00 | 346.75 | 93.24 | 27.15 | 107.07 | 119.29 |
| 2019 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 338.31 | 91.33 | 24.51 | 108.49 | 113.98 |
| 2020 | 0.00 | 0.00 | 91.42 | 0.00 | 0.00 | 0.00 | 91.42 | 0.85 | 0.00 | 372.44 | 91.26 | 19.34 | 118.12 | 143.73 |
| 2021 | 0.00 | 0.00 | 117.06 | 0.00 | 9.12 | 0.00 | 126.18 | 1.38 | 0.00 | 374.30 | 89.46 | 18.21 | 128.37 | 138.26 |
| 2022 | 0.00 | 0.00 | 14.50 | 0.00 | 0.00 | 0.00 | 14.50 | 1.45 | 3.92 | 362.08 | 87.28 | 33.96 | 130.55 | 110.29 |
| 2023 | 0.00 | 0.00 | 71.04 | 0.00 | 0.00 | 0.00 | 71.04 | 1.80 | 3.92 | 347.27 | 85.12 | 42.05 | 136.52 | 83.57 |
| 2024 | 0.00 | 0.00 | 99.07 | 0.00 | 71.81 | 0.00 | 170.88 | 2.65 | 3.92 | 339.09 | 83.70 | 48.13 | 141.55 | 65.71 |
| 2025 | 0.00 | 0.00 | 14.72 | 0.00 | 0.00 | 0.00 | 14.72 | 2.72 | 7.84 | 267.79 | 83.22 | 40.26 | 128.46 | 15.86 |
| 2026 | 0.00 | 0.00 | 72.11 | 0.00 | 0.00 | 0.00 | 72.11 | 3.08 | 7.84 | 250.09 | 81.94 | 41.32 | 130.70 | -3.87 |
| 2027 | 0.00 | 0.00 | 98.49 | 0.00 | 0.00 | 0.00 | 98.49 | 3.58 | 7.84 | 233.49 | 80.11 | 41.50 | 142.02 | -30.14 |
| 2028 | 0.00 | 0.00 | 165.09 | 0.00 | 0.00 | 0.00 | 165.09 | 4.40 | 11.76 | 216.91 | 78.24 | 63.85 | 141.01 | -66.18 |
| 2029 | 0.00 | 0.00 | 216.92 | 0.00 | 0.00 | 0.00 | 216.92 | 5.49 | 11.76 | 201.71 | 76.82 | 72.69 | 145.29 | -93.09 |
| 2030 | 0.00 | 0.00 | 97.15 | 0.00 | 9.12 | 0.00 | 106.27 | 6.02 | 11.77 | 214.36 | 77.72 | 67.36 | 141.54 | -72.26 |
| 2031 | 0.00 | 0.00 | 7.14 | 0.00 | 0.00 | 0.00 | 7.14 | 6.05 | 18.57 | 231.18 | 75.36 | 119.37 | 134.48 | -98.03 |
| 2032 | 0.00 | 0.00 | 74.30 | 0.00 | 0.00 | 0.00 | 74.30 | 6.42 | 18.58 | 211.51 | 73.49 | 132.08 | 140.95 | -135.01 |
| 2033 | 0.00 | 0.00 | 101.48 | 0.00 | 60.41 | 0.00 | 161.89 | 7.23 | 18.58 | 191.90 | 71.79 | 144.94 | 146.37 | -171.20 |
| 2034 | 0.00 | 0.00 | 170.10 | 0.00 | 0.00 | 0.00 | 170.10 | 8.08 | 22.50 | 178.29 | 70.41 | 162.98 | 149.87 | -204.97 |
| 2035 | 0.00 | 0.00 | 223.51 | 0.00 | 0.00 | 0.00 | 223.51 | 9.20 | 22.50 | 167.50 | 69.53 | 172.53 | 152.77 | -227.33 |
| 2036 | 0.00 | 0.00 | 100.10 | 0.00 | 0.00 | 0.00 | 100.10 | 9.70 | 22.50 | 165.69 | 69.48 | 167.98 | 158.71 | -230.48 |
| 2037 | 0.00 | 0.00 | 164.40 | 0.00 | 0.00 | 0.00 | 164.40 | 10.52 | 29.30 | 172.57 | 67.52 | 222.71 | 145.03 | -262.69 |
| 2038 | 0.00 | 0.00 | 226.88 | 0.00 | 0.00 | 0.00 | 226.88 | 11.66 | 29.31 | 157.78 | 66.34 | 236.20 | 151.13 | -295.89 |
| 2039 | 0.00 | 0.00 | 101.61 | 0.00 | 0.00 | 0.00 | 101.61 | 12.17 | 29.31 | 152.81 | 66.27 | 239.53 | 157.83 | -310.82 |
| 2040 | 0.00 | 0.00 | 7.47 | 0.00 | 0.00 | 0.00 | 7.47 | 12.20 | 36.11 | 162.54 | 64.39 | 290.23 | 151.66 | -343.73 |
| 2041 | 0.00 | 0.00 | 160.21 | 0.00 | 0.00 | 0.00 | 160.21 | 13.00 | 36.12 | 152.71 | 62.65 | 319.82 | 159.78 | -389.55 |
| 2042 | 0.00 | 0.00 | 231.45 | 0.00 | 0.00 | 0.00 | 231.45 | 14.16 | 36.12 | 147.09 | 61.62 | 341.29 | 165.75 | -421.57 |
| 2043 | 0.00 | 0.00 | 103.66 | 0.00 | 60.41 | 0.00 | 164.07 | 14.98 | 36.12 | 148.33 | 61.59 | 346.20 | 166.91 | -426.37 |
| 2044 | 0.00 | 0.00 | 7.62 | 0.00 | 0.00 | 0.00 | 7.62 | 15.02 | 42.93 | 156.58 | 60.07 | 395.17 | 159.01 | -457.67 |
| 2045 | 0.00 | 0.00 | 34.87 | 0.00 | 0.00 | 0.00 | 34.87 | 15.19 | 42.93 | 148.01 | 58.56 | 427.15 | 166.08 | -503.78 |
| 2046 | 0.00 | 0.00 | 47.63 | 0.00 | 0.00 | 0.00 | 47.63 | 15.43 | 42.93 | 142.37 | 57.48 | 453.23 | 171.71 | -540.05 |
| 2047 | 0.00 | 0.00 | 7.23 | 0.00 | 0.00 | 0.00 | 7.23 | 15.47 | 44.34 | 133.45 | 56.64 | 472.46 | 176.49 | -572.14 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.47 | 44.35 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 9.69 | 0.00 | 9.69 | 15.47 | 44.35 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2050 | 0.00 | 0.00 | 69.99 | 0.00 | 9.69 | 0.00 | 79.68 | 15.47 | 44.36 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2051 | 0.00 | 0.00 | 95.59 | 0.00 | 9.69 | 0.00 | 105.28 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2052 | 0.00 | 0.00 | 14.50 | 0.00 | 9.69 | 0.00 | 24.19 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2053 | 0.00 | 0.00 | 71.04 | 0.00 | 0.00 | 0.00 | 71.04 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2054 | 0.00 | 0.00 | 97.03 | 0.00 | 0.00 | 0.00 | 97.03 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2055 | 0.00 | 0.00 | 14.72 | 0.00 | 0.00 | 0.00 | 14.72 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2056 | 0.00 | 0.00 | 72.11 | 0.00 | 9.12 | 0.00 | 81.23 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2057 | 0.00 | 0.00 | 98.49 | 0.00 | 0.00 | 0.00 | 98.49 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2058 | 0.00 | 0.00 | 165.09 | 0.00 | 0.00 | 0.00 | 165.09 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2059 | 0.00 | 0.00 | 216.92 | 0.00 | 53.86 | 0.00 | 270.77 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2060 | 0.00 | 0.00 | 97.15 | 0.00 | 0.00 | 0.00 | 97.15 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2061 | 0.00 | 0.00 | 7.14 | 0.00 | 0.00 | 0.00 | 7.14 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2062 | 0.00 | 0.00 | 74.30 | 0.00 | 0.00 | 0.00 | 74.30 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2063 | 0.00 | 0.00 | 101.48 | 0.00 | 0.00 | 0.00 | 101.48 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2064 | 0.00 | 0.00 | 170.10 | 0.00 | 0.00 | 0.00 | 170.10 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2065 | 0.00 | 0.00 | 223.51 | 0.00 | 9.12 | 0.00 | 232.63 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2066 | 0.00 | 0.00 | 100.10 | 0.00 | 0.00 | 0.00 | 100.10 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2067 | 0.00 | 0.00 | 164.40 | 0.00 | 0.00 | 0.00 | 164.40 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2068 | 0.00 | 0.00 | 226.88 | 0.00 | 45.31 | 0.00 | 272.18 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2069 | 0.00 | 0.00 | 101.61 | 0.00 | 0.00 | 0.00 | 101.61 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2070 | 0.00 | 0.00 | 7.47 | 0.00 | 0.00 | 0.00 | 7.47 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2071 | 0.00 | 0.00 | 160.21 | 0.00 | 0.00 | 0.00 | 160.21 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2072 | 0.00 | 0.00 | 231.45 | 0.00 | 0.00 | 0.00 | 231.45 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2073 | 0.00 | 0.00 | 103.66 | 0.00 | 0.00 | 0.00 | 103.66 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2074 | 0.00 | 0.00 | 7.62 | 0.00 | 17.95 | 0.00 | 25.57 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2075 | 0.00 | 0.00 | 34.87 | 0.00 | 0.00 | 0.00 | 34.87 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2076 | 0.00 | 0.00 | 47.63 | 0.00 | 0.00 | 0.00 | 47.63 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2077 | 0.00 | 0.00 | 7.23 | 0.00 | 0.00 | 0.00 | 7.23 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 45.31 | 0.00 | 45.31 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2080 | 0.00 | 0.00 | 69.99 | 0.00 | 0.00 | 0.00 | 69.99 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2081 | 0.00 | 0.00 | 95.59 | 0.00 | 0.00 | 0.00 | 95.59 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2082 | 0.00 | 0.00 | 14.50 | 0.00 | 0.00 | 0.00 | 14.50 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2083 | 0.00 | 0.00 | 71.04 | 0.00 | 15.10 | 0.00 | 86.15 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2084 | 0.00 | 0.00 | 97.03 | 0.00 | 9.69 | 0.00 | 106.72 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2085 | 0.00 | 0.00 | 14.72 | 0.00 | 9.69 | 0.00 | 24.41 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2086 | 0.00 | 0.00 | 72.11 | 0.00 | 9.69 | 0.00 | 81.81 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2087 | 0.00 | 0.00 | 98.49 | 0.00 | 9.69 | 0.00 | 108.19 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2088 | 0.00 | 0.00 | 14.94 | 0.00 | 0.00 | 0.00 | 14.94 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.47 | 44.37 | 141.28 | 57.56 | 450.95 | 171.43 | -538.66 |
| Salvage Value | 0.00 | 0.00 | 98.73 | 0.00 | 9.17 | 0.00 | 107.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 3.35% | 0.00 | 61.86 | 2039.34 | 0.00 | 196.29 | 0.00 | 2297.49 | 226.03 | 608.54 | 6518.87 | 2118.84 | 5827.22 | 4077.80 | -5504.98 |

Net Present Value -8637

All Gas

TABLE 099
ECONOMIC SUMMARY
NFAT 2012

Energy Price Reference
Discount Rate High
Capital Cost Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 0.00 | 64.32 | 0.00 | 0.00 | 10.08 | 0.00 | 74.40 | 0.37 | 0.00 | 319.76 | 105.21 | 20.23 | 100.02 | 94.30 |
| 2015 | 0.00 | 0.00 | 0.00 | 0.00 | 10.08 | 0.00 | 10.08 | 0.42 | 0.00 | 352.45 | 103.29 | 24.03 | 104.25 | 120.88 |
| 2016 | 0.00 | 0.00 | 0.00 | 0.00 | 10.08 | 0.00 | 10.08 | 0.47 | 0.00 | 362.42 | 101.40 | 25.15 | 106.58 | 129.29 |
| 2017 | 0.00 | 0.00 | 0.00 | 0.00 | 10.08 | 0.00 | 10.08 | 0.52 | 0.00 | 381.33 | 99.79 | 25.80 | 108.52 | 147.22 |
| 2018 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.37 | 0.52 | 0.00 | 360.54 | 96.94 | 28.23 | 111.33 | 124.03 |
| 2019 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.52 | 0.00 | 351.76 | 94.96 | 25.49 | 112.81 | 118.51 |
| 2020 | 0.00 | 0.00 | 95.05 | 0.00 | 0.00 | 0.00 | 95.05 | 0.89 | 0.00 | 387.25 | 94.88 | 20.11 | 122.82 | 149.44 |
| 2021 | 0.00 | 0.00 | 121.71 | 0.00 | 9.48 | 0.00 | 131.20 | 1.43 | 0.00 | 389.18 | 93.02 | 18.94 | 133.47 | 143.75 |
| 2022 | 0.00 | 0.00 | 15.08 | 0.00 | 0.00 | 0.00 | 15.08 | 1.51 | 4.07 | 376.47 | 90.75 | 35.31 | 135.74 | 114.67 |
| 2023 | 0.00 | 0.00 | 73.87 | 0.00 | 0.00 | 0.00 | 73.87 | 1.88 | 4.07 | 361.08 | 88.51 | 43.72 | 141.95 | 86.90 |
| 2024 | 0.00 | 0.00 | 103.01 | 0.00 | 74.66 | 0.00 | 177.67 | 2.75 | 4.07 | 352.57 | 87.02 | 50.05 | 147.18 | 68.32 |
| 2025 | 0.00 | 0.00 | 15.30 | 0.00 | 0.00 | 0.00 | 15.30 | 2.83 | 8.16 | 278.44 | 86.52 | 41.86 | 133.57 | 16.49 |
| 2026 | 0.00 | 0.00 | 74.98 | 0.00 | 0.00 | 0.00 | 74.98 | 3.21 | 8.16 | 260.03 | 85.20 | 42.96 | 135.89 | -4.02 |
| 2027 | 0.00 | 0.00 | 102.41 | 0.00 | 0.00 | 0.00 | 102.41 | 3.72 | 8.16 | 242.78 | 83.30 | 43.15 | 147.67 | -31.34 |
| 2028 | 0.00 | 0.00 | 171.65 | 0.00 | 0.00 | 0.00 | 171.65 | 4.58 | 12.23 | 225.54 | 81.35 | 66.39 | 146.62 | -68.82 |
| 2029 | 0.00 | 0.00 | 225.54 | 0.00 | 0.00 | 0.00 | 225.54 | 5.70 | 12.23 | 209.73 | 79.87 | 75.59 | 151.06 | -96.79 |
| 2030 | 0.00 | 0.00 | 101.02 | 0.00 | 9.48 | 0.00 | 110.50 | 6.26 | 12.24 | 222.88 | 80.81 | 70.04 | 147.17 | -75.13 |
| 2031 | 0.00 | 0.00 | 7.43 | 0.00 | 0.00 | 0.00 | 7.43 | 6.29 | 19.31 | 240.37 | 78.35 | 124.12 | 139.83 | -101.93 |
| 2032 | 0.00 | 0.00 | 77.26 | 0.00 | 0.00 | 0.00 | 77.26 | 6.68 | 19.32 | 219.92 | 76.41 | 137.34 | 146.56 | -140.38 |
| 2033 | 0.00 | 0.00 | 105.52 | 0.00 | 62.81 | 0.00 | 168.33 | 7.52 | 19.32 | 199.53 | 74.64 | 150.70 | 152.19 | -178.00 |
| 2034 | 0.00 | 0.00 | 176.87 | 0.00 | 0.00 | 0.00 | 176.87 | 8.41 | 23.40 | 185.38 | 73.21 | 169.46 | 155.83 | -213.12 |
| 2035 | 0.00 | 0.00 | 232.39 | 0.00 | 0.00 | 0.00 | 232.39 | 9.57 | 23.40 | 174.16 | 72.30 | 179.39 | 158.84 | -236.37 |
| 2036 | 0.00 | 0.00 | 104.08 | 0.00 | 0.00 | 0.00 | 104.08 | 10.09 | 23.40 | 172.27 | 72.24 | 174.66 | 165.02 | -239.65 |
| 2037 | 0.00 | 0.00 | 170.94 | 0.00 | 0.00 | 0.00 | 170.94 | 10.94 | 30.46 | 179.44 | 70.21 | 231.56 | 150.80 | -273.13 |
| 2038 | 0.00 | 0.00 | 235.90 | 0.00 | 0.00 | 0.00 | 235.90 | 12.12 | 30.47 | 164.05 | 68.98 | 245.59 | 157.14 | -307.66 |
| 2039 | 0.00 | 0.00 | 105.65 | 0.00 | 0.00 | 0.00 | 105.65 | 12.65 | 30.48 | 158.88 | 68.90 | 249.06 | 164.10 | -323.18 |
| 2040 | 0.00 | 0.00 | 7.77 | 0.00 | 0.00 | 0.00 | 7.77 | 12.69 | 37.55 | 169.01 | 66.95 | 301.77 | 157.69 | -357.40 |
| 2041 | 0.00 | 0.00 | 166.58 | 0.00 | 0.00 | 0.00 | 166.58 | 13.52 | 37.55 | 158.78 | 65.15 | 332.54 | 166.13 | -405.04 |
| 2042 | 0.00 | 0.00 | 240.65 | 0.00 | 0.00 | 0.00 | 240.65 | 14.73 | 37.55 | 152.94 | 64.07 | 354.86 | 172.34 | -438.33 |
| 2043 | 0.00 | 0.00 | 107.78 | 0.00 | 62.81 | 0.00 | 170.60 | 15.58 | 37.55 | 154.23 | 64.04 | 359.96 | 173.55 | -443.33 |
| 2044 | 0.00 | 0.00 | 7.93 | 0.00 | 0.00 | 0.00 | 7.93 | 15.62 | 44.63 | 162.81 | 62.46 | 410.88 | 165.34 | -475.87 |
| 2045 | 0.00 | 0.00 | 36.26 | 0.00 | 0.00 | 0.00 | 36.26 | 15.80 | 44.63 | 153.90 | 60.89 | 444.13 | 172.69 | -523.81 |
| 2046 | 0.00 | 0.00 | 49.52 | 0.00 | 0.00 | 0.00 | 49.52 | 16.05 | 44.63 | 148.03 | 59.77 | 471.25 | 178.53 | -561.52 |
| 2047 | 0.00 | 0.00 | 7.51 | 0.00 | 0.00 | 0.00 | 7.51 | 16.08 | 46.11 | 138.76 | 58.90 | 491.24 | 183.51 | -594.89 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.08 | 46.11 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 10.08 | 0.00 | 10.08 | 16.08 | 46.12 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2050 | 0.00 | 0.00 | 72.77 | 0.00 | 10.08 | 0.00 | 82.85 | 16.08 | 46.12 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2051 | 0.00 | 0.00 | 99.39 | 0.00 | 10.08 | 0.00 | 109.47 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2052 | 0.00 | 0.00 | 15.08 | 0.00 | 10.08 | 0.00 | 25.16 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2053 | 0.00 | 0.00 | 73.87 | 0.00 | 0.00 | 0.00 | 73.87 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2054 | 0.00 | 0.00 | 100.89 | 0.00 | 0.00 | 0.00 | 100.89 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2055 | 0.00 | 0.00 | 15.30 | 0.00 | 0.00 | 0.00 | 15.30 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2056 | 0.00 | 0.00 | 74.98 | 0.00 | 9.48 | 0.00 | 84.46 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2057 | 0.00 | 0.00 | 102.41 | 0.00 | 0.00 | 0.00 | 102.41 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2058 | 0.00 | 0.00 | 171.65 | 0.00 | 0.00 | 0.00 | 171.65 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2059 | 0.00 | 0.00 | 225.54 | 0.00 | 56.00 | 0.00 | 281.54 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2060 | 0.00 | 0.00 | 101.02 | 0.00 | 0.00 | 0.00 | 101.02 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2061 | 0.00 | 0.00 | 7.43 | 0.00 | 0.00 | 0.00 | 7.43 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2062 | 0.00 | 0.00 | 77.26 | 0.00 | 0.00 | 0.00 | 77.26 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2063 | 0.00 | 0.00 | 105.52 | 0.00 | 0.00 | 0.00 | 105.52 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2064 | 0.00 | 0.00 | 176.87 | 0.00 | 0.00 | 0.00 | 176.87 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2065 | 0.00 | 0.00 | 232.39 | 0.00 | 9.48 | 0.00 | 241.88 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2066 | 0.00 | 0.00 | 104.08 | 0.00 | 0.00 | 0.00 | 104.08 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2067 | 0.00 | 0.00 | 170.94 | 0.00 | 0.00 | 0.00 | 170.94 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2068 | 0.00 | 0.00 | 235.90 | 0.00 | 47.11 | 0.00 | 283.01 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2069 | 0.00 | 0.00 | 105.65 | 0.00 | 0.00 | 0.00 | 105.65 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2070 | 0.00 | 0.00 | 7.77 | 0.00 | 0.00 | 0.00 | 7.77 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2071 | 0.00 | 0.00 | 166.58 | 0.00 | 0.00 | 0.00 | 166.58 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2072 | 0.00 | 0.00 | 240.65 | 0.00 | 0.00 | 0.00 | 240.65 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2073 | 0.00 | 0.00 | 107.78 | 0.00 | 0.00 | 0.00 | 107.78 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2074 | 0.00 | 0.00 | 7.93 | 0.00 | 18.67 | 0.00 | 26.59 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2075 | 0.00 | 0.00 | 36.26 | 0.00 | 0.00 | 0.00 | 36.26 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2076 | 0.00 | 0.00 | 49.52 | 0.00 | 0.00 | 0.00 | 49.52 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2077 | 0.00 | 0.00 | 7.51 | 0.00 | 0.00 | 0.00 | 7.51 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 47.11 | 0.00 | 47.11 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2080 | 0.00 | 0.00 | 72.77 | 0.00 | 0.00 | 0.00 | 72.77 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2081 | 0.00 | 0.00 | 99.39 | 0.00 | 0.00 | 0.00 | 99.39 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2082 | 0.00 | 0.00 | 15.08 | 0.00 | 0.00 | 0.00 | 15.08 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2083 | 0.00 | 0.00 | 73.87 | 0.00 | 15.70 | 0.00 | 89.57 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2084 | 0.00 | 0.00 | 100.89 | 0.00 | 10.08 | 0.00 | 110.97 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2085 | 0.00 | 0.00 | 15.30 | 0.00 | 10.08 | 0.00 | 25.38 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2086 | 0.00 | 0.00 | 74.98 | 0.00 | 10.08 | 0.00 | 85.06 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2087 | 0.00 | 0.00 | 102.41 | 0.00 | 10.08 | 0.00 | 112.49 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2088 | 0.00 | 0.00 | 15.54 | 0.00 | 0.00 | 0.00 | 15.54 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.08 | 46.13 | 146.89 | 59.85 | 468.88 | 178.24 | -560.08 |
| Salvage Value | 0.00 | 0.00 | 25.89 | 0.00 | 0.99 | 0.00 | 26.88 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 6.50% | 0.00 | 64.32 | 1069.44 | 0.00 | 126.11 | 0.00 | 1259.87 | 87.87 | 224.68 | 4511.07 | 1374.75 | 2130.65 | 2238.71 | -1233.05 |

Net Present Value -2805

**K19/C25/750MW (WPS Sale &Inv)**

**TABLE 001**
**ECONOMIC SUMMARY**
**NFAT 2012**

**Energy Price** Reference
**Discount Rate** Reference
**Capital Cost** Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 31.71 | 221.41 | 0.00 | 0.00 | 21.01 | 3.78 | 277.90 | 1.39 | 0.00 | 311.23 | 102.98 | 19.82 | 98.34 | 90.08 |
| 2015 | 87.48 | 485.83 | 0.00 | 0.00 | 18.92 | 6.75 | 598.98 | 4.38 | 0.00 | 341.10 | 101.10 | 23.49 | 102.11 | 114.39 |
| 2016 | 182.24 | 643.32 | 0.00 | 0.00 | 25.89 | 17.15 | 868.60 | 8.73 | 0.00 | 351.61 | 99.26 | 24.63 | 104.47 | 123.24 |
| 2017 | 212.03 | 779.65 | 0.00 | 0.00 | 37.88 | 24.95 | 1054.51 | 14.00 | 0.00 | 367.37 | 97.30 | 26.31 | 107.43 | 136.33 |
| 2018 | 254.86 | 549.74 | 0.00 | 0.00 | 39.82 | 103.34 | 947.77 | 18.74 | 0.00 | 351.91 | 95.21 | 26.94 | 108.58 | 121.18 |
| 2019 | 260.97 | 393.19 | 0.00 | 0.00 | 50.71 | 85.16 | 790.03 | 22.69 | 13.01 | 378.89 | 95.14 | 25.52 | 108.28 | 149.94 |
| 2020 | 719.36 | 160.55 | 0.00 | 0.00 | 3.54 | 157.85 | 1041.30 | 27.90 | 44.86 | 617.12 | 102.28 | 20.22 | 123.67 | 370.96 |
| 2021 | 1154.84 | 55.71 | 0.00 | 0.00 | 42.90 | 0.00 | 1253.46 | 34.16 | 42.99 | 697.22 | 102.84 | 22.23 | 133.26 | 438.89 |
| 2022 | 1036.87 | 0.00 | 0.00 | 0.00 | 22.26 | 0.00 | 1059.12 | 39.46 | 41.65 | 694.56 | 101.65 | 22.24 | 135.74 | 434.92 |
| 2023 | 740.43 | 0.00 | 0.00 | 0.00 | 37.45 | 0.00 | 777.88 | 43.35 | 39.80 | 664.06 | 99.33 | 22.12 | 139.94 | 402.68 |
| 2024 | 512.79 | 0.00 | 0.00 | 0.00 | 64.84 | 0.00 | 577.64 | 46.24 | 38.24 | 641.23 | 97.13 | 24.58 | 145.52 | 374.00 |
| 2025 | 336.82 | 0.00 | 0.00 | 0.00 | 86.88 | 0.00 | 423.70 | 48.35 | 50.89 | 661.04 | 101.75 | 21.82 | 113.58 | 423.89 |
| 2026 | 124.05 | 0.00 | 0.00 | 0.00 | 102.39 | 0.00 | 226.44 | 49.49 | 49.35 | 862.16 | 109.86 | 21.76 | 114.33 | 616.22 |
| 2027 | 39.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 39.15 | 49.68 | 47.92 | 899.07 | 109.90 | 21.29 | 125.05 | 642.84 |
| 2028 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 46.91 | 889.29 | 108.23 | 22.00 | 128.24 | 630.82 |
| 2029 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 48.20 | 868.89 | 106.31 | 22.04 | 131.31 | 609.24 |
| 2030 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 43.02 | 859.25 | 104.97 | 21.57 | 133.01 | 599.70 |
| 2031 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 41.70 | 846.94 | 103.31 | 22.04 | 136.64 | 584.95 |
| 2032 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 40.22 | 828.23 | 101.62 | 22.09 | 139.90 | 564.62 |
| 2033 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 39.21 | 804.17 | 99.84 | 22.11 | 143.08 | 539.15 |
| 2034 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 38.27 | 781.53 | 98.11 | 22.27 | 147.20 | 513.94 |
| 2035 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 39.54 | 741.75 | 96.43 | 22.07 | 143.82 | 479.43 |
| 2036 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 36.10 | 672.95 | 94.82 | 22.47 | 128.55 | 427.11 |
| 2037 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.36 | 49.68 | 35.57 | 640.80 | 93.20 | 22.58 | 129.84 | 395.19 |
| 2038 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 49.68 | 35.06 | 615.74 | 91.55 | 22.53 | 134.49 | 367.17 |
| 2039 | 0.00 | 0.00 | 100.11 | 0.00 | 0.00 | 0.00 | 100.11 | 50.07 | 37.47 | 592.43 | 89.94 | 22.48 | 146.19 | 333.82 |
| 2040 | 0.00 | 0.00 | 128.75 | 0.00 | 9.28 | 0.00 | 138.03 | 50.66 | 34.09 | 589.00 | 88.66 | 21.37 | 156.31 | 322.66 |
| 2041 | 0.00 | 0.00 | 16.22 | 0.00 | 0.00 | 0.00 | 16.22 | 50.74 | 36.95 | 570.11 | 86.66 | 38.13 | 158.02 | 287.31 |
| 2042 | 0.00 | 0.00 | 79.53 | 0.00 | 0.00 | 0.00 | 79.53 | 51.13 | 36.51 | 555.62 | 85.12 | 42.52 | 164.06 | 263.91 |
| 2043 | 0.00 | 0.00 | 108.56 | 0.00 | 9.28 | 0.00 | 117.84 | 51.72 | 36.07 | 545.01 | 83.76 | 44.88 | 172.02 | 244.36 |
| 2044 | 0.00 | 0.00 | 96.75 | 0.00 | 0.00 | 0.00 | 96.75 | 52.21 | 41.37 | 541.23 | 82.55 | 51.48 | 180.82 | 226.39 |
| 2045 | 0.00 | 0.00 | 111.72 | 0.00 | 73.08 | 0.00 | 184.80 | 53.12 | 43.86 | 516.67 | 80.70 | 66.61 | 181.87 | 187.49 |
| 2046 | 0.00 | 0.00 | 16.63 | 0.00 | 0.00 | 0.00 | 16.63 | 53.20 | 44.56 | 505.17 | 79.26 | 80.82 | 187.57 | 157.51 |
| 2047 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 43.31 | 491.59 | 77.99 | 84.47 | 196.24 | 132.89 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 42.07 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 10.59 | 0.68 | 11.28 | 53.20 | 44.61 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2050 | 0.00 | 0.00 | 0.00 | 0.00 | 10.27 | 1.37 | 11.64 | 53.20 | 43.11 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2051 | 0.00 | 0.00 | 0.00 | 0.00 | 24.85 | 4.11 | 28.96 | 53.20 | 42.78 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2052 | 0.00 | 0.00 | 0.00 | 0.00 | 28.87 | 6.16 | 35.03 | 53.20 | 42.46 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2053 | 0.00 | 0.00 | 0.00 | 0.00 | 20.54 | 18.49 | 39.04 | 53.20 | 42.15 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2054 | 0.00 | 0.00 | 0.00 | 0.00 | 17.63 | 18.49 | 36.12 | 53.20 | 41.84 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2055 | 0.00 | 0.00 | 0.00 | 0.00 | 0.87 | 19.18 | 20.05 | 53.20 | 42.71 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2056 | 0.00 | 0.00 | 0.00 | 0.00 | 10.47 | 0.00 | 10.47 | 53.20 | 55.02 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2057 | 0.00 | 0.00 | 0.00 | 0.00 | 5.23 | 0.00 | 5.23 | 53.20 | 39.25 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2058 | 0.00 | 0.00 | 0.00 | 0.00 | 8.72 | 0.00 | 8.72 | 53.20 | 54.48 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2059 | 0.00 | 0.00 | 0.00 | 0.00 | 14.83 | 0.00 | 14.83 | 53.20 | 41.62 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2060 | 0.00 | 0.00 | 0.00 | 0.00 | 20.93 | 0.00 | 20.93 | 53.20 | 51.26 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2061 | 0.00 | 0.00 | 0.00 | 0.00 | 25.29 | 0.00 | 25.29 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2062 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 66.75 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2063 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2064 | 0.00 | 0.00 | 0.00 | 0.00 | 10.42 | 2.09 | 12.50 | 53.20 | 66.75 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2065 | 0.00 | 0.00 | 0.00 | 0.00 | 8.65 | 4.18 | 12.82 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2066 | 0.00 | 0.00 | 0.00 | 0.00 | 1.04 | 12.53 | 13.57 | 53.20 | 66.75 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2067 | 0.00 | 0.00 | 0.00 | 0.00 | 9.01 | 18.79 | 27.80 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2068 | 0.00 | 0.00 | 0.00 | 0.00 | 19.28 | 56.37 | 75.65 | 53.20 | 66.75 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2069 | 0.00 | 0.00 | 78.30 | 0.00 | 33.08 | 56.37 | 167.75 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2070 | 0.00 | 0.00 | 106.94 | 0.00 | 2.67 | 58.46 | 168.07 | 53.20 | 53.00 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2071 | 0.00 | 0.00 | 16.22 | 0.00 | 32.44 | 0.00 | 48.66 | 53.20 | 37.50 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2072 | 0.00 | 0.00 | 79.48 | 0.00 | 17.02 | 0.00 | 96.51 | 53.20 | 53.00 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2073 | 0.00 | 0.00 | 108.56 | 0.00 | 28.73 | 0.00 | 137.28 | 53.20 | 36.63 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2074 | 0.00 | 0.00 | 96.75 | 0.00 | 50.02 | 0.00 | 146.76 | 53.20 | 51.26 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2075 | 0.00 | 0.00 | 109.64 | 0.00 | 75.23 | 0.00 | 184.87 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2076 | 0.00 | 0.00 | 16.63 | 0.00 | 77.10 | 0.00 | 93.73 | 53.20 | 53.00 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2077 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 37.50 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 9.28 | 0.00 | 9.28 | 53.20 | 53.00 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 40.40 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2080 | 0.00 | 0.00 | 0.00 | 0.00 | 54.81 | 0.00 | 54.81 | 53.20 | 53.00 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2081 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2082 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2083 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2084 | 0.00 | 0.00 | 0.00 | 0.00 | 10.59 | 0.68 | 11.28 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2085 | 0.00 | 0.00 | 0.00 | 0.00 | 10.27 | 1.37 | 11.64 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2086 | 0.00 | 0.00 | 0.00 | 0.00 | 24.85 | 4.11 | 28.96 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2087 | 0.00 | 0.00 | 0.00 | 0.00 | 28.87 | 6.16 | 35.03 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2088 | 0.00 | 0.00 | 0.00 | 0.00 | 20.54 | 18.49 | 39.04 | 53.20 | 35.76 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 16.76 | 18.49 | 35.25 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 19.18 | 19.18 | 53.20 | 38.66 | 504.47 | 79.32 | 77.30 | 188.56 | 159.30 |
| Salvage Value | 2.31 | 0.00 | 6.54 | 0.00 | 10.30 | 4.78 | 23.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 5.05% | 4000.14 | 2857.05 | 193.35 | 0.00 | 449.81 | 337.17 | 7837.52 | 779.59 | 651.85 | 11808.35 | 1938.98 | 705.38 | 2816.45 | 6347.54 |

Net Present Value -2921

**K19/C25/750MW (WPS Sale &Inv)**

**TABLE 046**
**ECONOMIC SUMMARY**
**NFAT 2012**

**Energy Price** Reference
**Discount Rate** Low
**Capital Cost** Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 31.16 | 217.56 | 0.00 | 0.00 | 20.64 | 3.71 | 273.08 | 1.37 | 0.00 | 305.83 | 101.20 | 19.48 | 96.63 | 88.52 |
| 2015 | 85.96 | 477.40 | 0.00 | 0.00 | 18.59 | 6.63 | 588.59 | 4.31 | 0.00 | 335.18 | 99.35 | 23.08 | 100.34 | 112.41 |
| 2016 | 179.08 | 632.15 | 0.00 | 0.00 | 25.44 | 16.86 | 853.53 | 8.58 | 0.00 | 345.50 | 97.54 | 24.20 | 102.65 | 121.10 |
| 2017 | 208.35 | 766.12 | 0.00 | 0.00 | 37.23 | 24.52 | 1036.22 | 13.76 | 0.00 | 360.99 | 95.61 | 25.86 | 105.56 | 133.96 |
| 2018 | 250.44 | 540.20 | 0.00 | 0.00 | 39.13 | 101.55 | 931.32 | 18.41 | 0.00 | 345.80 | 93.56 | 26.47 | 106.70 | 119.07 |
| 2019 | 256.44 | 386.37 | 0.00 | 0.00 | 49.83 | 83.68 | 776.33 | 22.30 | 12.78 | 372.31 | 93.49 | 25.08 | 106.40 | 147.34 |
| 2020 | 706.88 | 157.77 | 0.00 | 0.00 | 3.48 | 155.11 | 1023.24 | 27.41 | 44.08 | 606.42 | 100.50 | 19.87 | 121.52 | 364.53 |
| 2021 | 1134.80 | 54.75 | 0.00 | 0.00 | 42.16 | 0.00 | 1231.71 | 33.57 | 42.24 | 685.12 | 101.05 | 21.85 | 130.95 | 431.27 |
| 2022 | 1018.88 | 0.00 | 0.00 | 0.00 | 21.87 | 0.00 | 1040.75 | 38.77 | 40.92 | 682.51 | 99.89 | 21.86 | 133.39 | 427.37 |
| 2023 | 727.59 | 0.00 | 0.00 | 0.00 | 36.80 | 0.00 | 764.39 | 42.60 | 39.11 | 652.54 | 97.60 | 21.73 | 137.51 | 395.69 |
| 2024 | 503.90 | 0.00 | 0.00 | 0.00 | 63.72 | 0.00 | 567.62 | 45.43 | 37.57 | 630.10 | 95.44 | 24.15 | 142.99 | 367.52 |
| 2025 | 330.97 | 0.00 | 0.00 | 0.00 | 85.37 | 0.00 | 416.35 | 47.52 | 50.01 | 649.57 | 99.98 | 21.44 | 111.61 | 416.54 |
| 2026 | 121.90 | 0.00 | 0.00 | 0.00 | 100.61 | 0.00 | 222.51 | 48.63 | 48.49 | 847.21 | 107.95 | 21.38 | 112.35 | 605.53 |
| 2027 | 38.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38.47 | 48.82 | 47.09 | 883.47 | 107.99 | 20.92 | 122.88 | 631.68 |
| 2028 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 46.10 | 873.86 | 106.35 | 21.62 | 126.01 | 619.88 |
| 2029 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 47.36 | 853.82 | 104.46 | 21.65 | 129.03 | 598.67 |
| 2030 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 42.28 | 844.34 | 103.14 | 21.19 | 130.71 | 589.29 |
| 2031 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 40.98 | 832.25 | 101.52 | 21.65 | 134.27 | 574.80 |
| 2032 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 39.52 | 813.86 | 99.86 | 21.70 | 137.47 | 554.82 |
| 2033 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 38.53 | 790.22 | 98.10 | 21.72 | 140.59 | 529.79 |
| 2034 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 37.61 | 767.97 | 96.41 | 21.89 | 144.64 | 505.03 |
| 2035 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 38.86 | 728.88 | 94.76 | 21.68 | 141.33 | 471.11 |
| 2036 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 35.47 | 661.27 | 93.17 | 22.08 | 126.32 | 419.70 |
| 2037 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 0.35 | 48.82 | 34.96 | 629.68 | 91.58 | 22.18 | 127.58 | 388.33 |
| 2038 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 48.82 | 34.46 | 605.06 | 89.96 | 22.14 | 132.15 | 360.80 |
| 2039 | 0.00 | 0.00 | 98.37 | 0.00 | 0.00 | 0.00 | 98.37 | 49.21 | 36.82 | 582.15 | 88.38 | 22.09 | 143.66 | 328.03 |
| 2040 | 0.00 | 0.00 | 126.52 | 0.00 | 9.12 | 0.00 | 135.64 | 49.78 | 33.50 | 578.78 | 87.12 | 21.00 | 153.59 | 317.07 |
| 2041 | 0.00 | 0.00 | 15.94 | 0.00 | 0.00 | 0.00 | 15.94 | 49.86 | 36.31 | 560.22 | 85.15 | 37.47 | 155.28 | 282.32 |
| 2042 | 0.00 | 0.00 | 78.15 | 0.00 | 0.00 | 0.00 | 78.15 | 50.25 | 35.87 | 545.98 | 83.64 | 41.79 | 161.22 | 259.33 |
| 2043 | 0.00 | 0.00 | 106.67 | 0.00 | 9.12 | 0.00 | 115.79 | 50.83 | 35.44 | 535.56 | 82.31 | 44.10 | 169.03 | 240.12 |
| 2044 | 0.00 | 0.00 | 95.07 | 0.00 | 0.00 | 0.00 | 95.07 | 51.30 | 40.65 | 531.84 | 81.11 | 50.58 | 177.69 | 222.46 |
| 2045 | 0.00 | 0.00 | 109.78 | 0.00 | 71.81 | 0.00 | 181.59 | 52.20 | 43.10 | 507.70 | 79.30 | 65.45 | 178.72 | 184.24 |
| 2046 | 0.00 | 0.00 | 16.34 | 0.00 | 0.00 | 0.00 | 16.34 | 52.28 | 43.79 | 496.40 | 77.89 | 79.42 | 184.32 | 154.78 |
| 2047 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 42.56 | 483.06 | 76.63 | 83.00 | 192.84 | 130.58 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 41.34 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 10.41 | 0.67 | 11.08 | 52.28 | 43.83 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2050 | 0.00 | 0.00 | 0.00 | 0.00 | 10.09 | 1.35 | 11.44 | 52.28 | 42.36 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2051 | 0.00 | 0.00 | 0.00 | 0.00 | 24.42 | 4.04 | 28.46 | 52.28 | 42.03 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2052 | 0.00 | 0.00 | 0.00 | 0.00 | 28.37 | 6.06 | 34.42 | 52.28 | 41.72 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2053 | 0.00 | 0.00 | 0.00 | 0.00 | 20.19 | 18.17 | 38.36 | 52.28 | 41.42 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2054 | 0.00 | 0.00 | 0.00 | 0.00 | 17.32 | 18.17 | 35.50 | 52.28 | 41.12 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2055 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 18.85 | 19.70 | 52.28 | 41.96 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2056 | 0.00 | 0.00 | 0.00 | 0.00 | 10.28 | 0.00 | 10.28 | 52.28 | 54.06 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2057 | 0.00 | 0.00 | 0.00 | 0.00 | 5.14 | 0.00 | 5.14 | 52.28 | 38.57 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2058 | 0.00 | 0.00 | 0.00 | 0.00 | 8.57 | 0.00 | 8.57 | 52.28 | 53.53 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2059 | 0.00 | 0.00 | 0.00 | 0.00 | 14.57 | 0.00 | 14.57 | 52.28 | 40.90 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2060 | 0.00 | 0.00 | 0.00 | 0.00 | 20.57 | 0.00 | 20.57 | 52.28 | 50.37 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2061 | 0.00 | 0.00 | 0.00 | 0.00 | 24.85 | 0.00 | 24.85 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2062 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 65.59 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2063 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2064 | 0.00 | 0.00 | 0.00 | 0.00 | 10.23 | 2.05 | 12.29 | 52.28 | 65.59 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2065 | 0.00 | 0.00 | 0.00 | 0.00 | 8.50 | 4.10 | 12.60 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2066 | 0.00 | 0.00 | 0.00 | 0.00 | 1.02 | 12.31 | 13.33 | 52.28 | 65.59 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2067 | 0.00 | 0.00 | 0.00 | 0.00 | 8.86 | 18.46 | 27.32 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2068 | 0.00 | 0.00 | 0.00 | 0.00 | 18.95 | 55.39 | 74.34 | 52.28 | 65.59 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2069 | 0.00 | 0.00 | 76.94 | 0.00 | 32.51 | 55.39 | 164.84 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2070 | 0.00 | 0.00 | 105.09 | 0.00 | 2.62 | 57.44 | 165.15 | 52.28 | 52.08 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2071 | 0.00 | 0.00 | 15.94 | 0.00 | 31.87 | 0.00 | 47.82 | 52.28 | 36.85 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2072 | 0.00 | 0.00 | 78.10 | 0.00 | 16.73 | 0.00 | 94.83 | 52.28 | 52.08 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2073 | 0.00 | 0.00 | 106.67 | 0.00 | 28.23 | 0.00 | 134.90 | 52.28 | 36.00 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2074 | 0.00 | 0.00 | 95.07 | 0.00 | 49.15 | 0.00 | 144.22 | 52.28 | 50.37 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2075 | 0.00 | 0.00 | 107.74 | 0.00 | 73.92 | 0.00 | 181.66 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2076 | 0.00 | 0.00 | 16.34 | 0.00 | 75.76 | 0.00 | 92.10 | 52.28 | 52.08 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2077 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 36.85 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 9.12 | 0.00 | 9.12 | 52.28 | 52.08 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 39.70 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2080 | 0.00 | 0.00 | 0.00 | 0.00 | 53.86 | 0.00 | 53.86 | 52.28 | 52.08 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2081 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2082 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2083 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2084 | 0.00 | 0.00 | 0.00 | 0.00 | 10.41 | 0.67 | 11.08 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2085 | 0.00 | 0.00 | 0.00 | 0.00 | 10.09 | 1.35 | 11.44 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2086 | 0.00 | 0.00 | 0.00 | 0.00 | 24.42 | 4.04 | 28.46 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2087 | 0.00 | 0.00 | 0.00 | 0.00 | 28.37 | 6.06 | 34.42 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2088 | 0.00 | 0.00 | 0.00 | 0.00 | 20.19 | 18.17 | 38.36 | 52.28 | 35.14 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 16.47 | 18.17 | 34.64 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.85 | 18.85 | 52.28 | 37.99 | 495.72 | 77.94 | 75.96 | 185.29 | 156.53 |
| Salvage Value | 7.48 | 0.00 | 21.73 | 0.00 | 34.06 | 15.84 | 79.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 3.35% | 4404.95 | 2939.45 | 322.69 | 0.00 | 545.81 | 377.72 | 8590.62 | 1165.64 | 974.39 | 16221.18 | 2594.75 | 1132.54 | 4096.71 | 8397.18 |

Net Present Value -2333

**K19/C25/750MW (WPS Sale &Inv)**

**TABLE 091**
**ECONOMIC SUMMARY**
**NFAT 2012**

**Energy Price** Reference
**Discount Rate** High
**Capital Cost** Reference

| | Capital and Related Costs (Millions of 2014$) | | | | | | | | | Net Average Flow Related Revenue (Millions of 2014$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conawapa | Keeyask | Thermal | Wind | Transmission | | Total | Capital | Fixed | Gross | Water | Thermal | Power | Net |
| FYB | GS | GS | GS | GS | GOT | US T/L | Capital | Taxes | O&M | Revenue | Rental | Burn | Purchases | Revenue |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2014 | 32.40 | 226.22 | 0.00 | 0.00 | 21.46 | 3.86 | 283.93 | 1.42 | 0.00 | 317.99 | 105.22 | 20.25 | 100.48 | 92.04 |
| 2015 | 89.38 | 496.39 | 0.00 | 0.00 | 19.33 | 6.90 | 611.99 | 4.48 | 0.00 | 348.51 | 103.30 | 24.00 | 104.33 | 116.88 |
| 2016 | 186.20 | 657.29 | 0.00 | 0.00 | 26.45 | 17.53 | 887.47 | 8.92 | 0.00 | 359.24 | 101.42 | 25.17 | 106.74 | 125.92 |
| 2017 | 216.63 | 796.58 | 0.00 | 0.00 | 38.71 | 25.50 | 1077.42 | 14.30 | 0.00 | 375.35 | 99.42 | 26.89 | 109.76 | 139.29 |
| 2018 | 260.39 | 561.68 | 0.00 | 0.00 | 40.69 | 105.59 | 968.35 | 19.15 | 0.00 | 359.55 | 97.28 | 27.52 | 110.94 | 123.81 |
| 2019 | 266.64 | 401.73 | 0.00 | 0.00 | 51.81 | 87.01 | 807.19 | 23.18 | 13.29 | 387.12 | 97.21 | 26.08 | 110.63 | 153.20 |
| 2020 | 734.99 | 164.04 | 0.00 | 0.00 | 3.62 | 161.28 | 1063.92 | 28.50 | 45.83 | 630.53 | 104.50 | 20.66 | 126.35 | 379.02 |
| 2021 | 1179.93 | 56.92 | 0.00 | 0.00 | 43.84 | 0.00 | 1280.69 | 34.90 | 43.92 | 712.36 | 105.07 | 22.72 | 136.16 | 448.42 |
| 2022 | 1059.39 | 0.00 | 0.00 | 0.00 | 22.74 | 0.00 | 1082.13 | 40.32 | 42.55 | 709.65 | 103.86 | 22.73 | 138.69 | 444.37 |
| 2023 | 756.52 | 0.00 | 0.00 | 0.00 | 38.26 | 0.00 | 794.78 | 44.29 | 40.67 | 678.49 | 101.48 | 22.60 | 142.98 | 411.42 |
| 2024 | 523.93 | 0.00 | 0.00 | 0.00 | 66.25 | 0.00 | 590.19 | 47.24 | 39.07 | 655.15 | 99.24 | 25.11 | 148.68 | 382.13 |
| 2025 | 344.13 | 0.00 | 0.00 | 0.00 | 88.77 | 0.00 | 432.90 | 49.40 | 52.00 | 675.40 | 103.96 | 22.29 | 116.05 | 433.10 |
| 2026 | 126.75 | 0.00 | 0.00 | 0.00 | 104.61 | 0.00 | 231.36 | 50.56 | 50.42 | 880.89 | 112.24 | 22.23 | 116.82 | 629.61 |
| 2027 | 40.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 40.00 | 50.76 | 48.96 | 918.60 | 112.29 | 21.75 | 127.77 | 656.80 |
| 2028 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 47.93 | 908.61 | 110.58 | 22.48 | 131.02 | 644.52 |
| 2029 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 49.25 | 887.77 | 108.61 | 22.51 | 134.16 | 622.48 |
| 2030 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 43.96 | 877.91 | 107.25 | 22.04 | 135.90 | 612.73 |
| 2031 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 42.61 | 865.34 | 105.56 | 22.51 | 139.61 | 597.66 |
| 2032 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 41.09 | 846.22 | 103.83 | 22.57 | 142.94 | 576.89 |
| 2033 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 40.06 | 821.64 | 102.00 | 22.59 | 146.18 | 550.86 |
| 2034 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 39.10 | 798.51 | 100.24 | 22.76 | 150.40 | 525.11 |
| 2035 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 40.40 | 757.86 | 98.52 | 22.55 | 146.95 | 489.84 |
| 2036 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 36.88 | 687.57 | 96.88 | 22.96 | 131.34 | 436.39 |
| 2037 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.37 | 50.76 | 36.35 | 654.72 | 95.22 | 23.07 | 132.66 | 403.77 |
| 2038 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.76 | 35.83 | 629.12 | 93.54 | 23.02 | 137.41 | 375.15 |
| 2039 | 0.00 | 0.00 | 102.29 | 0.00 | 0.00 | 0.00 | 102.29 | 51.16 | 38.28 | 605.30 | 91.89 | 22.97 | 149.37 | 341.07 |
| 2040 | 0.00 | 0.00 | 131.55 | 0.00 | 9.48 | 0.00 | 141.03 | 51.76 | 34.83 | 601.80 | 90.59 | 21.84 | 159.70 | 329.67 |
| 2041 | 0.00 | 0.00 | 16.58 | 0.00 | 0.00 | 0.00 | 16.58 | 51.84 | 37.76 | 582.50 | 88.54 | 38.96 | 161.45 | 293.55 |
| 2042 | 0.00 | 0.00 | 81.26 | 0.00 | 0.00 | 0.00 | 81.26 | 52.24 | 37.30 | 567.69 | 86.97 | 43.45 | 167.63 | 269.64 |
| 2043 | 0.00 | 0.00 | 110.91 | 0.00 | 9.48 | 0.00 | 120.40 | 52.85 | 36.85 | 556.85 | 85.58 | 45.86 | 175.75 | 249.66 |
| 2044 | 0.00 | 0.00 | 98.85 | 0.00 | 0.00 | 0.00 | 98.85 | 53.34 | 42.27 | 552.99 | 84.34 | 52.59 | 184.75 | 231.31 |
| 2045 | 0.00 | 0.00 | 114.15 | 0.00 | 74.66 | 0.00 | 188.81 | 54.27 | 44.81 | 527.89 | 82.45 | 68.05 | 185.82 | 191.56 |
| 2046 | 0.00 | 0.00 | 16.99 | 0.00 | 0.00 | 0.00 | 16.99 | 54.36 | 45.53 | 516.14 | 80.99 | 82.58 | 191.65 | 160.93 |
| 2047 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 44.25 | 502.27 | 79.68 | 86.30 | 200.51 | 135.78 |
| 2048 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 42.98 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2049 | 0.00 | 0.00 | 0.00 | 0.00 | 10.82 | 0.70 | 11.52 | 54.36 | 45.58 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2050 | 0.00 | 0.00 | 0.00 | 0.00 | 10.50 | 1.40 | 11.90 | 54.36 | 44.04 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2051 | 0.00 | 0.00 | 0.00 | 0.00 | 25.39 | 4.20 | 29.59 | 54.36 | 43.70 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2052 | 0.00 | 0.00 | 0.00 | 0.00 | 29.50 | 6.30 | 35.79 | 54.36 | 43.38 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2053 | 0.00 | 0.00 | 0.00 | 0.00 | 20.99 | 18.89 | 39.88 | 54.36 | 43.06 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2054 | 0.00 | 0.00 | 0.00 | 0.00 | 18.01 | 18.89 | 36.91 | 54.36 | 42.75 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2055 | 0.00 | 0.00 | 0.00 | 0.00 | 0.89 | 19.59 | 20.49 | 54.36 | 43.63 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2056 | 0.00 | 0.00 | 0.00 | 0.00 | 10.69 | 0.00 | 10.69 | 54.36 | 56.21 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2057 | 0.00 | 0.00 | 0.00 | 0.00 | 5.35 | 0.00 | 5.35 | 54.36 | 40.10 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2058 | 0.00 | 0.00 | 0.00 | 0.00 | 8.91 | 0.00 | 8.91 | 54.36 | 55.66 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2059 | 0.00 | 0.00 | 0.00 | 0.00 | 15.15 | 0.00 | 15.15 | 54.36 | 42.53 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2060 | 0.00 | 0.00 | 0.00 | 0.00 | 21.39 | 0.00 | 21.39 | 54.36 | 52.37 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2061 | 0.00 | 0.00 | 0.00 | 0.00 | 25.84 | 0.00 | 25.84 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2062 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 68.20 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2063 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2064 | 0.00 | 0.00 | 0.00 | 0.00 | 10.64 | 2.13 | 12.77 | 54.36 | 68.20 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2065 | 0.00 | 0.00 | 0.00 | 0.00 | 8.83 | 4.27 | 13.10 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2066 | 0.00 | 0.00 | 0.00 | 0.00 | 1.06 | 12.80 | 13.86 | 54.36 | 68.20 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2067 | 0.00 | 0.00 | 0.00 | 0.00 | 9.21 | 19.20 | 28.41 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2068 | 0.00 | 0.00 | 0.00 | 0.00 | 19.70 | 57.59 | 77.29 | 54.36 | 68.20 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2069 | 0.00 | 0.00 | 80.00 | 0.00 | 33.80 | 57.59 | 171.40 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2070 | 0.00 | 0.00 | 109.27 | 0.00 | 2.73 | 59.73 | 171.72 | 54.36 | 54.15 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2071 | 0.00 | 0.00 | 16.58 | 0.00 | 33.14 | 0.00 | 49.72 | 54.36 | 38.32 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2072 | 0.00 | 0.00 | 81.21 | 0.00 | 17.39 | 0.00 | 98.60 | 54.36 | 54.15 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2073 | 0.00 | 0.00 | 110.91 | 0.00 | 29.35 | 0.00 | 140.27 | 54.36 | 37.43 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2074 | 0.00 | 0.00 | 98.85 | 0.00 | 51.10 | 0.00 | 149.95 | 54.36 | 52.37 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2075 | 0.00 | 0.00 | 112.03 | 0.00 | 76.86 | 0.00 | 188.89 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2076 | 0.00 | 0.00 | 16.99 | 0.00 | 78.77 | 0.00 | 95.77 | 54.36 | 54.15 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2077 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 38.32 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2078 | 0.00 | 0.00 | 0.00 | 0.00 | 9.48 | 0.00 | 9.48 | 54.36 | 54.15 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2079 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 41.28 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2080 | 0.00 | 0.00 | 0.00 | 0.00 | 56.00 | 0.00 | 56.00 | 54.36 | 54.15 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2081 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2082 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2083 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2084 | 0.00 | 0.00 | 0.00 | 0.00 | 10.82 | 0.70 | 11.52 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2085 | 0.00 | 0.00 | 0.00 | 0.00 | 10.50 | 1.40 | 11.90 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2086 | 0.00 | 0.00 | 0.00 | 0.00 | 25.39 | 4.20 | 29.59 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2087 | 0.00 | 0.00 | 0.00 | 0.00 | 29.50 | 6.30 | 35.79 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2088 | 0.00 | 0.00 | 0.00 | 0.00 | 20.99 | 18.89 | 39.88 | 54.36 | 36.54 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2089 | 0.00 | 0.00 | 0.00 | 0.00 | 17.12 | 18.89 | 36.02 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| 2090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 19.59 | 19.59 | 54.36 | 39.50 | 515.43 | 81.04 | 78.98 | 192.66 | 162.76 |
| Salvage Value | 0.87 | 0.00 | 2.40 | 0.00 | 3.80 | 1.76 | 8.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PV @ 6.50% | 3716.73 | 2810.14 | 128.68 | 0.00 | 397.09 | 314.63 | 7367.28 | 591.87 | 494.22 | 9549.58 | 1609.11 | 516.49 | 2207.98 | 5215.99 |

Net Present Value -3237

## 2.7. Probabilistic Analysis Figures

**Figure 2.7.1: Red-Green Quilt: Relative to All Gas Ref-Ref-Ref Case**

| Energy Prices | Discount Rates | Capital Costs | All Gas | K22/Gas | Wind/Gas | K19/Gas24 /250MW | K19/Gas25/750MW (WPS Sale & Inv) | K19/Gas31 /750MW | SCGT/C26 | CCGT/26 | Wind/C26 | K22/C29 | K19/C31 /250MW | K19/C31 /750MW | K19/C25 /250MW | K19/C25/750MW (WPS Sale & Inv) | K19/C25/ 750MW | Scenario Probabilities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low (30%) | Low (15%) | High (30%) | -4043 | -3792 | -7769 | -3190 | -2855 | -3418 | -3309 | -3529 | -4543 | -4064 | -3506 | -3554 | -3459 | -2841 | -3642 | 1.35% |
| | | Ref (50%) | -3049 | -2532 | -5403 | -1877 | -1616 | -2130 | -2401 | -2482 | -3149 | -2786 | -2166 | -2138 | -2124 | -1410 | -2177 | 2.25% |
| | | Low (20%) | -2247 | -1590 | -3666 | -890 | -703 | -1175 | -1655 | -1627 | -2041 | -1773 | -1099 | -1022 | -1069 | -292 | -1030 | 0.90% |
| | Ref (50%) | High (30%) | -463 | -1212 | -3056 | -911 | -730 | -1191 | -1297 | -1531 | -2243 | -2539 | -2161 | -2323 | -2510 | -2155 | -2816 | 4.50% |
| | | Ref (50%) | 208 | -278 | -1478 | 95 | 257 | -185 | -582 | -704 | -1181 | -1496 | -1050 | -1153 | -1368 | -929 | -1559 | 7.50% |
| | | Low (20%) | 750 | 408 | -323 | 837 | 974 | 548 | 6 | -29 | -335 | -678 | -176 | -243 | -473 | 20 | -585 | 3.00% |
| | High (35%) | High (30%) | 1204 | 25 | -796 | 117 | 203 | -182 | -284 | -517 | -1070 | -1659 | -1413 | -1622 | -2029 | -1810 | -2383 | 3.15% |
| | | Ref (50%) | 1708 | 785 | 384 | 963 | 1060 | 679 | 323 | 187 | -187 | -755 | -434 | -592 | -994 | -698 | -1243 | 5.25% |
| | | Low (20%) | 2114 | 1336 | 1245 | 1580 | 1674 | 1297 | 822 | 762 | 516 | -51 | 327 | 201 | -189 | 157 | -364 | 2.10% |
| Ref (55%) | Low (15%) | High (30%) | -5014 | -2511 | -7167 | -1796 | -2103 | -2041 | -1760 | -1703 | -2360 | -840 | -334 | 0 | 206 | 853 | 498 | 2.48% |
| | | Ref (50%) | -4020 | -1251 | -4802 | -482 | -865 | -753 | -852 | -656 | -967 | 438 | 1006 | 1415 | 1541 | 2284 | 1963 | 4.13% |
| | | Low (20%) | -3217 | -309 | -3064 | 504 | 49 | 202 | -107 | 199 | 141 | 1451 | 2073 | 2531 | 2597 | 3402 | 3110 | 1.65% |
| | Ref (50%) | High (30%) | -671 | -46 | -2354 | 341 | 109 | 85 | 23 | -43 | -531 | -237 | 104 | 190 | 152 | 470 | 170 | 8.25% |
| | | Ref (50%) | 0 | 887 | -775 | 1346 | 1097 | 1091 | 738 | 784 | 531 | 806 | 1215 | 1360 | 1295 | 1696 | 1427 | 13.75% |
| | | Low (20%) | 542 | 1573 | 380 | 2089 | 1813 | 1824 | 1326 | 1459 | 1376 | 1624 | 2089 | 2270 | 2189 | 2645 | 2401 | 5.50% |
| | High (35%) | High (30%) | 1308 | 1091 | -82 | 1258 | 1041 | 998 | 879 | 764 | 370 | 168 | 391 | 366 | 109 | 268 | 2 | 5.78% |
| | | Ref (50%) | 1812 | 1851 | 1098 | 2104 | 1898 | 1859 | 1487 | 1468 | 1254 | 1073 | 1370 | 1396 | 1144 | 1380 | 1143 | 9.63% |
| | | Low (20%) | 2218 | 2402 | 1959 | 2721 | 2512 | 2478 | 1986 | 2044 | 1956 | 1777 | 2132 | 2189 | 1949 | 2235 | 2022 | 3.85% |
| High (15%) | Low (15%) | High (30%) | -6435 | -1499 | -6719 | -692 | -1694 | -1006 | -355 | -23 | -267 | 2355 | 2796 | 3410 | 3819 | 4372 | 4455 | 0.68% |
| | | Ref (50%) | -5441 | -239 | -4353 | 621 | -456 | 282 | 552 | 1024 | 1126 | 3633 | 4135 | 4826 | 5154 | 5803 | 5921 | 1.13% |
| | | Low (20%) | -4638 | 703 | -2616 | 1607 | 458 | 1237 | 1298 | 1879 | 2234 | 4646 | 5203 | 5941 | 6210 | 6922 | 7068 | 0.45% |
| | Ref (50%) | High (30%) | -1158 | 941 | -1767 | 1398 | 713 | 1127 | 1241 | 1336 | 1104 | 2014 | 2308 | 2571 | 2746 | 2940 | 2993 | 2.25% |
| | | Ref (50%) | -487 | 1874 | -189 | 2403 | 1701 | 2134 | 1956 | 2163 | 2166 | 3057 | 3420 | 3741 | 3888 | 4166 | 4250 | 3.75% |
| | | Low (20%) | 55 | 2560 | 966 | 3146 | 2417 | 2867 | 2543 | 2838 | 3011 | 3875 | 4293 | 4652 | 4783 | 5115 | 5225 | 1.50% |
| | High (35%) | High (30%) | 1210 | 2017 | 533 | 2246 | 1691 | 1993 | 1956 | 1951 | 1738 | 1935 | 2127 | 2228 | 2170 | 2203 | 2236 | 1.58% |
| | | Ref (50%) | 1713 | 2777 | 1712 | 3092 | 2549 | 2854 | 2563 | 2656 | 2622 | 2839 | 3106 | 3259 | 3206 | 3315 | 3377 | 2.63% |
| | | Low (20%) | 2120 | 3328 | 2573 | 3709 | 3163 | 3473 | 3063 | 3231 | 3325 | 3543 | 3867 | 4051 | 4010 | 4170 | 4256 | 1.05% |

| $2014 NPV | All Gas | K22/Gas | Wind/Gas | K19/Gas24 /250MW | K19/Gas25/750MW (WPS Sale & Inv) | K19/Gas31 /750MW | SCGT/C26 | CCGT/26 | Wind/C26 | K22/C29 | K19/C31 /250MW | K19/C31 /750MW | K19/C25 /250MW | K19/C25/750MW (WPS Sale & Inv) | K19/C25/ 750MW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Expected Value | -70 | 564 | -1084 | 971 | 772 | 706 | 455 | 459 | 147 | 348 | 736 | 821 | 712 | 1085 | 760 |
| 10th Percentile -"Risk" | -3502 | -1249 | -4599 | -898 | -828 | -1181 | -1217 | -1424 | -2118 | -1692 | -1362 | -1594 | -1988 | -1429 | -2186 |
| 25th Percentile | -560 | -248 | -2200 | 115 | 139 | -183 | -297 | -490 | -910 | -750 | -363 | -361 | -650 | -204 | -904 |
| 75th Percentile | 1481 | 1636 | 383 | 2092 | 1726 | 1832 | 1363 | 1462 | 1256 | 1460 | 2074 | 2009 | 1854 | 2255 | 2008 |
| 90th Percentile - "Reward" | 1905 | 2007 | 1209 | 2479 | 2256 | 2215 | 1956 | 2070 | 2028 | 2601 | 2953 | 3220 | 3180 | 3377 | 3360 |
| EV Difference From AllGas | 0 | 634 | -1014 | 1041 | 842 | 776 | 525 | 529 | 217 | 418 | 806 | 891 | 782 | 1155 | 830 |

**Figure 2.7.2: Red-Green Quilt; Relative to All Gas Development Plan**

| Energy Prices | Discount Rates | Capital Costs | All Gas | Wind/Gas | K22/Gas | K19/Gas24 /250MW | K19/Gas25/750MW (WPS Sale & Inv) | K19/Gas31 /750MW | SCGT/C26 | CCGT/26 | Wind/C26 | K22/C29 | K19/C31/ 250MW | K19/C31/ 750MW | K19/C25/ 250MW | K19/C25/750MW (WPS Sale & Inv) | K19/C25/ 750MW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low (30%) | Low (15%) | High (30%) | 0 | -3726 | 251 | 853 | 1188 | 625 | 734 | 514 | -500 | -22 | 537 | 489 | 584 | 1202 | 401 |
| | | Ref (50%) | 0 | -2354 | 517 | 1172 | 1433 | 919 | 648 | 567 | -100 | 263 | 883 | 911 | 925 | 1639 | 872 |
| | | Low (20%) | 0 | -1419 | 657 | 1357 | 1544 | 1072 | 592 | 620 | 206 | 474 | 1148 | 1224 | 1178 | 1955 | 1217 |
| | Ref (50%) | High (30%) | 0 | -2593 | -749 | -448 | -267 | -729 | -834 | -1068 | -1780 | -2076 | -1698 | -1861 | -2047 | -1692 | -2353 |
| | | Ref (50%) | 0 | -1686 | -487 | -114 | 49 | -393 | -790 | -913 | -1389 | -1704 | -1258 | -1362 | -1576 | -1137 | -1768 |
| | | Low (20%) | 0 | -1073 | -342 | 87 | 224 | -202 | -744 | -779 | -1085 | -1428 | -926 | -993 | -1223 | -730 | -1335 |
| | High (35%) | High (30%) | 0 | -2000 | -1179 | -1087 | -1001 | -1386 | -1488 | -1721 | -2274 | -2863 | -2617 | -2826 | -3233 | -3014 | -3587 |
| | | Ref (50%) | 0 | -1324 | -923 | -744 | -648 | -1029 | -1385 | -1521 | -1894 | -2462 | -2141 | -2299 | -2701 | -2406 | -2950 |
| | | Low (20%) | 0 | -869 | -778 | -534 | -440 | -817 | -1292 | -1352 | -1598 | -2165 | -1787 | -1914 | -2303 | -1958 | -2478 |
| Ref (55%) | Low (15%) | High (30%) | 0 | -2154 | 2502 | 3218 | 2910 | 2973 | 3253 | 3310 | 2653 | 4174 | 4680 | 5013 | 5220 | 5866 | 5511 |
| | | Ref (50%) | 0 | -782 | 2768 | 3537 | 3155 | 3267 | 3167 | 3364 | 3053 | 4458 | 5026 | 5435 | 5561 | 6304 | 5983 |
| | | Low (20%) | 0 | 153 | 2908 | 3721 | 3266 | 3420 | 3111 | 3417 | 3359 | 4669 | 5291 | 5749 | 5814 | 6620 | 6327 |
| | Ref (50%) | High (30%) | 0 | -1683 | 625 | 1012 | 780 | 756 | 694 | 628 | 140 | 434 | 775 | 861 | 823 | 1141 | 841 |
| | | Ref (50%) | 0 | -775 | 887 | 1346 | 1097 | 1091 | 738 | 784 | 531 | 806 | 1215 | 1360 | 1295 | 1696 | 1427 |
| | | Low (20%) | 0 | -162 | 1031 | 1547 | 1272 | 1282 | 784 | 917 | 834 | 1083 | 1547 | 1729 | 1648 | 2103 | 1860 |
| | High (35%) | High (30%) | 0 | -1390 | -218 | -50 | -268 | -310 | -429 | -544 | -938 | -1140 | -917 | -942 | -1199 | -1040 | -1306 |
| | | Ref (50%) | 0 | -714 | 39 | 292 | 86 | 47 | -325 | -344 | -558 | -739 | -441 | -416 | -668 | -432 | -669 |
| | | Low (20%) | 0 | -260 | 184 | 503 | 294 | 259 | -233 | -175 | -262 | -441 | -87 | -30 | -269 | 16 | -196 |
| High (15%) | Low (15%) | High (30%) | 0 | -284 | 4936 | 5742 | 4740 | 5428 | 6079 | 6411 | 6167 | 8790 | 9230 | 9844 | 10254 | 10807 | 10890 |
| | | Ref (50%) | 0 | 1087 | 5202 | 6062 | 4985 | 5722 | 5993 | 6465 | 6567 | 9074 | 9576 | 10266 | 10595 | 11244 | 11361 |
| | | Low (20%) | 0 | 2023 | 5342 | 6246 | 5096 | 5875 | 5937 | 6518 | 6873 | 9285 | 9841 | 10580 | 10849 | 11560 | 11706 |
| | Ref (50%) | High (30%) | 0 | -609 | 2099 | 2556 | 1871 | 2285 | 2398 | 2494 | 2261 | 3172 | 3466 | 3729 | 3903 | 4098 | 4151 |
| | | Ref (50%) | 0 | 298 | 2361 | 2890 | 2187 | 2620 | 2442 | 2649 | 2653 | 3543 | 3906 | 4228 | 4375 | 4653 | 4736 |
| | | Low (20%) | 0 | 912 | 2505 | 3091 | 2362 | 2812 | 2489 | 2783 | 2956 | 3820 | 4238 | 4597 | 4728 | 5060 | 5170 |
| | High (35%) | High (30%) | 0 | -677 | 807 | 1036 | 482 | 783 | 747 | 742 | 529 | 725 | 917 | 1019 | 961 | 994 | 1027 |
| | | Ref (50%) | 0 | -1 | 1064 | 1379 | 835 | 1141 | 850 | 942 | 909 | 1126 | 1392 | 1546 | 1492 | 1602 | 1664 |
| | | Low (20%) | 0 | 454 | 1208 | 1589 | 1043 | 1353 | 943 | 1111 | 1205 | 1424 | 1747 | 1931 | 1891 | 2050 | 2136 |

# TAB 2

# MANITOBA PUBLIC UTILITIES BOARD

Re: MANITOBA HYDRO
NEEDS FOR AND ALTERNATIVES TO
REVIEW OF MANITOBA HYDRO'S
PREFERRED DEVELOPMENT PLAN

Regis Gosselin - Chairperson
Marilyn Kapitany - Board Member
Larry Soldier - Board Member
Richard Bel - Board Member
Hugh Grant - Board Member

HELD AT:

Public Utilities Board
400, 330 Portage Avenue
Winnipeg, Manitoba
March 3, 2014
Pages 1 to 320

to assist in this modelling and analysis.

This work has enabled Hydro to respond to changing conditions and develop plan sensitivities to gain understanding of how shifts in underlying assumptions might impact or alter our Preferred Plan over time.

Third, on Keeyask, which is the first major component of the Preferred Development Plan, Hydro has undertaken the necessary steps to bring us to the point where we can begin construction with confidence. There have been extensive community consultations. We've submitted mutually beneficial partners -- partnerships with our First Nations partners. We've conducted environmental studies. The CEC hearings are now complete, and we look forward to their report in April.

We've conducted significant field investigations, engineering analysis, and construction preparations. We've recently selected a -- a very experienced and capable contractor for the general civil contract. We're intending to award the contract next week with construction being conditional on the -- upon final project approvals.

We're completing the process of incorporating the successful build into our overall

project cost estimate, including assessing the adequacy of project contingencies and management reserves. The estimate will be reviewed for approval this week, and preliminary results shared with you next week.

What I can say to you today is that the general civil contract price is higher than what we had estimated, but based on what we know, we don't see the updated estimate changing our conclusion that Keeyask is beneficial and justified by the variety of significant benefits it brings to the table.

With the award of the general civil contract, over 80 percent of the value of construction contracts will be committed. We'll have the benefit of greater confidence around the Keeyask -- we have the benefit of the greater -- greater confidence around the Keeyask cost estimate, one of the larger var -- variables in the plan analysis.

Finally, Manitoba Hydro has developed a comprehensive Risk Management Plan for the Preferred Plan, including detailed contract provisions and project management requirements. Here I would point to lessons learned from Wuskwatim and revisions to our capital planning processes.

All of these steps were important for improving our confidence in the appropriate path

(BRIEF PAUSE)

MR. ED WOJCZYNSKI: Well, that's too bad. He -- he raised an issue that is -- been integral to Manitoba Hydro's thinking for the last ten (10) years in -- in working with Wuskwatim itself, what happened with Wuskwatim, and then what -- and our preparations for other activities, including Keeyask and Conawapa. One (1) of the things we have done is learn from what we're doing.

I was involved in the 1990 capital plans hearing plan Conawapa, which is quite a ways back. I was the lead for the Wuskwatim NFAT process. I was the chief planner then. And now I've led this NFAT process.

But in this process, we have -- we have modified what we do as we go along. And the Wuskwatim experience was a major one for us, as it was for other infrastructure developers throughout North America.

So what happened with Wuskwatim? There were two (2) major parameters that struck it and caused the economics to deteriorate, compared to what we were looking at in that NFAT. The first was the capital costs went up significantly. And I think you're quite aware that the cas -- cost of other infrastructure

throughout North America, and particularly in western Canada, went up dramatically. So it wasn't that we were the only ones who misjudged and mis-estimated what was going to happen.

That structural change in capital construction costs, commodity costs, that's something that has been integrated into our planning. And that's one (1) of the reasons, when you saw earlier today one (1) of the presenta -- one (1) of the overheads when -- during the cross of the increase in capital cost -- I think it was perhaps a PUB cross-examination, you saw Keeyask and Conawapa costs increasing significantly. That is because those structural changes are now incorporated into those projects. And -- and we are continuing, of course, to mo -- to update those. But the big shifts we feel have happened on the -- and we have done many things that have caused us to have more confidence in these costs compared to Wuskwatim.

A major element that we did different was we undertook the Keeyask infrastructure project ahead of coming into this process where we are today. We had a lesson learned in Wuskwatim that the First Nation contract -- joint venture contractor didn't have the same cap -- capabilities that a lot of other contractors might have had, and that there were delays

and cost increases due to that. It harmed the ability of the First Nations to benefit. So we've done that early.

Another major difference, if you look at Wuskwatim, when we were in that NFAT process and the -- and there was the completion of it and we had the report, construction didn't start until two (2) years later. We still hadn't yet had a development agreement with the First Nations. We still had to go through that. It took longer than we thought. Plus we had a far dis -- a fair distance to go in the environmental review process.

Where we are different with Keeyask? We have agreements with the four (4) First Nations. We are virtually, we hope, finished the environmental review process. We are on the verge, hopefully, of starting construction, so we're in a much different situation that we were with Wuskwatim.

Mr. Thomson referred to the fact we have 80 percent of the value of the construction contracts already in hand, that we had virtually none with Wuskwatim when were in the NFAT process.

So from -- plus in our contracting approaches we've learnt from Wuskwatim. We do things much differently. We've significantly enhanced our

capital cost estimating process. We're learnt from other projects in Canada, including Pointe du Bois, not just Wuskwatim.

When we did Wuskwatim, there had been not maj -- there had not been very much major hydro construction in Canada since Limestone. We've had a lot of experience in Canada on hydro projects, including in Manitoba, so we -- we've built on all of that.

The other big thing that happened, was the export prices and national gas prices. The shale -- the natural gas prices are going up, export prices are going up. We saw the numbers earlier.

Then the shale revolution hit. It had a big impact, we all know about that. We know that's not going away. But our forecasts and those of all the expert North American consultants we use, already integrate that in. People -- some people claim that we haven't noticed these things, or that we're -- we're playing catch up. If that's true, then that's true for all the -- most of the major consultants and oil and gas companies in North America. We're quite aware of what's going on and that has been integrated in -- already into our analysis.

So -- and I'll just make one (1) or two

(2) other points. Our whole evaluation approach now we are m -- more aware, as others are of the volatility in things like export prices. And so lesson learned from Wuskwatim, we strongly enhanced how we evaluate our projects. And that's why you see us having this probabilistic scenario analysis, which is a significant enhancement than anything we did it with Wuskwatim.

So the last point on the export price side. Wuskwatim, we had no contracts in place for any of the output. As we heard already today, we still have some surplus power to be sold at -- even with the ones we've announced here. But we have a large chunk of our surplus already contracted for and we're engaged with others, which is much different than we were with Wuskwatim.

So I'd better move on to the rest of my presentation. But we thought it was important to -- to highlight that for you as we go along. And we'll go through some of those things in more detail over the next four (4) or five (5) weeks.

I'll just very briefly go through the plan, but you've already seen it. Focus as a -- as a Ms. Ramage did earlier today, and actually our MIPUG colleagues indicated, focus on the major issues and the major decisions. I'll refer to that and then go

through the various perspectives. We were talking earlier today when Mr. Thomson was being crossed, what are the priorities, what -- what are, what is -- what are you focussing on?

Well according to the Manitoba Hydro mandate and the NFAT terms of reference, we have a number of perspectives that we're supposed to utilize. And -- and we utilize them right through the evaluation and through our conclusions. I'll run through that, then try and indicate what the panels will cover, the four (4) different panels, and then just come to the conclusion.

And if I'm talking a bit quickly it's because I know the time-frame. Scott you're suppose to kick me if I go to fast. No, Patti was supposed to.

The preferred plan, I am not going to go through this in detail you've already had it presented to you. I'd like to reinforce what Mr. Thomson said, and that is in our plan DSM will be expanded. And you will hear more about that over the next couple of weeks.

In our plan we -- we didn't seek approval for a particular level of DSM, in our plan, partly because we did not yet have the analysis of the alternative levels. And partly it's 'cause something

that we intend to update and work on as we go along. And as more opportunities arise and the economics become clearer, then we will expand to that level of DSM. It's not something that's going to be staying static.

We've gone through the rest of the plan and that we need to have commitments this summer. We focussed on Conawapa again that we -- that we're not seeking of -- of -- for a -- make a firm construction decision that we'll have to -- early 2018, and we'll consider all the factors that could arise between now and then, including what's going to happen to the DSM capital cost energy prices.

MS. MARILYN KAPITANY: Could I just ask a question before you move off DSM?

MR. ED WOJCZYNSKI: Sure.

MS. MARILYN KAPITANY: We heard this morning that in First Nation communities there are some higher -- Hydro costs. Are the DSM programs available and accessible to First Nation costumers in Manitoba?

MR. ED WOJCZYNSKI: I -- I understand DSM programs are available and accessible to them, but -- but how successful that is and what the details of that, I'm -- I'm not the best person to talk that -- but tomorrow morning and the DSM panel, it's the right

intergenerational equity, and some consideration of provincial credit ratings. And I won't go through any explanation of those, I think, just to save some time here.

Briefly, particularly for people who haven't been as involved in this NFAT process for the last while, we've got the two (2) different evaluations: the economic and the financial. And what's the difference between them? The economic evaluation only thinks about the costs and revenues that are related to that project proceeding or not. It's an incremental analysis.

The financial analysis looks at the -- all the reve -- the rev -- costs and revenues from the Company, whether they're reallocated or overhead or sunk costs, or whatever. There's -- the economic evaluation concerns itself only with the project or things that are affected by the project. The financial evaluation is the whole company, and very similar to the IFF and the CEF, it -- it's really repeating those, but as almost to sensitivities.

The economics measure the end pre -- net present value that I mentioned. It's for the -- for the project, or for the plan. The financial evaluation doesn't come up with a single metric. It has hundreds

of measures, rate increases, and all the financial targets and objectives, and on a year-by-year basis.

Economics is done in the real terms; that is, inflation removed. Financial evaluation, we do it in current dollars we -- we -- and leave inflation in. Depreciation. In -- it came up from -- with one (1) of the independent consultants, My goodness, your economic evaluation doesn't have a depreciation or -- or a revenue requirement. Well, we don't do -- that isn't done in the economic evaluation. That's done in the financial evaluation.

When you do -- in standard approach in economic benefit cost benefit cost evaluation, you do it for the life of the asset you're evaluating. Now, we don't pretend we can do a seventy (70) year study and have excellent forecasts all the way through. We have a thirty-five (35) year detailed study period and forecast for that, and then we have an extension beyond that with some assumptions that we'll explain later in another panel where we calculate the -- what's called the residual value, or the -- the value of the asset at the end of the thirty-five (35) years. And -- and you can do that in different ways, and the -- the way we done it we think is the best way, and we'll certainly discuss that.

# TAB 3

distribution of costs and benefits are addressed in the financial analysis. The multiple account benefit cost analysis takes into consideration consequences for Manitobans that are not reflected in the revenues and expenditures of Manitoba Hydro and provides a comprehensive assessment of all the benefits and costs to Manitobans to address the question of overall socio-economic benefit. Manitoba Hydro provided these analyses in separate chapters to distinguish the purpose and value of each type of analysis in the NFAT process.

LCA in their Economic Analysis Appendix on pages 9A-22 and 9A-49 are examples where the purpose of the economic analysis has been confused with that of the financial analysis. The following table provides a comparison of the major attributes related to economic and financial evaluations.

| | **Economic Evaluations (standard benefit/cost methodology)** | **Financial Evaluations** |
|---|---|---|
| **Type of Costing** | Incremental, only those costs/revenues that would be incurred if the project proceeded | All relevant costs/revenues including reallocated and overhead costs |
| **Operations** | Project only or project with considerations of how other operations may be affected | Total financial operations of the corporation |
| **Measurement** | Net Present Value benefit to Manitoba Hydro (domestic customers and project partners) | Rate increases & consumers revenue for domestic customers, effect on financial targets |
| **Price Levels** | Constant currencies with real escalation, ignoring general inflation (real $) | Nominal currency with real escalation & inflation (current $) |
| **Financing** | Specific funding requirements not relevant; reflected in the discounting of cash flows | Project funding, interest payments, debt repayments explicitly included in costs and revenue requirements |
| **Depreciation** | Depreciation not directly applicable.<br>Residual Value calculated for project life longer than 35 year study period | Depreciation used.<br>Residual value not needed as project cost calculated annually |

# TAB 4

# Window of Opportunity
# Signed Agreements

- NSP 125 MW System Power Sale
  - May 1, 2021 – April 30, 2025
  - Subject to Keeyask
- WPS 100 MW System Power Sale
  - June 1, 2021 – May 31, 2027
  - Subject to Keeyask
- MP 250 MW System Power Sale
  - June 1, 2020 – May 31, 2035
  - Subject to Keeyask and new US interconnection
- WPS 308 MW System Power Sale
  - 2027 – May 31, 2036
  - Subject to Keeyask, Conawapa and new US interconnection

**These MH supply obligations have displaced the need for other resources**

# Development Plan Implementation Pathways

-All include DSM (& potentially wind, etc.)

| | | |
|---|---|---|
| **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, 100 MW WPS sale | Later Conawapa or gas generation |
| 4 | Keeyask 2019, 750 MW Interconnection, MP 250 MW Sale, 125 MW NSP extension, 100 MW WPS sale | 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 |

# Changes to Preferred Development Plan Reference Economics

| Planning Assumptions | Incremental NPV over All Gas Plan | Delta | Discount Rate |
|---|---|---|---|
| | Millions of NPV 2014$ | | |
| 2012 – Chapter 9 | $1696 | $898 | 5.05% |
| 2012<br>With 2014 Cost K&C | $798 | | 5.05% |
| 2013 Update – Chapter 12 | $1462 | | 5.40% |
| 2013 Update<br>No WPS Inv | $1245 | $871 | 5.40% |
| 2013 Update<br>No WPS Inv, With 2014 Cost K&C | $374 | | 5.40% |

# NFAT Results - Keeyask

| | Keeyask 2019/20 (Billions of $) | | |
|---|---|---|---|
| **Description** | **Low** | **Reference** | **High** |
| A) Key Variables (2014 Update) | | | |
| i) Contingency | -0.18 | 0.31 | 0.88 |
| ii) Labour Reserve | 0.18 | 0.19 | 0.19 |
| iii) Escalation Reserve | 0.04 | 0.09 | 0.14 |
| | | | |
| B) Base Cost (Including Sunk) | | | |
| i) 2012 Values (2013$) | 4.07 | 4.39 | 4.87 |
| ii) 2014 Update (2013$) | 4.36 | 4.95 | 5.62 |
| **Base Cost Difference** | **0.29** | **0.56** | **0.75** |
| | | | |
| C) Total In-Service Costs | | | |
| i) 2012 Values | 5.31 | 5.71 | 6.33 |
| ii) 2014 Update | 5.61 | 6.35 | 7.18 |
| **In-Service Cost Difference** | **0.30** | **0.64** | **0.85** |

# NFAT Results - Conawapa

| | Conawapa 2026/27 (Billions of $) | | |
|---|---|---|---|
| **Description** | **Low** | **Reference** | **High** |
| A) Key Variables (2014 Update) | | | |
| i) Contingency | -0.47 | 0.46 | 1.56 |
| ii) Labour Reserve | 0.35 | 0.36 | 0.38 |
| iii) Escalation Reserve | 0.13 | 0.31 | 0.51 |
| | | | |
| B) Base Cost (Including Sunk) | | | |
| i) 2012 Values (2013$ - 2026/27 ISD) | 5.40 | 5.97 | 6.65 |
| ii) 2014 Update (2013$ - 2026/27 ISD) | 5.23 | 6.36 | 7.68 |
| **Base Cost Difference** | **-0.17** | **0.39** | **1.03** |
| | | | |
| C) Total In-Service Costs | | | |
| i) 2012 Values (2026/27 ISD) | 8.82 | 9.70 | 10.76 |
| ii) 2014 Update (2026/27 ISD) | 8.64 | 10.40 | 12.48 |
| **In-Service Cost Difference** | **-0.18** | **0.70** | **1.72** |

# DSM Analysis – 3 Additional Levels

What level of DSM is economic?

| | Total Resource Cost<br>Without Pipeline Load<br>Includes all costs and does not account for changes in Domestic revenue<br>[with pipeline load for level 2 to level 3 only]<br>Incremental NPV (millions of 2014$) of implementing higher level of DSM | | |
|---|---|---|---|
| | All Gas | K19/Gas/750MW | K19/C/750MW |
| Base to Level 1 | 535 | 497 | 285 |
| Level 1 to Level 2 | 816 | 887 | 737 |
| Level 2 to Level 3<br>[with pipeline] | -49<br>[-60] | -86<br>[-39] | -102<br>[-85] |

Note: ISD changes with Level of DSM for Conawapa (DSM1:2030, DSM2:2031, DSM3:2033) and All Gas (DSM1:2028, DSM2:2031, DSM3:2033).

# Impact of DSM Levels on Development Plan Economics

| | Without Pipeline Load<br>[with pipeline load for level 2 and level 3 only]<br>Incremental NPV (millions of 2014)$<br>Relative to All Gas at specified level of DSM | | | |
|---|---|---|---|---|
| | Base DSM | Level 1 DSM | Level 2 DSM | Level 3 DSM |
| Plan 5<br>K19/Gas/750MW<br>[Pipeline] | 377 | 339 | 410<br><br>[339] | 373<br><br>[361] |
| Plan 14<br>K19/C/750MW<br>[Pipeline] | 374 | 124 | 45<br><br>[139] | -7<br><br>[114] |

# Overall Conclusions

- Keeyask Gas plan with 750MW line & MP/WPS/NSP
  - Approx $300 to $400M corporate benefits in new scenarios
  - Over $1 Billion including provincial transfers
  - Justified as being economic and by other benefits- rates, reliability, energy security, environment, economy, aboriginal

- Keeyask Conawapa plan with 750MW line & MP/WPS/NSP
  - $ Zero to $400M corporate benefits in new scenarios
  - Over $ 1 ½ Billion including provincial transfers
  - Likely justified as being economic and by other benefits- rates, reliability, energy security, environment, economy, aboriginal
  - Will confirm in future if proceed with Conawapa depending on additional export contracts, gas/export prices forecasts, load growth, DSM, capital costs, interest rates, etc.

**Table 2.2: Range of Real Discount Rates used in Economic Probabilistic Analysis**

| Factor | Low | Reference | High |
|---|---|---|---|
| Discount Rate | 3.35% | 5.05% | 6.50% |

### 2.1.3. Capital Costs

Capital Cost factors include generation costs for all resource types, transmission costs and applicable real escalation.

Three sets of capital costs are produced based on internal analysis, or contingencies recommended by consultants on the basis of capital type. As discussed further in Section 2.3.3, it is assumed different types of capital costs are correlated. Therefore, in a 'high capital cost' world, natural gas-fired generation, wind generation, hydro-electric generation, and transmission capital costs are all at their high values, and in a 'low capital cost' world, they are all set to their low values.

The low and high base cost estimates for Keeyask G.S. and Conawapa G.S. differ from the reference case based on the amount included to address uncertainty (i.e. contingency and management reserve). As such, the point estimate is the same in each of the scenarios. The low estimate is based on a contingency amount at a P10 confidence level. This means there should be less than a 10% chance actual costs are less than the low amount. The high estimate is based on the inclusion of both the P50 contingency amount plus the labour reserve. The labour reserve represents the potential additional costs associated with labour productivity risk and associated cumulative impacts. The labour reserve was derived by applying outcomes of the Wuskwatim process reviews to the labour components of the Keeyask and Conawapa estimates. Based on the analysis, it is anticipated that this high amount has a low probability of being exceeded (less than 10%). The selection of low and high amounts is intended to provide a large range of potential costs in the analyses (versus selecting low and high amounts closer to the mean).

A contingency is applied to the point estimates for new wind and natural gas-fired generating stations and their associated transmission to account for uncertainty and potential risks that could be encountered during project implementation. Cost distributions for systemic risks were calculated by a 3rd party risk and contingency consultant so that, when applied to the point estimate, they would represent cost estimates at varying confidence levels. For the purposes of determining low and high cost estimates for these projects, P10 and P90 level project estimates were selected from these cost distributions. The contingency is consistent with and developed using AACE Recommended Practices.

Major new transmission projects, including new U.S. interconnections and north/south transmission associated with the development of both Keeyask and Conawapa, were developed with a cost estimate range of -10% and +50% of the P50 project costs. This range was applied to determine low and high project costs, respectively.

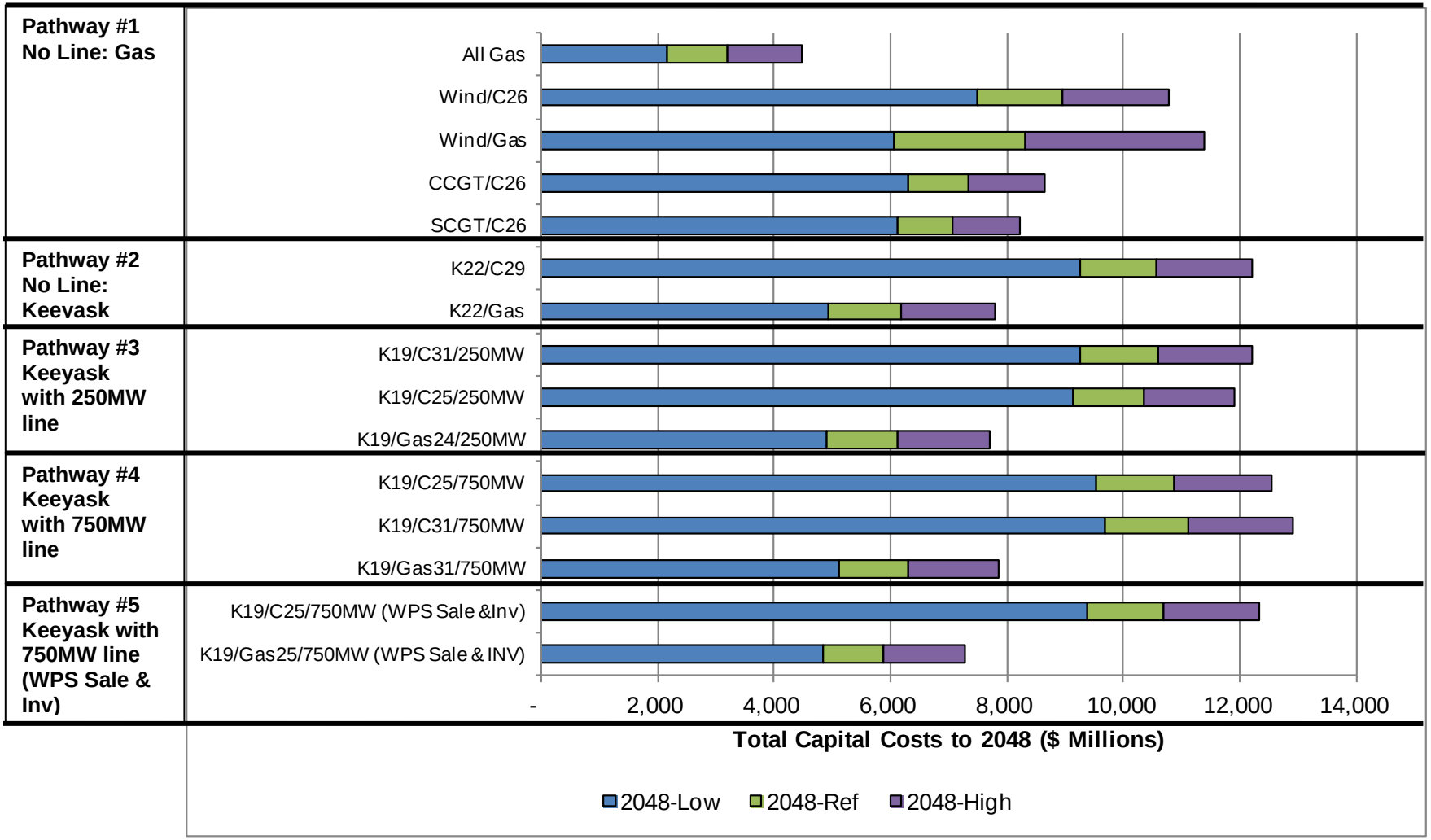
Capital costs estimates are classed by development stage, as defined by the Cost Estimate Classification Table outlined in AACE Recommended Practice 18r-97 as shown below in Table 2.3.

**Table 2.3: AACE Cost Estimate Classification Table**

| | *Primary Characteristic* | *Secondary Characteristic* | | |
|---|---|---|---|---|
| **ESTIMATE CLASS** | **MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition | **END USAGE** Typical purpose of estimate | **METHODOLOGY** Typical estimating method | **EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a] |
| Class 5 | 0% to 2% | Concept screening | Capacity factored, parametric models, judgment, or analogy | L: -20% to -50%<br>H: +30% to +100% |
| Class 4 | 1% to 15% | Study or feasibility | Equipment factored or parametric models | L: -15% to -30%<br>H: +20% to +50% |
| Class 3 | 10% to 40% | Budget authorization or control | Semi-detailed unit costs with assembly level line items | L: -10% to -20%<br>H: +10% to +30% |
| Class 2 | 30% to 75% | Control or bid/tender | Detailed unit cost with forced detailed take-off | L: -5% to -15%<br>H: +5% to +20% |
| Class 1 | 65% to 100% | Check estimate or bid/tender | Detailed unit cost with detailed take-off | L: -3% to -10%<br>H: +3% to +15% |

# TAB 5

**Figure 1: Total Capital Costs from 2012-2048 per Plan under Reference Energy Prices and Reference Discount Rates (2012 $ Millions - Real)[1]**




[1] Calculated from Appendix 9.3 Economic Summary tables as the summation of the Total Capital column from 2012 – 2048 (for Figure and Table 1. Salvage value is not included in the summation. The summation is done for the reference energy prices and reference discount rate scenarios, for the low, reference and high capital costs, as seen below.

## Table 1: Summation of Total Capital Costs per Plan from 2012 – 2048 (2012 $ Millions - Real) for Reference Energy Prices and Reference Discount Rates

| 2048 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pathway** | **1** | | | | | **2** | | **3** | | | **4** | | | **5** | |
| | 1 | 9 | 3 | 8 | 7 | 10 | 2 | 11 | 13 | 4 | 15 | 12 | 6 | 14 | 5 |
| **Plan** | All Gas | Wind/C26 | Wind/Gas | CCGT/ C26 | SCGT/ C26 | K22/C29 | K22/Gas | K19/C31/ 250MW | K19/C25/ 250MW | K19/Gas24/ 250MW | K19/C25/ 750MW | K19/C31/ 750MW | K19/Gas31/ 750MW | K19/C25/ 750MW (WPS Sale &Inv) | K19/Gas25/ 750MW (WPS Sale & Inv) |
| **Low** | 2,150 | 7,493 | 6,072 | 6,296 | 6,110 | 9,249 | 4,936 | 9,270 | 9,126 | 4,910 | 9,543 | 9,692 | 5,127 | 9,391 | 4,840 |
| **Ref** | 3,195 | 8,953 | 8,305 | 7,351 | 7,071 | 10,569 | 6,173 | 10,591 | 10,360 | 6,125 | 10,869 | 11,130 | 6,310 | 10,687 | 5,890 |
| **High** | 4,486 | 10,779 | 11,401 | 8,637 | 8,238 | 12,211 | 7,804 | 12,211 | 11,903 | 7,718 | 12,541 | 12,908 | 7,872 | 12,321 | 7,290 |

# TAB 6

**REFERENCE: Appendix 9.3 Economic Evaluation Documentation**

**QUESTION:**

Please provide the net flow related revenue (in the form of Exhibit MH#56 from the 2012/13 GRA) for each of the scenarios shown in Table 2 of the Executive Summary for on consistent fiscal year occurring after all major projects have been placed in service (e.g., 2034/35).

**RESPONSE:**

The attached tables contain the projected net extra provincial revenue, for fiscal year 2034/35, for each of the scenarios shown in Table 2 of the Executive Summary. Consistent with Exhibit MH#56 from the 2012/13 GRA the net extra provincial revenue is provided for the entire 99 flow history (1912/13 to 2010/11 inclusive).

These tables have also been attached in the form of an excel spreadsheet file:

www.hydro.mb.ca/projects/development_plan/bc_documents/mipug_0007_attachment_1.xls

| Pathway | Pathway 1 | | | | | | | | | Pathway 2 | | | | | | Pathway 3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Development Plan | 1 | | | 7 | | | 8 | | | 2 | | | 10 | | | 4 | | | 13 | | | 11 | | |
| | All Gas | | | SCGT/C26 | | | CCGT/C26 | | | K22/Gas | | | K22/C29 | | | K19/Gas24/250MW | | | K19/C25/250MW | | | K19/C31/250MW | | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| Flow Year | Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | | | | | | | | | | |
| 1912/13 | -76.1 | -44.6 | -11.5 | 147.2 | 337.4 | 543.2 | 150.7 | 350.2 | 565.1 | 82.3 | 234.2 | 391.5 | 264.2 | 551.1 | 857.5 | 145.0 | 285.8 | 429.2 | 331.9 | 600.2 | 888.9 | 331.5 | 609.5 | 907.2 |
| 1913/14 | -110.5 | -100.8 | -93.6 | 115.1 | 274.0 | 450.6 | 117.8 | 284.5 | 460.6 | 51.6 | 169.3 | 299.0 | 248.2 | 518.5 | 807.3 | 113.3 | 217.5 | 328.9 | 310.4 | 564.6 | 834.4 | 309.7 | 560.5 | 824.0 |
| 1914/15 | -239.7 | -318.9 | -421.0 | -17.8 | 17.4 | 66.2 | -9.5 | 34.9 | 74.4 | -74.2 | -54.2 | -40.8 | 131.4 | 280.0 | 427.2 | -13.2 | -12.4 | -11.3 | 186.5 | 310.1 | 438.4 | 214.0 | 359.0 | 511.2 |
| 1915/16 | -157.1 | -188.4 | -225.2 | 56.6 | 168.1 | 283.2 | 54.6 | 165.0 | 281.9 | 0.5 | 81.1 | 158.4 | 196.4 | 415.0 | 642.0 | 63.8 | 129.0 | 189.8 | 258.3 | 454.7 | 663.1 | 247.3 | 443.6 | 639.0 |
| 1916/17 | -18.6 | 68.7 | 159.4 | 204.4 | 450.3 | 726.1 | 203.4 | 449.5 | 724.1 | 137.6 | 338.2 | 565.2 | 292.2 | 610.6 | 950.0 | 200.4 | 389.3 | 594.0 | 372.6 | 690.7 | 1032.1 | 372.6 | 693.3 | 1038.1 |
| 1917/18 | -67.8 | -30.6 | 6.4 | 155.4 | 355.8 | 569.8 | 158.0 | 361.6 | 580.0 | 89.4 | 248.8 | 411.4 | 270.0 | 566.3 | 882.5 | 153.0 | 299.4 | 447.6 | 341.1 | 621.5 | 920.7 | 340.4 | 625.5 | 928.9 |
| 1918/19 | -195.4 | -263.4 | -329.5 | 32.9 | 114.9 | 192.8 | 44.6 | 132.8 | 218.6 | -22.8 | 23.1 | 64.3 | 176.7 | 368.6 | 568.7 | 38.3 | 69.1 | 100.0 | 234.8 | 395.3 | 572.0 | 252.9 | 442.6 | 632.8 |
| 1919/20 | -252.4 | -343.0 | -454.1 | -43.3 | -2.5 | 34.1 | -42.4 | 5.0 | 40.4 | -93.4 | -79.2 | -71.9 | 111.6 | 257.0 | 398.5 | -31.7 | -34.3 | -44.7 | 170.3 | 293.6 | 408.7 | 162.8 | 288.4 | 415.0 |
| 1920/21 | -202.0 | -261.3 | -326.9 | 13.9 | 94.9 | 174.5 | 10.2 | 93.3 | 171.6 | -41.6 | 8.6 | 57.2 | 157.9 | 344.8 | 533.2 | 23.8 | 56.3 | 82.8 | 219.2 | 384.7 | 551.3 | 209.1 | 377.6 | 544.9 |
| 1921/22 | -130.1 | -139.1 | -154.1 | 91.1 | 233.5 | 377.7 | 87.5 | 229.1 | 369.3 | 26.9 | 131.1 | 236.4 | 228.8 | 476.4 | 742.1 | 89.5 | 179.0 | 265.3 | 289.9 | 515.8 | 759.2 | 273.0 | 499.6 | 735.2 |
| 1922/23 | -182.0 | -229.7 | -288.4 | 31.2 | 127.2 | 228.7 | 32.9 | 131.0 | 229.7 | -21.4 | 45.2 | 105.2 | 164.5 | 364.1 | 560.0 | 41.7 | 90.9 | 136.4 | 226.2 | 408.6 | 581.4 | 236.2 | 415.9 | 600.3 |
| 1923/24 | -147.8 | -169.9 | -193.7 | 72.8 | 202.7 | 339.7 | 68.6 | 200.9 | 328.3 | 12.8 | 106.4 | 197.4 | 210.4 | 446.0 | 691.6 | 75.0 | 155.5 | 227.3 | 272.3 | 488.0 | 712.6 | 256.8 | 469.1 | 692.6 |
| 1924/25 | -285.7 | -397.4 | -529.5 | -74.1 | -54.3 | -38.6 | -73.5 | -44.9 | -28.0 | -124.7 | -130.7 | -139.9 | 86.5 | 214.5 | 327.5 | -62.2 | -88.7 | -118.1 | 143.7 | 251.3 | 339.9 | 140.6 | 245.8 | 349.1 |
| 1925/26 | -103.7 | -89.8 | -86.3 | 121.1 | 286.2 | 460.8 | 115.7 | 281.8 | 458.8 | 53.4 | 179.3 | 310.1 | 254.5 | 532.8 | 828.3 | 116.3 | 226.2 | 334.9 | 319.4 | 577.7 | 854.9 | 298.8 | 548.4 | 810.1 |
| 1926/27 | -136.5 | -152.5 | -172.8 | 84.9 | 218.3 | 359.0 | 79.8 | 213.4 | 356.6 | 25.8 | 120.8 | 218.5 | 224.9 | 461.0 | 717.7 | 84.7 | 170.0 | 239.3 | 286.2 | 504.8 | 730.9 | 283.2 | 502.1 | 732.6 |
| 1927/28 | -14.1 | 78.8 | 175.2 | 207.2 | 455.6 | 734.0 | 212.7 | 466.7 | 753.6 | 145.8 | 357.7 | 591.5 | 290.0 | 603.9 | 940.2 | 217.0 | 424.7 | 647.5 | 371.8 | 687.8 | 1028.7 | 372.7 | 692.4 | 1037.1 |
| 1928/29 | -73.0 | -37.1 | 0.3 | 147.9 | 339.8 | 546.7 | 152.2 | 352.4 | 569.3 | 84.7 | 238.1 | 399.0 | 256.4 | 536.0 | 835.7 | 147.6 | 289.5 | 436.5 | 329.2 | 594.4 | 882.4 | 333.7 | 609.4 | 905.1 |
| 1929/30 | -387.2 | -558.8 | -757.6 | -173.3 | -231.0 | -299.0 | -141.7 | -177.7 | -219.2 | -202.8 | -278.4 | -363.1 | -26.4 | 26.3 | 71.1 | -135.6 | -227.4 | -333.5 | 27.9 | 59.3 | 83.9 | 76.4 | 134.5 | 175.1 |
| 1930/31 | -389.8 | -561.9 | -762.6 | -184.8 | -236.3 | -297.7 | -171.8 | -212.7 | -260.1 | -214.8 | -280.8 | -361.3 | -21.9 | 33.9 | 82.9 | -156.3 | -243.9 | -341.7 | 32.5 | 67.0 | 95.6 | 35.4 | 73.4 | 105.4 |
| 1931/32 | -411.8 | -596.7 | -811.7 | -212.4 | -280.4 | -360.2 | -192.9 | -247.1 | -311.2 | -237.3 | -316.9 | -411.5 | -49.5 | -12.2 | 15.5 | -180.0 | -276.1 | -392.4 | 4.6 | 20.4 | 30.6 | 9.7 | 29.6 | 41.9 |
| 1932/33 | -300.3 | -420.6 | -560.8 | -92.6 | -85.6 | -82.8 | -91.5 | -70.6 | -72.7 | -138.3 | -150.4 | -179.0 | 65.6 | 177.8 | 280.7 | -77.0 | -103.9 | -152.2 | 120.7 | 210.3 | 288.9 | 122.2 | 214.2 | 297.9 |
| 1933/34 | -244.4 | -327.8 | -433.1 | -29.3 | 17.7 | 66.8 | -29.9 | 26.8 | 66.0 | -81.0 | -59.1 | -43.4 | 121.4 | 274.0 | 434.3 | -19.0 | -13.0 | -9.7 | 183.4 | 316.7 | 444.9 | 178.1 | 315.0 | 441.0 |
| 1934/35 | -96.0 | -76.1 | -64.8 | 125.9 | 297.7 | 481.9 | 119.8 | 292.7 | 479.1 | 59.4 | 191.4 | 329.2 | 258.1 | 541.2 | 841.3 | 120.8 | 237.6 | 357.0 | 324.9 | 586.5 | 869.8 | 303.3 | 554.4 | 821.9 |
| 1935/36 | -107.9 | -95.2 | -91.2 | 115.8 | 276.8 | 450.8 | 111.2 | 272.7 | 448.2 | 50.8 | 171.9 | 301.1 | 251.7 | 522.1 | 812.7 | 107.3 | 215.8 | 326.2 | 314.9 | 566.3 | 838.1 | 306.4 | 552.7 | 809.8 |
| 1936/37 | -312.5 | -437.7 | -589.1 | -95.7 | -94.5 | -100.9 | -86.1 | -77.8 | -82.6 | -136.5 | -159.4 | -186.8 | 55.4 | 157.1 | 262.2 | -78.7 | -114.9 | -164.2 | 106.6 | 191.3 | 276.3 | 151.8 | 254.6 | 337.8 |
| 1937/38 | -239.7 | -322.0 | -416.5 | -27.5 | 21.4 | 68.5 | -28.5 | 27.9 | 69.1 | -80.9 | -59.9 | -45.1 | 122.0 | 273.4 | 430.2 | -20.1 | -14.7 | -16.0 | 179.6 | 312.7 | 442.2 | 173.1 | 311.0 | 441.0 |
| 1938/39 | -326.5 | -463.3 | -621.8 | -127.8 | -144.7 | -165.6 | -125.0 | -128.4 | -151.0 | -168.1 | -202.1 | -248.9 | 19.5 | 104.1 | 183.2 | -106.5 | -160.4 | -227.8 | 78.0 | 139.5 | 195.2 | 78.8 | 147.3 | 197.0 |
| 1939/40 | -497.0 | -730.3 | -1001.3 | -324.0 | -456.0 | -609.0 | -287.9 | -399.4 | -528.8 | -316.6 | -446.4 | -596.5 | -166.2 | -197.7 | -249.0 | -265.1 | -415.0 | -591.1 | -112.0 | -165.3 | -236.4 | -86.9 | -126.7 | -183.7 |
| 1940/41 | -616.7 | -913.7 | -1257.6 | -443.2 | -641.8 | -870.0 | -435.8 | -626.6 | -847.4 | -510.5 | -744.8 | -1016.3 | -292.9 | -392.3 | -521.2 | -430.7 | -669.4 | -947.1 | -239.5 | -361.2 | -510.8 | -293.9 | -445.7 | -632.1 |
| 1941/42 | -508.3 | -754.4 | -1036.1 | -365.8 | -519.5 | -697.2 | -286.3 | -399.8 | -530.8 | -323.7 | -458.9 | -615.5 | -229.6 | -296.0 | -387.0 | -263.3 | -414.7 | -591.1 | -172.6 | -258.9 | -369.2 | -91.6 | -136.7 | -199.1 |
| 1942/43 | -200.5 | -260.3 | -327.1 | 13.8 | 92.9 | 164.4 | 10.7 | 89.1 | 164.7 | -44.9 | 3.1 | 44.4 | 150.3 | 321.4 | 504.8 | 20.4 | 48.7 | 79.5 | 207.3 | 356.7 | 514.1 | 206.7 | 370.0 | 533.0 |
| 1943/44 | -148.6 | -170.4 | -196.7 | 66.0 | 191.0 | 313.7 | 60.8 | 184.4 | 308.5 | 4.0 | 93.0 | 179.3 | 202.1 | 430.6 | 664.6 | 67.5 | 140.0 | 206.1 | 265.1 | 472.3 | 693.0 | 247.2 | 445.4 | 657.2 |
| 1944/45 | -154.6 | -182.0 | -215.4 | 55.6 | 173.1 | 292.8 | 51.7 | 166.6 | 287.5 | -4.2 | 78.1 | 159.1 | 196.8 | 413.9 | 645.1 | 58.5 | 122.5 | 183.8 | 260.2 | 457.2 | 657.2 | 244.0 | 427.0 | 630.4 |
| 1945/46 | -105.5 | -91.1 | -81.8 | 116.7 | 283.9 | 465.7 | 111.1 | 280.4 | 457.0 | 48.0 | 171.7 | 304.3 | 250.2 | 524.2 | 818.1 | 107.2 | 220.2 | 334.7 | 315.1 | 574.3 | 849.5 | 301.3 | 538.7 | 791.9 |
| 1946/47 | -121.6 | -128.8 | -136.6 | 102.3 | 246.8 | 387.0 | 102.7 | 246.4 | 386.0 | 40.0 | 149.3 | 262.2 | 240.5 | 496.7 | 764.3 | 99.7 | 181.4 | 270.2 | 299.0 | 526.4 | 770.2 | 294.8 | 532.4 | 777.7 |
| 1947/48 | -66.8 | -21.0 | 24.0 | 158.8 | 363.6 | 583.2 | 153.9 | 353.2 | 573.8 | 87.8 | 246.2 | 416.6 | 266.8 | 558.1 | 869.4 | 147.8 | 291.5 | 441.2 | 345.7 | 630.2 | 939.7 | 343.1 | 623.4 | 928.1 |
| 1948/49 | -130.8 | -136.9 | -150.5 | 85.8 | 232.3 | 380.6 | 107.0 | 259.7 | 423.8 | 37.5 | 151.1 | 269.9 | 183.3 | 397.0 | 622.3 | 107.4 | 205.6 | 307.8 | 255.5 | 463.3 | 676.8 | 292.5 | 534.4 | 787.8 |
| 1949/50 | -139.4 | -158.4 | -175.7 | 91.3 | 229.5 | 375.7 | 84.7 | 223.5 | 372.6 | 24.3 | 127.0 | 216.3 | 228.2 | 477.4 | 746.6 | 85.6 | 174.3 | 245.7 | 291.1 | 519.3 | 756.1 | 280.7 | 503.6 | 737.0 |
| 1950/51 | -42.5 | 27.4 | 102.8 | 187.7 | 421.8 | 675.8 | 190.1 | 425.0 | 686.6 | 116.3 | 305.7 | 511.6 | 281.6 | 589.1 | 917.6 | 180.8 | 358.7 | 543.8 | 362.7 | 668.9 | 1000.0 | 361.1 | 670.3 | 1003.3 |
| 1951/52 | -22.0 | 61.4 | 147.1 | 201.4 | 442.8 | 710.8 | 207.1 | 452.8 | 730.2 | 134.9 | 335.1 | 555.0 | 293.6 | 612.6 | 954.7 | 201.4 | 391.4 | 592.7 | 371.3 | 687.7 | 1030.2 | 372.9 | 693.4 | 1041.9 |
| 1952/53 | -124.6 | -136.5 | -153.0 | 92.7 | 233.7 | 380.8 | 101.1 | 249.3 | 406.4 | 32.4 | 132.0 | 242.9 | 218.5 | 455.1 | 709.8 | 97.4 | 185.8 | 276.8 | 282.7 | 501.2 | 723.9 | 283.8 | 520.4 | 767.8 |
| 1953/54 | -74.1 | -37.8 | -1.6 | 147.4 | 342.5 | 553.9 | 146.8 | 333.5 | 541.4 | 79.6 | 229.9 | 387.4 | 274.3 | 573.3 | 893.9 | 139.0 | 276.0 | 415.6 | 342.0 | 625.8 | 931.8 | 334.2 | 603.1 | 894.0 |
| 1954/55 | -7.4 | 79.7 | 175.1 | 218.6 | 476.8 | 761.9 | 220.9 | 478.3 | 769.4 | 152.1 | 363.8 | 596.8 | 301.3 | 628.9 | 980.8 | 215.4 | 410.8 | 625.4 | 382.8 | 712.3 | 1069.6 | 384.0 | 716.7 | 1077.4 |
| 1955/56 | -58.5 | -1.9 | 59.0 | 162.4 | 372.7 | 603.3 | 170.7 | 386.2 | 625.8 | 100.4 | 271.5 | 451.7 | 262.5 | 549.3 | 856.8 | 168.8 | 335.1 | 507.8 | 337.9 | 618.8 | 919.1 | 340.6 | 626.4 | 935.0 |
| 1956/57 | -101.5 | -88.3 | -71.4 | 118.7 | 292.2 | 488.0 | 125.6 | 302.9 | 495.2 | 56.0 | 184.9 | 323.0 | 231.6 | 494.8 | 768.2 | 121.5 | 237.8 | 356.2 | 306.0 | 560.0 | 821.9 | 309.2 | 569.5 | 835.6 |
| 1957/58 | -148.3 | -176.4 | -215.3 | 78.6 | 202.9 | 330.1 | 88.0 | 223.7 | 359.8 | 15.9 | 108.3 | 197.1 | 199.3 | 418.1 | 653.8 | 82.0 | 158.5 | 228.8 | 260.6 | 463.6 | 677.6 | 276.8 | 501.9 | 737.6 |
| 1958/59 | -286.9 | -400.5 | -530.6 | -83.5 | -69.0 | -60.1 | -80.0 | -57.8 | -46.3 | -129.0 | -140.4 | -157.5 | 75.2 | 196.2 | 301.3 | -66.5 | -92.3 | -127.3 | 132.3 | 231.0 | 311.7 | 145.1 | 233.5 | 315.0 |
| 1959/60 | -47.4 | 16.8 | 87.3 | 187.7 | 418.2 | 673.2 | 183.1 | 410.9 | 666.4 | 109.7 | 291.5 | 487.9 | 290.5 | 606.0 | 943.5 | 170.5 | 339.4 | 514.1 | 367.1 | 678.0 | 1014.1 | 361.4 | 670.0 | 1004.5 |
| 1960/61 | -206.6 | -272.9 | -352.2 | 11.0 | 89.8 | 174.2 | 29.0 | 118.2 | 202.1 | -39.4 | 15.7 | 57.7 | 139.4 | 318.6 | 490.8 | 29.0 | 67.9 | 98.3 | 198.1 | 359.8 | 507.4 | 239.2 | 430.2 | 621.9 |

1

| Pathway | Pathway 1 | | | | | | | | | Pathway 2 | | | | | | Pathway 3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Development Plan | 1 | | | 7 | | | 8 | | | 2 | | | 10 | | | 4 | | | 13 | | | 11 | | |
| | All Gas | | | SCGT/C26 | | | CCGT/C26 | | | K22/Gas | | | K22/C29 | | | K19/Gas24/250MW | | | K19/C25/250MW | | | K19/C31/250MW | | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| Flow Year | Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | | | | | | | | | | |
| 1961/62 | -548.0 | -804.9 | -1102.7 | -363.7 | -513.7 | -687.4 | -349.8 | -487.6 | -649.2 | -391.3 | -559.0 | -754.5 | -214.4 | -267.4 | -343.9 | -350.3 | -541.0 | -764.7 | -160.8 | -235.7 | -332.6 | -179.9 | -267.3 | -379.8 |
| 1962/63 | -118.1 | -114.5 | -116.5 | 102.2 | 253.4 | 407.8 | 103.9 | 261.5 | 432.2 | 39.5 | 158.7 | 282.9 | 236.4 | 491.8 | 766.2 | 99.4 | 202.8 | 306.8 | 299.7 | 536.3 | 788.5 | 288.5 | 531.5 | 781.5 |
| 1963/64 | -142.2 | -156.1 | -182.5 | 79.3 | 211.2 | 345.8 | 77.9 | 207.1 | 346.3 | 16.8 | 114.7 | 207.2 | 211.3 | 446.6 | 694.0 | 80.0 | 162.2 | 236.8 | 275.5 | 487.3 | 718.7 | 281.8 | 499.4 | 723.2 |
| 1964/65 | -121.8 | -126.2 | -134.4 | 99.1 | 249.2 | 401.4 | 94.7 | 241.9 | 393.1 | 35.7 | 145.9 | 257.7 | 235.0 | 491.5 | 765.8 | 96.3 | 194.0 | 281.3 | 299.0 | 527.3 | 777.7 | 285.5 | 516.2 | 759.7 |
| 1965/66 | -8.7 | 86.9 | 187.6 | 216.2 | 476.0 | 762.5 | 221.5 | 488.3 | 785.2 | 148.6 | 363.6 | 602.8 | 310.5 | 646.3 | 1006.6 | 217.6 | 424.9 | 650.5 | 387.3 | 720.5 | 1082.6 | 388.5 | 725.1 | 1090.5 |
| 1966/67 | -44.8 | 23.9 | 93.9 | 182.8 | 409.7 | 658.0 | 187.9 | 421.5 | 680.4 | 114.8 | 297.2 | 499.3 | 279.6 | 584.0 | 910.3 | 181.6 | 354.6 | 540.9 | 356.9 | 655.9 | 980.5 | 354.7 | 659.0 | 988.5 |
| 1967/68 | -125.3 | -122.1 | -124.2 | 101.5 | 256.4 | 419.7 | 115.1 | 288.2 | 467.5 | 41.4 | 164.9 | 287.1 | 201.9 | 426.1 | 667.5 | 108.8 | 220.5 | 331.9 | 276.0 | 490.4 | 722.7 | 297.2 | 547.0 | 811.3 |
| 1968/69 | -65.0 | -15.2 | 36.7 | 167.9 | 382.3 | 614.3 | 162.5 | 372.3 | 603.6 | 91.3 | 255.2 | 431.1 | 289.6 | 606.2 | 945.5 | 151.0 | 300.3 | 456.6 | 361.0 | 666.8 | 997.8 | 346.5 | 636.3 | 948.8 |
| 1969/70 | -8.8 | 90.2 | 196.0 | 215.6 | 473.6 | 759.3 | 220.7 | 486.1 | 783.1 | 151.6 | 369.7 | 613.3 | 297.7 | 621.5 | 968.4 | 221.6 | 430.9 | 656.2 | 379.5 | 705.2 | 1057.5 | 380.5 | 709.9 | 1067.6 |
| 1970/71 | -24.1 | 59.0 | 152.4 | 204.1 | 449.7 | 720.7 | 209.3 | 461.6 | 745.9 | 135.1 | 337.6 | 559.3 | 297.4 | 620.8 | 968.1 | 203.1 | 399.7 | 609.2 | 374.4 | 694.2 | 1040.2 | 375.1 | 699.1 | 1051.2 |
| 1971/72 | -31.7 | 42.9 | 117.9 | 197.1 | 439.7 | 703.3 | 203.8 | 452.2 | 728.6 | 125.7 | 318.6 | 528.3 | 295.0 | 616.1 | 960.5 | 190.0 | 369.1 | 561.9 | 369.8 | 686.9 | 1030.0 | 372.6 | 694.7 | 1043.2 |
| 1972/73 | -81.5 | -48.6 | -11.9 | 137.5 | 326.0 | 524.1 | 149.2 | 351.3 | 569.6 | 78.7 | 230.1 | 392.6 | 236.9 | 495.0 | 767.2 | 146.8 | 293.4 | 447.0 | 312.9 | 562.2 | 826.8 | 322.2 | 594.0 | 882.7 |
| 1973/74 | -124.7 | -127.9 | -135.0 | 95.5 | 242.3 | 392.2 | 97.3 | 238.9 | 391.6 | 30.1 | 136.7 | 248.6 | 232.7 | 488.9 | 762.3 | 92.1 | 180.2 | 267.0 | 295.8 | 530.0 | 782.9 | 287.9 | 517.9 | 757.8 |
| 1974/75 | -32.9 | 45.5 | 125.9 | 193.6 | 431.8 | 690.9 | 199.9 | 440.4 | 710.8 | 127.0 | 324.5 | 538.6 | 283.8 | 593.9 | 925.0 | 195.0 | 385.2 | 584.9 | 362.8 | 669.6 | 1002.1 | 363.9 | 677.0 | 1015.4 |
| 1975/76 | -42.7 | 26.1 | 97.6 | 179.0 | 406.7 | 650.6 | 186.6 | 419.0 | 676.0 | 114.5 | 299.2 | 496.9 | 275.1 | 574.3 | 895.1 | 184.7 | 360.9 | 548.3 | 352.5 | 648.1 | 967.3 | 354.8 | 656.3 | 982.1 |
| 1976/77 | -396.1 | -576.2 | -779.5 | -194.3 | -240.4 | -298.3 | -121.7 | -134.1 | -148.2 | -191.2 | -250.4 | -317.0 | -74.3 | -24.1 | 12.0 | -128.3 | -199.7 | -284.6 | -19.8 | 4.0 | 17.6 | 92.8 | 171.1 | 247.8 |
| 1977/78 | -282.8 | -396.0 | -523.2 | -74.4 | -52.7 | -37.3 | -70.5 | -43.2 | -25.4 | -122.8 | -128.3 | -145.7 | 79.3 | 198.8 | 315.8 | -64.0 | -89.2 | -121.7 | 136.2 | 237.6 | 324.9 | 142.7 | 250.5 | 346.5 |
| 1978/79 | -84.7 | -54.3 | -29.0 | 142.8 | 329.3 | 530.1 | 138.2 | 322.6 | 523.8 | 73.6 | 218.3 | 370.9 | 272.3 | 568.3 | 884.5 | 133.2 | 264.9 | 396.6 | 337.8 | 615.8 | 915.7 | 321.4 | 592.5 | 881.3 |
| 1979/80 | -107.6 | -90.2 | -74.3 | 114.3 | 285.0 | 462.7 | 132.1 | 318.4 | 512.1 | 57.9 | 194.9 | 337.2 | 213.8 | 451.7 | 703.5 | 124.3 | 252.4 | 384.5 | 287.6 | 513.9 | 760.5 | 307.0 | 570.2 | 842.5 |
| 1980/81 | -346.3 | -495.0 | -667.2 | -140.0 | -165.1 | -195.0 | -133.8 | -144.1 | -165.9 | -180.2 | -222.2 | -280.9 | 17.8 | 103.3 | 172.0 | -118.2 | -177.3 | -250.0 | 72.9 | 136.5 | 185.5 | 86.1 | 141.9 | 190.6 |
| 1981/82 | -416.3 | -606.4 | -825.7 | -219.0 | -293.3 | -379.7 | -200.2 | -258.0 | -323.8 | -245.7 | -333.3 | -434.7 | -58.9 | -28.6 | -10.1 | -187.5 | -292.0 | -415.3 | -5.4 | 2.3 | 0.2 | -0.3 | 11.5 | 14.7 |
| 1982/83 | -128.1 | -129.2 | -140.0 | 93.6 | 237.8 | 388.2 | 90.6 | 232.8 | 382.7 | 25.6 | 131.2 | 243.5 | 229.4 | 483.4 | 752.4 | 88.9 | 178.2 | 266.5 | 291.5 | 524.6 | 773.9 | 269.9 | 495.2 | 731.6 |
| 1983/84 | -179.2 | -219.8 | -271.9 | 42.2 | 149.0 | 249.7 | 49.2 | 151.6 | 264.0 | -11.0 | 57.6 | 124.5 | 174.5 | 378.3 | 588.3 | 49.6 | 104.8 | 156.3 | 237.5 | 427.0 | 608.1 | 257.3 | 455.6 | 654.2 |
| 1984/85 | -236.3 | -318.8 | -415.5 | -23.7 | 26.7 | 80.8 | -24.9 | 32.4 | 80.1 | -78.9 | -53.9 | -39.8 | 123.3 | 279.3 | 433.2 | -14.9 | -9.2 | -10.7 | 183.0 | 321.3 | 449.1 | 180.6 | 317.0 | 455.0 |
| 1985/86 | -52.3 | 7.3 | 72.2 | 174.8 | 398.6 | 640.6 | 172.6 | 391.9 | 633.6 | 102.6 | 276.3 | 462.5 | 271.9 | 569.7 | 888.3 | 163.3 | 323.7 | 491.5 | 348.9 | 642.7 | 959.3 | 350.7 | 649.0 | 970.2 |
| 1986/87 | -93.5 | -70.1 | -42.4 | 126.5 | 307.4 | 498.0 | 140.8 | 333.4 | 542.6 | 67.7 | 209.8 | 359.9 | 227.2 | 476.5 | 740.8 | 136.7 | 269.8 | 412.5 | 301.6 | 543.4 | 800.6 | 314.3 | 581.5 | 860.5 |
| 1987/88 | -497.2 | -732.4 | -1004.3 | -312.6 | -440.7 | -588.2 | -256.7 | -374.3 | -505.8 | -311.9 | -440.0 | -588.6 | -173.2 | -201.6 | -252.0 | -262.3 | -411.5 | -586.2 | -117.5 | -166.7 | -235.2 | -43.3 | -79.3 | -128.9 |
| 1988/89 | -598.1 | -884.6 | -1216.6 | -427.4 | -615.1 | -831.7 | -408.4 | -583.0 | -785.6 | -467.1 | -679.4 | -925.6 | -275.5 | -366.0 | -483.9 | -414.4 | -642.7 | -909.1 | -222.3 | -335.2 | -473.7 | -271.8 | -410.4 | -581.7 |
| 1989/90 | -320.6 | -455.0 | -608.7 | -128.8 | -146.8 | -170.0 | -110.7 | -101.8 | -116.1 | -148.4 | -173.0 | -200.9 | 10.5 | 91.4 | 156.4 | -84.4 | -126.4 | -177.2 | 65.4 | 124.9 | 170.3 | 104.4 | 185.7 | 255.1 |
| 1990/91 | -384.0 | -553.3 | -746.3 | -194.3 | -248.0 | -309.8 | -157.8 | -188.0 | -221.7 | -203.5 | -263.6 | -334.6 | -89.6 | -56.2 | -34.2 | -145.7 | -224.0 | -313.7 | -30.1 | -14.9 | -15.3 | 43.7 | 82.4 | 119.4 |
| 1991/92 | -305.0 | -432.2 | -577.0 | -109.3 | -113.3 | -119.9 | -105.3 | -99.2 | -107.0 | -152.5 | -175.9 | -211.5 | 44.3 | 141.8 | 228.5 | -90.2 | -131.9 | -187.2 | 99.3 | 177.1 | 238.9 | 98.9 | 174.8 | 241.1 |
| 1992/93 | -133.0 | -142.6 | -156.0 | 87.3 | 227.5 | 374.7 | 84.1 | 220.9 | 366.0 | 20.0 | 120.6 | 226.4 | 229.8 | 481.5 | 748.1 | 80.8 | 163.6 | 247.6 | 289.1 | 519.4 | 765.3 | 269.0 | 494.7 | 733.2 |
| 1993/94 | -177.9 | -220.7 | -269.1 | 34.3 | 132.5 | 238.0 | 29.3 | 131.8 | 232.9 | -26.9 | 38.5 | 103.3 | 177.9 | 378.4 | 586.3 | 34.5 | 82.2 | 128.9 | 237.9 | 423.6 | 604.8 | 227.4 | 399.6 | 573.1 |
| 1994/95 | -216.6 | -287.0 | -368.6 | -9.3 | 58.4 | 130.0 | -10.5 | 60.0 | 126.3 | -65.0 | -28.0 | 8.7 | 140.6 | 317.3 | 490.0 | -5.9 | 13.9 | 33.1 | 199.9 | 356.6 | 508.7 | 185.3 | 319.1 | 465.0 |
| 1995/96 | -191.1 | -243.7 | -310.8 | 20.1 | 107.6 | 194.8 | 18.5 | 107.8 | 193.8 | -33.8 | 18.8 | 70.7 | 167.4 | 360.8 | 557.3 | 29.9 | 62.8 | 99.9 | 227.9 | 396.7 | 576.9 | 221.7 | 380.7 | 544.3 |
| 1996/97 | -55.8 | -0.8 | 58.9 | 165.6 | 375.1 | 607.3 | 172.4 | 387.3 | 625.1 | 100.4 | 270.8 | 455.1 | 267.8 | 558.9 | 871.3 | 167.8 | 331.5 | 503.8 | 341.8 | 626.4 | 930.9 | 343.3 | 629.9 | 940.6 |
| 1997/98 | -33.8 | 40.5 | 123.9 | 199.5 | 441.3 | 709.2 | 204.8 | 451.6 | 730.8 | 125.4 | 320.0 | 534.1 | 296.7 | 620.6 | 968.3 | 192.1 | 380.6 | 578.2 | 373.5 | 692.0 | 1037.4 | 373.8 | 697.5 | 1048.6 |
| 1998/99 | -241.2 | -317.8 | -406.0 | -18.5 | 53.7 | 130.8 | 7.4 | 100.0 | 194.4 | -65.9 | -21.1 | 25.7 | 80.8 | 226.9 | 376.9 | -1.2 | 30.6 | 61.0 | 152.1 | 291.4 | 437.7 | 202.5 | 381.7 | 561.8 |
| 1999/00 | -150.2 | -172.8 | -198.6 | 60.9 | 181.6 | 302.1 | 57.4 | 178.4 | 297.4 | -0.6 | 84.0 | 167.3 | 205.1 | 432.8 | 671.2 | 60.4 | 128.3 | 195.8 | 266.4 | 469.4 | 684.5 | 242.3 | 442.1 | 652.1 |
| 2000/01 | -83.5 | -54.1 | -19.2 | 142.4 | 335.4 | 545.3 | 136.6 | 325.1 | 527.1 | 73.5 | 215.7 | 371.1 | 272.5 | 570.2 | 888.0 | 130.1 | 261.5 | 395.6 | 337.6 | 618.2 | 920.8 | 326.0 | 592.0 | 876.0 |
| 2001/02 | -143.0 | -147.9 | -155.3 | 92.7 | 248.2 | 413.4 | 98.8 | 260.8 | 432.3 | 31.6 | 150.1 | 274.9 | 199.6 | 428.9 | 671.9 | 98.7 | 207.8 | 318.0 | 270.2 | 492.1 | 720.8 | 281.0 | 521.0 | 777.2 |
| 2002/03 | -219.5 | -289.3 | -372.4 | -5.4 | 68.0 | 146.5 | 0.4 | 75.7 | 152.3 | -56.6 | -15.3 | 25.7 | 128.9 | 305.9 | 483.2 | 7.0 | 30.3 | 54.3 | 189.4 | 346.5 | 502.9 | 211.3 | 370.3 | 526.0 |
| 2003/04 | -579.4 | -861.7 | -1188.5 | -429.4 | -622.6 | -845.6 | -381.5 | -551.4 | -746.3 | -399.3 | -583.3 | -793.9 | -301.5 | -404.9 | -540.2 | -361.5 | -568.2 | -809.3 | -246.8 | -371.8 | -526.2 | -196.2 | -304.2 | -438.5 |
| 2004/05 | -45.0 | 19.0 | 86.8 | 189.8 | 422.7 | 679.6 | 183.8 | 411.8 | 668.5 | 110.9 | 290.7 | 491.8 | 305.2 | 636.0 | 990.9 | 170.8 | 337.6 | 513.3 | 379.2 | 703.9 | 1056.4 | 364.4 | 677.3 | 1017.0 |
| 2005/06 | 0.3 | 109.5 | 223.0 | 232.7 | 512.2 | 821.5 | 237.1 | 522.7 | 839.7 | 156.5 | 388.5 | 646.9 | 321.7 | 668.7 | 1041.1 | 228.5 | 452.6 | 701.5 | 401.2 | 748.0 | 1124.6 | 399.5 | 747.9 | 1128.0 |
| 2006/07 | -185.3 | -221.7 | -270.5 | 26.5 | 128.6 | 240.3 | 55.0 | 180.6 | 305.7 | -18.8 | 59.5 | 138.6 | 135.6 | 317.4 | 488.4 | 55.2 | 126.0 | 197.5 | 201.9 | 372.3 | 534.9 | 248.1 | 455.5 | 664.8 |
| 2007/08 | -24.2 | 59.6 | 148.2 | 202.0 | 446.2 | 714.9 | 207.6 | 458.1 | 738.7 | 133.0 | 333.7 | 553.5 | 297.2 | 620.8 | 968.4 | 200.7 | 395.3 | 599.5 | 373.0 | 692.7 | 1039.0 | 374.5 | 698.8 | 1050.5 |
| 2008/09 | -27.8 | 52.7 | 137.8 | 199.1 | 442.4 | 708.8 | 206.0 | 456.3 | 734.0 | 132.6 | 331.7 | 548.0 | 287.4 | 601.2 | 936.1 | 197.6 | 387.4 | 585.7 | 367.1 | 679.4 | 1016.6 | 367.9 | 686.1 | 1029.4 |
| 2009/10 | -48.4 | 17.7 | 87.8 | 181.0 | 409.8 | 656.6 | 188.1 | 423.3 | 683.2 | 109.9 | 294.7 | 493.2 | 280.6 | 586.0 | 912.8 | 177.5 | 353.3 | 540.8 | 357.9 | 657.7 | 982.4 | 356.5 | 660.9 | 989.6 |
| 2010/11 | 5.0 | 114.8 | 228.2 | 230.0 | 503.3 | 806.1 | 234.9 | 515.2 | 826.9 | 164.2 | 395.8 | 654.3 | 312.3 | 650.4 | 1013.3 | 233.6 | 458.8 | 707.6 | 394.3 | 734.7 | 1104.8 | 394.6 | 738.3 | 1111.1 |
| Average | -176.9 | -208.6 | -248.8 | 38.4 | 151.2 | 270.2 | 45.7 | 164.9 | 290.5 | -16.0 | 64.0 | 145.7 | 163.9 | 370.5 | 585.4 | 46.8 | 112.8 | 177.0 | 229.5 | 421.0 | 620.8 | 234.2 | 430.8 | 635.4 |

1

| Pathway | Pathway 4 | | | | | | | | | Pathway 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Development Plan | 6 | | | 15 | | | 12 | | | 5 | | | 14 | | |
| | K19/Gas31/750MW | | | K19/C25/750MW | | | K19/C31/750MW | | | K19/Gas25/750MW (WPS Sale & Inv) | | | K19/C25/750MW (WPS Sale & Inv) | | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| Flow Year | Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | |
| 1912/13 | 149.9 | 281.7 | 419.8 | 376.7 | 670.0 | 967.9 | 376.4 | 669.3 | 967.0 | 227.7 | 310.2 | 397.4 | 446.9 | 685.9 | 929.1 |
| 1913/14 | 130.5 | 240.0 | 357.3 | 357.7 | 636.0 | 915.8 | 357.8 | 636.1 | 916.5 | 204.3 | 268.1 | 331.2 | 427.6 | 650.8 | 878.5 |
| 1914/15 | 10.0 | 15.2 | 20.9 | 223.3 | 377.3 | 499.4 | 223.6 | 377.7 | 501.0 | 79.8 | 36.2 | -15.0 | 292.3 | 391.9 | 461.5 |
| 1915/16 | 86.2 | 157.7 | 224.4 | 302.2 | 518.0 | 738.2 | 302.4 | 518.3 | 738.8 | 159.8 | 179.5 | 196.0 | 371.0 | 531.8 | 698.1 |
| 1916/17 | 216.0 | 414.3 | 633.3 | 444.4 | 814.2 | 1209.1 | 444.4 | 814.2 | 1209.0 | 292.1 | 442.9 | 609.1 | 515.3 | 829.4 | 1170.8 |
| 1917/18 | 160.1 | 299.9 | 445.2 | 387.5 | 691.3 | 1004.6 | 387.2 | 690.7 | 1004.0 | 238.1 | 329.5 | 423.7 | 457.7 | 706.6 | 965.3 |
| 1918/19 | 47.9 | 85.1 | 125.8 | 267.4 | 458.6 | 635.6 | 267.6 | 459.5 | 636.8 | 119.3 | 111.1 | 87.7 | 336.8 | 473.2 | 593.4 |
| 1919/20 | -3.3 | -7.8 | -12.6 | 211.9 | 360.5 | 481.3 | 212.1 | 360.4 | 482.0 | 64.2 | 10.1 | -50.3 | 280.5 | 371.0 | 439.3 |
| 1920/21 | 45.2 | 82.3 | 119.4 | 263.2 | 451.5 | 617.4 | 263.5 | 452.1 | 619.0 | 116.1 | 106.3 | 83.0 | 332.3 | 465.5 | 576.9 |
| 1921/22 | 109.6 | 205.5 | 299.3 | 335.6 | 589.6 | 835.4 | 335.8 | 589.9 | 835.7 | 186.7 | 235.7 | 269.4 | 405.3 | 607.6 | 800.2 |
| 1922/23 | 61.0 | 109.1 | 158.7 | 271.1 | 474.6 | 662.3 | 270.8 | 474.4 | 662.7 | 135.6 | 134.0 | 128.5 | 338.5 | 486.3 | 625.0 |
| 1923/24 | 97.7 | 180.7 | 259.1 | 319.7 | 560.1 | 792.3 | 320.1 | 560.5 | 791.6 | 171.6 | 206.0 | 232.5 | 389.8 | 574.8 | 753.0 |
| 1924/25 | -33.7 | -56.9 | -89.5 | 189.1 | 313.7 | 418.1 | 189.4 | 314.2 | 418.6 | 36.4 | -33.4 | -121.8 | 253.3 | 321.1 | 379.4 |
| 1925/26 | 136.6 | 250.0 | 367.7 | 362.5 | 641.6 | 932.6 | 362.7 | 642.0 | 933.4 | 211.7 | 278.3 | 340.8 | 433.3 | 657.7 | 894.9 |
| 1926/27 | 102.2 | 191.2 | 279.6 | 326.6 | 571.1 | 816.6 | 326.7 | 570.9 | 816.0 | 177.5 | 217.2 | 254.5 | 398.1 | 589.2 | 781.1 |
| 1927/28 | 227.4 | 443.6 | 678.2 | 449.0 | 823.9 | 1224.3 | 449.0 | 823.8 | 1224.1 | 304.3 | 471.3 | 654.8 | 519.9 | 839.3 | 1185.4 |
| 1928/29 | 154.5 | 288.5 | 432.5 | 378.6 | 672.7 | 974.4 | 378.5 | 672.7 | 973.8 | 232.0 | 319.3 | 410.4 | 450.0 | 689.5 | 937.2 |
| 1929/30 | -137.6 | -223.5 | -326.3 | 66.8 | 117.9 | 154.4 | 67.2 | 118.6 | 155.3 | -79.5 | -217.7 | -379.8 | 131.6 | 125.0 | 107.1 |
| 1930/31 | -134.7 | -219.6 | -321.5 | 74.2 | 130.2 | 172.5 | 74.6 | 130.7 | 173.3 | -76.2 | -214.0 | -374.5 | 139.9 | 136.5 | 122.2 |
| 1931/32 | -158.0 | -258.2 | -376.6 | 48.5 | 85.6 | 107.9 | 48.6 | 86.2 | 108.8 | -100.8 | -253.4 | -431.4 | 114.6 | 94.3 | 61.4 |
| 1932/33 | -48.4 | -78.3 | -129.6 | 165.5 | 275.8 | 365.9 | 165.8 | 276.3 | 366.3 | 22.1 | -55.8 | -148.3 | 229.7 | 289.8 | 329.5 |
| 1933/34 | 9.5 | 12.7 | 14.0 | 226.7 | 382.6 | 508.1 | 226.6 | 382.8 | 509.0 | 80.1 | 36.2 | -14.9 | 295.9 | 396.3 | 473.3 |
| 1934/35 | 139.6 | 260.7 | 390.0 | 366.9 | 653.3 | 951.1 | 367.1 | 654.7 | 951.7 | 216.0 | 290.3 | 361.9 | 437.4 | 669.5 | 912.9 |
| 1935/36 | 125.8 | 238.1 | 356.1 | 355.0 | 631.0 | 915.2 | 355.2 | 631.4 | 916.0 | 203.6 | 266.7 | 330.8 | 425.7 | 645.7 | 877.9 |
| 1936/37 | -59.3 | -101.1 | -149.7 | 148.3 | 255.7 | 349.5 | 147.9 | 254.9 | 348.7 | 5.6 | -81.6 | -189.7 | 215.2 | 264.6 | 303.6 |
| 1937/38 | 1.0 | 7.4 | 7.9 | 218.7 | 372.2 | 500.8 | 218.8 | 372.5 | 500.8 | 72.8 | 24.7 | -27.0 | 288.2 | 388.2 | 461.8 |
| 1938/39 | -88.3 | -141.1 | -209.7 | 113.0 | 192.3 | 267.3 | 113.3 | 193.3 | 267.6 | -25.4 | -129.7 | -251.7 | 181.0 | 203.3 | 223.6 |
| 1939/40 | -252.5 | -409.1 | -590.8 | -70.2 | -102.7 | -159.3 | -69.6 | -102.0 | -158.3 | -195.9 | -405.8 | -648.4 | -6.3 | -96.9 | -210.0 |
| 1940/41 | -393.1 | -623.3 | -891.0 | -196.3 | -296.7 | -431.0 | -196.2 | -296.8 | -431.3 | -341.4 | -626.0 | -956.6 | -130.0 | -287.0 | -476.0 |
| 1941/42 | -315.3 | -505.1 | -725.2 | -134.6 | -200.3 | -296.7 | -131.4 | -196.4 | -291.7 | -242.5 | -477.8 | -750.2 | -67.0 | -189.4 | -340.3 |
| 1942/43 | 44.1 | 74.2 | 108.6 | 246.2 | 418.1 | 572.1 | 248.8 | 423.8 | 581.7 | 115.3 | 99.1 | 70.7 | 318.4 | 435.9 | 530.1 |
| 1943/44 | 90.0 | 167.5 | 240.5 | 311.3 | 539.2 | 768.0 | 311.1 | 540.4 | 767.9 | 163.9 | 192.1 | 213.1 | 380.4 | 554.8 | 726.9 |
| 1944/45 | 81.9 | 154.7 | 220.1 | 301.5 | 524.3 | 744.1 | 301.7 | 524.5 | 745.3 | 155.1 | 175.7 | 190.7 | 371.5 | 541.2 | 709.0 |
| 1945/46 | 126.0 | 244.9 | 369.9 | 360.4 | 646.3 | 935.4 | 360.7 | 646.7 | 936.0 | 201.9 | 268.5 | 335.6 | 430.3 | 661.2 | 898.3 |
| 1946/47 | 110.8 | 204.1 | 304.6 | 340.4 | 593.5 | 843.4 | 340.6 | 594.0 | 844.3 | 187.5 | 233.5 | 276.4 | 412.1 | 611.6 | 806.7 |
| 1947/48 | 166.2 | 318.5 | 482.4 | 399.1 | 719.7 | 1054.5 | 399.1 | 719.7 | 1054.5 | 241.1 | 345.9 | 457.5 | 469.5 | 735.1 | 1016.2 |
| 1948/49 | 104.9 | 199.7 | 299.8 | 314.3 | 561.1 | 791.1 | 314.0 | 560.9 | 788.9 | 179.5 | 224.5 | 271.8 | 384.1 | 576.2 | 748.7 |
| 1949/50 | 98.9 | 189.7 | 269.6 | 328.0 | 580.9 | 837.8 | 328.1 | 581.6 | 838.6 | 174.4 | 217.0 | 253.9 | 398.4 | 595.6 | 801.9 |
| 1950/51 | 189.5 | 372.2 | 571.4 | 427.1 | 779.5 | 1153.0 | 427.1 | 779.6 | 1153.1 | 266.4 | 400.9 | 547.6 | 497.7 | 795.8 | 1114.9 |
| 1951/52 | 207.7 | 398.2 | 604.5 | 436.7 | 797.1 | 1179.8 | 436.7 | 797.0 | 1179.7 | 285.1 | 429.2 | 584.9 | 507.8 | 813.1 | 1141.6 |
| 1952/53 | 98.3 | 180.6 | 259.5 | 323.1 | 560.5 | 789.3 | 322.7 | 560.4 | 788.6 | 175.8 | 210.2 | 237.3 | 392.7 | 575.9 | 752.7 |
| 1953/54 | 158.9 | 305.0 | 462.9 | 389.3 | 706.4 | 1032.3 | 389.6 | 706.9 | 1033.2 | 234.5 | 331.8 | 434.1 | 459.9 | 722.0 | 996.1 |
| 1954/55 | 222.7 | 427.5 | 650.2 | 457.4 | 839.8 | 1248.2 | 457.4 | 840.4 | 1249.0 | 300.1 | 453.7 | 624.2 | 528.1 | 854.6 | 1209.3 |
| 1955/56 | 178.5 | 348.4 | 531.4 | 399.7 | 725.7 | 1067.6 | 399.6 | 725.5 | 1067.9 | 256.8 | 378.8 | 511.2 | 470.6 | 741.4 | 1030.3 |
| 1956/57 | 128.4 | 244.2 | 367.1 | 360.1 | 635.6 | 915.9 | 359.8 | 635.8 | 915.9 | 202.7 | 268.7 | 337.6 | 429.9 | 649.9 | 875.9 |
| 1957/58 | 86.9 | 165.4 | 242.9 | 304.2 | 535.3 | 751.0 | 304.0 | 535.7 | 751.1 | 161.3 | 191.1 | 212.0 | 374.7 | 550.0 | 710.1 |
| 1958/59 | -37.4 | -64.0 | -103.4 | 176.4 | 293.1 | 390.2 | 176.7 | 293.5 | 390.8 | 31.4 | -41.4 | -126.0 | 240.7 | 299.4 | 346.6 |
| 1959/60 | 183.9 | 359.3 | 549.8 | 426.6 | 777.9 | 1153.1 | 426.8 | 778.2 | 1153.6 | 259.6 | 386.5 | 524.9 | 497.7 | 794.0 | 1114.9 |
| 1960/61 | 24.3 | 43.1 | 61.7 | 241.2 | 420.4 | 573.8 | 240.5 | 419.4 | 572.8 | 100.9 | 74.4 | 43.9 | 306.3 | 428.9 | 535.3 |

1

| Pathway | Pathway 4 | | | | | | | | | Pathway 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Development Plan | 6 | | | 15 | | | 12 | | | 5 | | | 14 | | |
| | K19/Gas31/750MW | | | K19/C25/750MW | | | K19/C31/750MW | | | K19/Gas25/750MW (WPS Sale & Inv) | | | K19/C25/750MW (WPS Sale & Inv) | | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| Flow Year | Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | |
| 1961/62 | -324.1 | -513.1 | -733.8 | -118.3 | -172.1 | -253.9 | -118.3 | -172.1 | -254.0 | -273.2 | -518.1 | -803.2 | -53.5 | -165.4 | -303.2 |
| 1962/63 | 110.1 | 206.9 | 308.5 | 339.0 | 600.9 | 865.1 | 339.9 | 602.1 | 867.6 | 190.0 | 245.1 | 295.0 | 409.9 | 615.4 | 827.9 |
| 1963/64 | 95.7 | 178.4 | 266.1 | 316.5 | 555.8 | 792.0 | 316.4 | 556.0 | 792.0 | 172.0 | 206.1 | 237.4 | 386.7 | 569.1 | 750.5 |
| 1964/65 | 114.6 | 216.6 | 311.8 | 338.5 | 601.1 | 852.9 | 338.6 | 601.9 | 855.6 | 191.3 | 243.3 | 286.3 | 409.8 | 616.9 | 820.4 |
| 1965/66 | 224.7 | 436.2 | 666.9 | 452.2 | 833.2 | 1240.7 | 452.2 | 833.1 | 1240.5 | 302.0 | 464.5 | 645.2 | 522.5 | 847.9 | 1201.5 |
| 1966/67 | 188.5 | 367.0 | 564.4 | 420.1 | 767.7 | 1134.8 | 420.1 | 767.2 | 1134.7 | 265.2 | 397.5 | 544.0 | 491.1 | 783.5 | 1096.8 |
| 1967/68 | 110.4 | 204.5 | 310.8 | 330.3 | 579.8 | 828.7 | 329.7 | 578.9 | 826.4 | 186.6 | 231.7 | 283.0 | 398.5 | 593.2 | 787.4 |
| 1968/69 | 163.0 | 321.8 | 492.2 | 406.0 | 740.1 | 1095.6 | 406.3 | 740.7 | 1096.4 | 239.2 | 350.4 | 467.5 | 476.7 | 755.7 | 1057.4 |
| 1969/70 | 229.5 | 444.5 | 677.7 | 456.9 | 841.1 | 1251.7 | 456.9 | 841.0 | 1251.5 | 306.8 | 472.7 | 654.9 | 527.6 | 856.6 | 1213.4 |
| 1970/71 | 210.2 | 411.2 | 631.4 | 439.1 | 804.9 | 1194.4 | 438.9 | 804.9 | 1194.2 | 287.3 | 441.5 | 610.4 | 510.0 | 820.8 | 1156.4 |
| 1971/72 | 196.2 | 375.5 | 566.7 | 431.7 | 794.1 | 1178.8 | 431.7 | 794.0 | 1178.7 | 273.8 | 405.0 | 545.9 | 502.1 | 809.4 | 1140.1 |
| 1972/73 | 151.4 | 293.7 | 435.9 | 367.4 | 656.6 | 956.4 | 367.2 | 655.9 | 955.3 | 229.9 | 324.9 | 416.0 | 438.5 | 672.9 | 916.1 |
| 1973/74 | 112.9 | 208.6 | 303.1 | 341.7 | 597.3 | 852.9 | 342.0 | 598.6 | 853.6 | 189.8 | 237.0 | 275.3 | 413.2 | 614.0 | 816.7 |
| 1974/75 | 204.9 | 400.6 | 612.6 | 431.6 | 789.8 | 1170.0 | 431.5 | 790.4 | 1169.8 | 281.6 | 430.3 | 591.6 | 502.5 | 805.7 | 1131.5 |
| 1975/76 | 192.5 | 373.8 | 571.7 | 415.6 | 760.3 | 1119.3 | 415.6 | 760.2 | 1119.2 | 271.0 | 405.5 | 551.4 | 486.4 | 775.8 | 1082.7 |
| 1976/77 | -181.7 | -289.3 | -413.1 | 24.9 | 67.4 | 89.3 | 25.0 | 67.3 | 89.1 | -108.3 | -261.2 | -442.0 | 92.5 | 79.7 | 45.6 |
| 1977/78 | -33.6 | -59.2 | -85.0 | 177.4 | 295.9 | 390.3 | 175.8 | 292.5 | 384.5 | 36.9 | -32.8 | -121.2 | 243.3 | 302.4 | 347.9 |
| 1978/79 | 146.0 | 278.7 | 419.0 | 381.2 | 682.5 | 996.9 | 381.5 | 683.4 | 998.0 | 222.7 | 306.6 | 391.6 | 452.0 | 699.0 | 958.3 |
| 1979/80 | 130.2 | 254.0 | 386.0 | 346.0 | 613.6 | 887.3 | 345.4 | 613.1 | 885.9 | 207.9 | 280.7 | 366.5 | 414.7 | 626.8 | 844.4 |
| 1980/81 | -94.9 | -156.5 | -230.5 | 116.2 | 200.4 | 261.6 | 116.5 | 201.0 | 262.7 | -28.7 | -139.0 | -268.9 | 180.7 | 207.8 | 226.7 |
| 1981/82 | -165.0 | -269.9 | -392.6 | 36.0 | 64.4 | 77.2 | 36.4 | 65.0 | 78.2 | -110.0 | -270.0 | -455.9 | 99.4 | 69.0 | 24.6 |
| 1982/83 | 108.7 | 200.1 | 297.0 | 337.0 | 594.6 | 848.3 | 337.1 | 595.8 | 849.4 | 183.2 | 226.8 | 267.1 | 407.4 | 612.4 | 814.6 |
| 1983/84 | 63.1 | 119.5 | 175.6 | 283.4 | 497.2 | 693.7 | 283.3 | 497.4 | 692.5 | 137.9 | 146.2 | 147.4 | 350.8 | 511.9 | 653.7 |
| 1984/85 | 8.4 | 18.0 | 28.3 | 222.9 | 382.8 | 523.0 | 223.2 | 383.6 | 523.9 | 80.3 | 39.0 | -7.6 | 291.2 | 396.1 | 483.7 |
| 1985/86 | 174.7 | 343.0 | 523.2 | 413.3 | 757.0 | 1118.7 | 413.4 | 757.2 | 1119.1 | 252.4 | 374.2 | 504.8 | 484.0 | 772.4 | 1082.8 |
| 1986/87 | 140.4 | 268.2 | 406.6 | 357.9 | 636.6 | 920.1 | 357.6 | 636.6 | 918.9 | 217.6 | 300.5 | 385.6 | 429.6 | 652.7 | 880.5 |
| 1987/88 | -254.9 | -409.6 | -590.6 | -77.9 | -107.1 | -161.5 | -78.3 | -107.7 | -162.2 | -194.4 | -400.8 | -641.0 | -13.9 | -101.9 | -212.6 |
| 1988/89 | -382.1 | -605.9 | -866.2 | -179.5 | -271.6 | -395.2 | -179.5 | -271.7 | -395.6 | -328.3 | -605.5 | -927.6 | -113.4 | -261.5 | -439.6 |
| 1989/90 | -95.0 | -151.9 | -222.4 | 101.0 | 177.8 | 236.6 | 101.8 | 179.2 | 237.4 | -18.6 | -119.0 | -239.1 | 167.8 | 189.6 | 193.9 |
| 1990/91 | -158.8 | -249.6 | -356.7 | 8.8 | 43.4 | 61.3 | 7.7 | 42.3 | 59.1 | -93.0 | -237.4 | -401.6 | 76.4 | 53.5 | 16.9 |
| 1991/92 | -61.7 | -99.2 | -154.8 | 142.7 | 241.3 | 317.1 | 142.8 | 241.5 | 317.7 | 5.5 | -84.1 | -193.9 | 207.4 | 252.3 | 275.5 |
| 1992/93 | 96.7 | 185.8 | 269.3 | 327.9 | 579.7 | 830.5 | 328.4 | 580.4 | 831.2 | 172.2 | 211.8 | 241.5 | 399.5 | 597.1 | 793.9 |
| 1993/94 | 62.2 | 116.6 | 168.0 | 282.1 | 491.8 | 691.7 | 282.4 | 492.8 | 690.8 | 135.9 | 137.9 | 135.7 | 353.1 | 509.1 | 654.4 |
| 1994/95 | 26.0 | 49.5 | 73.3 | 247.5 | 425.6 | 588.3 | 247.8 | 426.1 | 587.9 | 96.4 | 67.6 | 37.8 | 314.5 | 435.3 | 544.1 |
| 1995/96 | 53.7 | 89.1 | 131.0 | 267.8 | 463.0 | 638.1 | 267.9 | 463.2 | 638.5 | 126.2 | 109.4 | 96.9 | 338.2 | 477.8 | 596.7 |
| 1996/97 | 174.6 | 341.2 | 520.7 | 401.1 | 726.9 | 1073.4 | 401.0 | 726.8 | 1073.3 | 253.6 | 373.3 | 500.7 | 472.2 | 743.1 | 1036.7 |
| 1997/98 | 198.7 | 388.1 | 593.7 | 434.4 | 797.0 | 1183.9 | 434.4 | 796.9 | 1183.7 | 275.7 | 417.7 | 572.9 | 505.1 | 812.4 | 1145.6 |
| 1998/99 | -5.2 | 10.8 | 21.3 | 204.9 | 369.4 | 537.1 | 204.3 | 369.1 | 535.6 | 62.1 | 28.9 | -16.3 | 272.2 | 381.0 | 490.9 |
| 1999/00 | 84.7 | 159.3 | 230.3 | 311.8 | 534.7 | 756.8 | 312.0 | 535.0 | 756.7 | 160.0 | 187.2 | 204.6 | 381.0 | 552.8 | 719.7 |
| 2000/01 | 146.3 | 288.2 | 437.1 | 382.9 | 696.2 | 1022.9 | 383.1 | 696.7 | 1023.6 | 222.7 | 313.7 | 411.9 | 453.2 | 711.4 | 986.8 |
| 2001/02 | 103.4 | 207.4 | 322.8 | 324.8 | 582.9 | 838.1 | 324.4 | 582.3 | 837.7 | 178.7 | 234.6 | 294.7 | 392.3 | 595.2 | 797.6 |
| 2002/03 | 19.4 | 42.1 | 61.6 | 231.7 | 410.4 | 585.7 | 231.2 | 410.3 | 586.5 | 95.1 | 68.9 | 37.1 | 298.8 | 420.5 | 547.0 |
| 2003/04 | -355.1 | -568.2 | -816.2 | -204.2 | -308.1 | -447.4 | -203.7 | -307.5 | -446.7 | -302.2 | -568.7 | -878.7 | -138.6 | -299.9 | -494.5 |
| 2004/05 | 182.5 | 357.8 | 545.5 | 427.8 | 785.4 | 1167.5 | 428.1 | 785.8 | 1168.1 | 258.1 | 384.0 | 518.4 | 498.5 | 800.3 | 1128.4 |
| 2005/06 | 235.9 | 468.9 | 722.3 | 472.0 | 875.5 | 1307.7 | 472.0 | 875.4 | 1307.6 | 312.2 | 496.5 | 696.1 | 542.3 | 890.1 | 1269.0 |
| 2006/07 | 49.9 | 98.9 | 157.8 | 257.7 | 455.4 | 644.9 | 257.1 | 454.2 | 642.2 | 128.7 | 137.0 | 141.5 | 323.4 | 463.1 | 601.5 |
| 2007/08 | 206.8 | 402.1 | 614.4 | 435.9 | 800.9 | 1189.3 | 435.8 | 800.8 | 1189.3 | 283.9 | 433.4 | 594.6 | 506.6 | 816.3 | 1150.9 |
| 2008/09 | 202.3 | 390.1 | 594.3 | 438.1 | 803.4 | 1192.7 | 438.1 | 803.3 | 1192.5 | 280.3 | 420.8 | 573.9 | 509.2 | 819.1 | 1154.1 |
| 2009/10 | 183.5 | 364.0 | 562.5 | 420.1 | 767.0 | 1132.2 | 420.1 | 767.0 | 1132.0 | 261.0 | 393.8 | 538.9 | 490.9 | 783.2 | 1094.2 |
| 2010/11 | 242.3 | 472.9 | 725.7 | 472.5 | 873.2 | 1303.9 | 472.4 | 873.1 | 1303.8 | 319.4 | 500.1 | 699.1 | 542.7 | 887.8 | 1265.2 |
| Average | 59.4 | 125.8 | 193.0 | 278.7 | 500.3 | 720.3 | 278.7 | 500.6 | 720.5 | 132.2 | 149.8 | 162.8 | 347.7 | 513.9 | 680.4 |

1

# TAB 7

that second category that I talked about, put it through the filter, it -- it was economic. So we called that Level 2 because Level 1 was economic based on our assessment, Level 2 was economic, and Level 3 wasn't. And we provided that to our integrated resource planning staff for assessment, and they're undertaking that assessment.

So this graph here shows you the high-level estimate of what the energy savings we thought we could potentially achieve. Again, this was a very high-level estimate, and so I caution you to use it in that regard -- or in -- taking that into account.

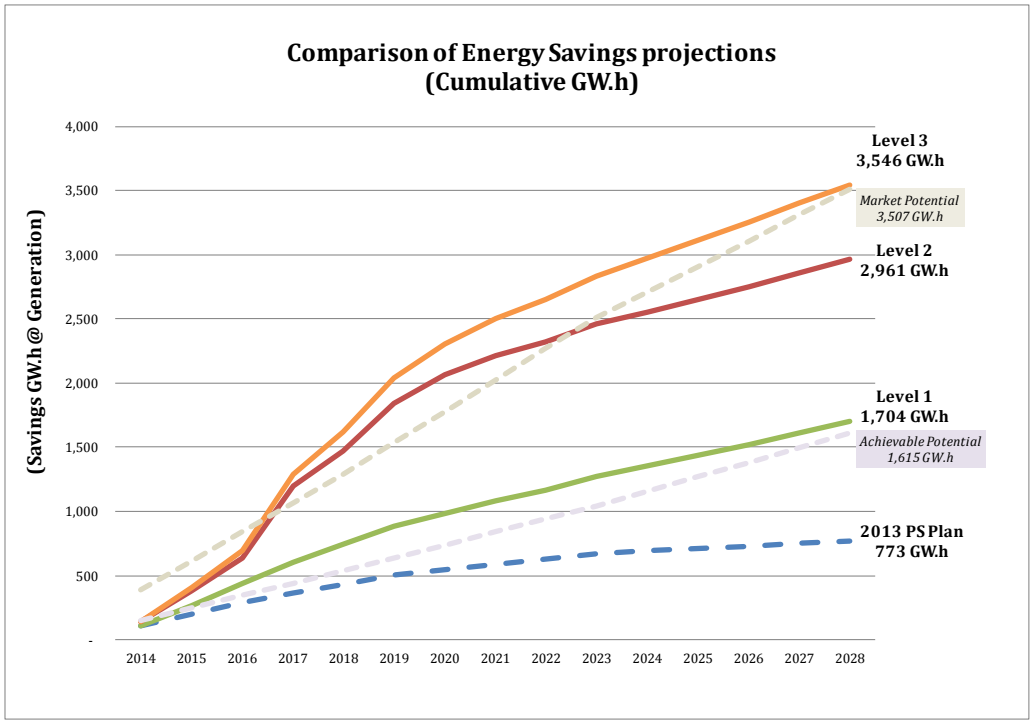
And my last point would be that our 2014 Power Smart Plan that we're currently working on updating will be different than any of those levels, which brings us to what can I tell you about our 2014 DSM Plan.

You can expect most programs identified in DSM Option 1 will be pursued. Not all, but there'll be modifications.

Level 2 DSM initiatives required broader consideration. Load displacement looks promising, I would say. Energy conservation rates need to be thought through carefully. They also require the Public Utility Board approval. And I'm

Demand Response was investigated as a DSM opportunity but not actively pursued beyond the present Curtailable Rates Program offering as Manitoba Hydro's focus under the present plan is on relieving energy constraints rather than capacity constraints, which is the primary benefit of demand response initiatives. The rationale behind this decision is provided in the response to Information Request CAC-GAC/MH I-30b.

The following figure presents the energy savings projections under the three levels of enhanced DSM in comparison to the 2013 Power Smart Plan and the Market and Achievable Potentials identified in the DSM Potential Study.




Level 1 DSM represents approximately 2.2 times the level of savings identified under the 2013 Power Smart Plan and is in line with the Achievable Potential identified under the DSM Potential Study.

Level 2 DSM, which includes conservation rates, fuel switching and load displacement, represents approximately 3.8 times the level of savings identified under the 2013 Power Smart Plan.

Level 3 DSM and including Level 2 DSM represents approximately 4.6 times the savings outlined under the 2013 Power Smart Plan.

# TAB 8

SUBJECT:

REFERENCE: Page 13

QUESTION:

**Please provide references in literature or documents produced by Hydro Quebec or the Quebec government that support Mr. Dunsky's assertion that Hydro Quebec was "overcommitting on new supply and failing to pull back from those commitments when evidence abounded that anticipated load growth would fail to materialize". Please also confirm that the DSM programs being referred to reflect a cost of 3 cents/kW.h excluding the impacts of lost domestic revenues. Please confirm that in an environment of surplus energy, pursuing DSM at 3 cents/kW.h plus an additional lost revenue, for the purposes of exporting the surplus for 3 to 3.5 cents/kW.h would be economically inefficient.**

RESPONSE:

**There are three parts to this question:**

(1) **See testimony of Thierry Vandal, CEO of Hydro-Quebec, before a Parliamentary Commission held in February, 2013. At the time, Mr. Vandal explained that as the economic crisis hit parts of Quebec's industrial loads in 2008-2009 and demand dropped significantly (by 10 TWh year-over-year), the utility, under political pressure to create jobs, continued to commit to additional supply resources despite clear knowledge that the supply was not needed, and that export prices would be well below cost. There is now debate on the extent of the cost of these surpluses, which some peg at approximately $1.25 billion/year over the coming 14 years.**

**Interestingly, a situation even more analogous to Manitoba is <u>currently</u> playing out in Quebec, where despite the large surpluses (75 TWh cumulative, according to Hydro-Quebec; up**

**to 169 TWh according to other analysts), the utility is pursuing construction of a previously-committed $6.5B hydropower project, La Romaine, and its associated $1B transmission line, while forecasting export prices of only 4¢/kWh in the coming years. In the meantime, the Quebec government has announced that it will offer at least 50 TWh of the surpluses to new customers at considerably below cost; to date, offers have been reported in the range of 3 to 3.5¢/kWh. The supply itself cost approximately 10¢/kWh.**

(2) **The DSM programs being referred to reflect a cost to procure saved energy of 3¢/kWh. This cost of course does not reflect Hydro's lost revenue, i.e. customers' direct bill savings.**

(3) **Pursuing domestic DSM at 3¢/kWh and exporting the freed up power at 3.5¢/kWh would be economically efficient for the province, notwithstanding any more advantageous options. Lost revenue from domestic sales, it should be noted, is an economic transfer -- a cost to the utility that is fully offset by a corresponding benefit to participating Manitoban ratepayers. Furthermore, from a broad economic standpoint, studies have typically found that savings from DSM generate more employment and greater economic activity, including GDP and fiscal revenue, than they offset from deferred investments in generation (and related areas). If this holds true for Manitoba, then the net economic efficiency of the scenario for the province would only increase.**

**It may be noteworthy that the Government of Canada recently commissioned a study of the macroeconomic impact of energy efficiency, including on GDP, employment and tax revenue; we anticipate that results for the Province of Manitoba will be published shortly.**

# TAB 9

| Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pathway | Pathway 1 | | | | | | | | | Pathway 2 | | | | | | Pathway 3 | | |
| Development Plan | 1 | | | 7 | | | 8 | | | 2 | | | 10 | | | 4 | | |
| | All Gas | | | SCGT/C26 | | | CCGT/C26 | | | K22/Gas | | | K22/C29 | | | K19/Gas24/250MW | | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| 1987/88 | (497.2) | (732.4) | (1,004.3) | (312.6) | (440.7) | (588.2) | (256.7) | (374.3) | (505.8) | (311.9) | (440.0) | (588.6) | (173.2) | (201.6) | (252.0) | (262.3) | (411.5) | (586.2) |
| 1988/89 | (598.1) | (884.6) | (1,216.6) | (427.4) | (615.1) | (831.7) | (408.4) | (583.0) | (785.6) | (467.1) | (679.4) | (925.6) | (275.5) | (366.0) | (483.9) | (414.4) | (642.7) | (909.1) |
| 1989/90 | (320.6) | (455.0) | (608.7) | (128.8) | (146.8) | (170.0) | (110.7) | (101.8) | (116.1) | (148.4) | (173.0) | (200.9) | 10.5 | 91.4 | 156.4 | (84.4) | (126.4) | (177.2) |
| 1990/91 | (384.0) | (553.3) | (746.3) | (194.3) | (248.0) | (309.8) | (157.8) | (188.0) | (221.7) | (203.5) | (263.6) | (334.6) | (89.6) | (56.2) | (34.2) | (145.7) | (224.0) | (313.7) |
| 1991/92 | (305.0) | (432.2) | (577.0) | (109.3) | (113.3) | (119.9) | (105.3) | (99.2) | (107.0) | (152.5) | (175.9) | (211.5) | 44.3 | 141.8 | 228.5 | (90.2) | (131.9) | (187.2) |

| 2034/35 (99-Year) Average Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | (176.9) | (208.6) | (248.8) | 38.4 | 151.2 | 270.2 | 45.7 | 164.9 | 290.5 | (16.0) | 64.0 | 145.7 | 163.9 | 370.5 | 585.4 | 46.8 | 112.8 | 177.0 |

| 2034/35 Net Revenue Less Average Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987/88 | (320.3) | (523.8) | (755.5) | (351.0) | (591.8) | (858.4) | (302.5) | (539.2) | (796.3) | (295.9) | (504.0) | (734.3) | (337.1) | (572.1) | (837.3) | (309.0) | (524.3) | (763.2) |
| 1988/89 | (421.2) | (676.0) | (967.8) | (465.8) | (766.3) | (1,101.9) | (454.1) | (748.0) | (1,076.1) | (451.1) | (743.4) | (1,071.3) | (439.4) | (736.5) | (1,069.2) | (461.2) | (755.5) | (1,086.1) |
| 1989/90 | (143.7) | (246.4) | (359.9) | (167.2) | (297.9) | (440.2) | (156.5) | (266.7) | (406.6) | (132.4) | (236.9) | (346.6) | (153.4) | (279.1) | (429.0) | (131.2) | (239.2) | (354.2) |
| 1990/91 | (207.1) | (344.7) | (497.5) | (232.7) | (399.2) | (580.0) | (203.5) | (352.9) | (512.2) | (187.5) | (327.6) | (480.3) | (253.5) | (426.7) | (619.6) | (192.5) | (336.7) | (490.7) |
| 1991/92 | (128.0) | (223.6) | (328.2) | (147.7) | (264.4) | (390.1) | (151.0) | (264.2) | (397.5) | (136.5) | (239.8) | (357.2) | (119.6) | (228.7) | (356.9) | (137.0) | (244.7) | (364.2) |

| Fiscal Year 2034/35 Total Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Low | (1,220.2) | | | (1,364.5) | | | (1,267.5) | | | (1,203.4) | | | (1,303.0) | | | (1,231.0) | | |
| Total Ref | | (2,014.6) | | | (2,319.7) | | | (2,171.0) | | | (2,051.7) | | | (2,243.2) | | | (2,100.3) | |
| Total High | | | (2,909.0) | | | (3,370.5) | | | (3,188.6) | | | (2,989.8) | | | (3,312.1) | | | (3,058.4) |

| Percentage Change from All Gas Plan (Plan 1) for Fiscal Year 2034/35 Total Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Low | 0% | | | 12% | | | 4% | | | -1% | | | 7% | | | 1% | | |
| Total Ref | | 0% | | | 15% | | | 8% | | | 2% | | | 11% | | | 4% | |
| Total High | | | 0% | | | 16% | | | 10% | | | 3% | | | 14% | | | 5% |

| Fiscal Year 2034/35 Net Revenue (Millions of 2014 dollars) - 5 Year Drought Continued | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pathway | Pathway 3 | | | | | | Pathway 4 | | | | | | | | | Pathway 5 | | | | |
| Development Plan | 13 | | | 11 | | | 6 | | | 15 | | | 12 | | | 5 | | | 14 | |
| | K19/C25/250MW | | | K19/C31/250MW | | | K19/Gas31/750MW | | | K19/C25/750MW | | | K19/C31/750MW | | | K19/Gas25/750MW | | | K19/C25/750MW | |
| Energy Prices | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High | Low | Ref | High |
| 1987/88 | (117.5) | (166.7) | (235.2) | (43.3) | (79.3) | (128.9) | (254.9) | (409.6) | (590.6) | (77.9) | (107.1) | (161.5) | (78.3) | (107.7) | (162.2) | (194.4) | (400.8) | (641.0) | (13.9) | (101.9) | (212.6) |
| 1988/89 | (222.3) | (335.2) | (473.7) | (271.8) | (410.4) | (581.7) | (382.1) | (605.9) | (866.2) | (179.5) | (271.6) | (395.2) | (179.5) | (271.7) | (395.6) | (328.3) | (605.5) | (927.6) | (113.4) | (261.5) | (439.6) |
| 1989/90 | 65.4 | 124.9 | 170.3 | 104.4 | 185.7 | 255.1 | (95.0) | (151.9) | (222.4) | 101.0 | 177.8 | 236.6 | 101.8 | 179.2 | 237.4 | (18.6) | (119.0) | (239.1) | 167.8 | 189.6 | 193.9 |
| 1990/91 | (30.1) | (14.9) | (15.3) | 43.7 | 82.4 | 119.4 | (158.8) | (249.6) | (356.7) | 8.8 | 43.4 | 61.3 | 7.7 | 42.3 | 59.1 | (93.0) | (237.4) | (401.6) | 76.4 | 53.5 | 16.9 |
| 1991/92 | 99.3 | 177.1 | 238.9 | 98.9 | 174.8 | 241.1 | (61.7) | (99.2) | (154.8) | 142.7 | 241.3 | 317.1 | 142.8 | 241.5 | 317.7 | 5.5 | (84.1) | (193.9) | 207.4 | 252.3 | 275.5 |

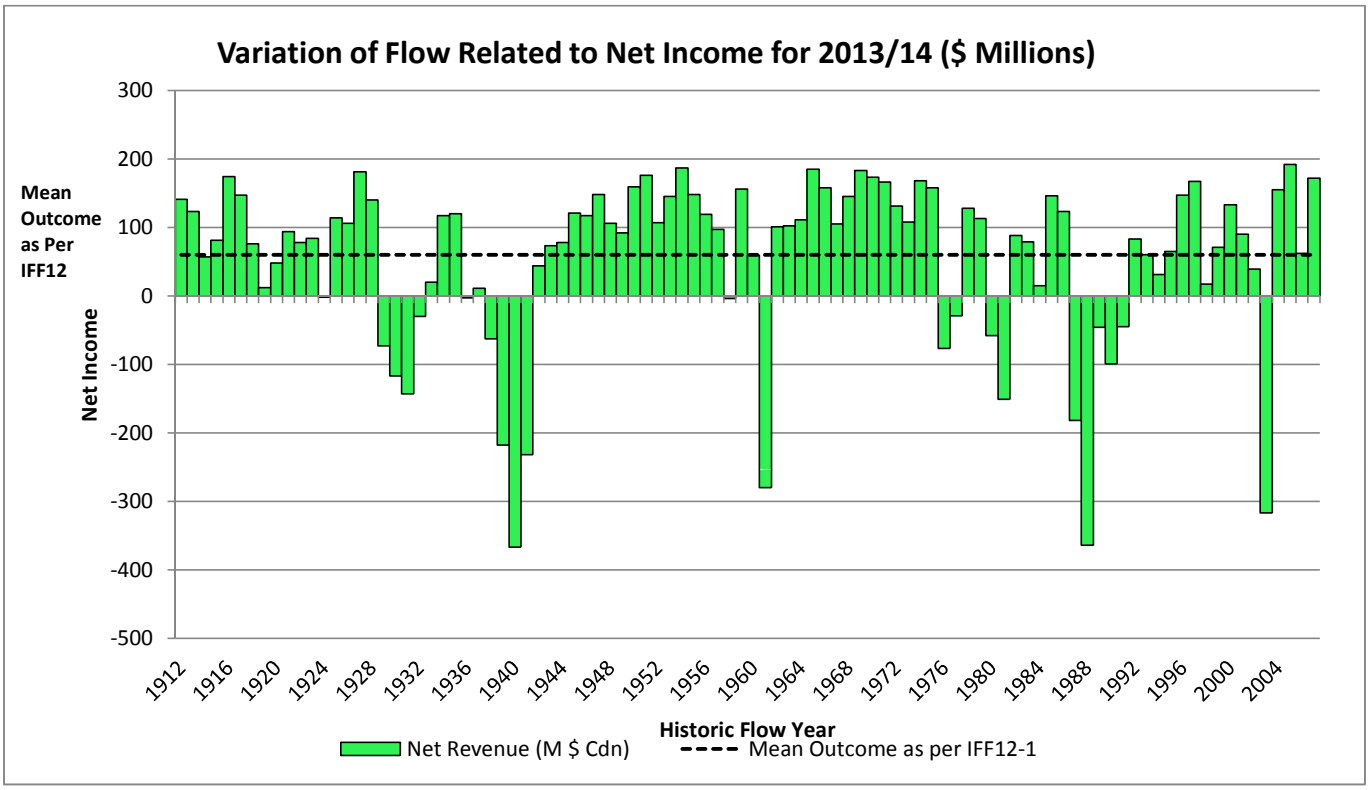
| 2034/35 (99-Year) Average Net Revenue (Millions of 2014 dollars) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 229.5 | 421.0 | 620.8 | 234.2 | 430.8 | 635.4 | 59.4 | 125.8 | 193.0 | 278.7 | 500.3 | 720.3 | 278.7 | 500.6 | 720.5 | 132.2 | 149.8 | 162.8 | 347.7 | 513.9 | 680.4 |

| 2034/35 Net Revenue Less Average Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987/88 | (347.0) | (587.7) | (856.0) | (277.5) | (510.1) | (764.3) | (314.4) | (535.4) | (783.6) | (356.5) | (607.5) | (881.9) | (357.1) | (608.2) | (882.8) | (326.6) | (550.6) | (803.8) | (361.6) | (615.9) | (892.9) |
| 1988/89 | (451.7) | (756.2) | (1,094.5) | (506.0) | (841.1) | (1,217.1) | (441.5) | (731.7) | (1,059.2) | (458.2) | (771.9) | (1,115.6) | (458.3) | (772.3) | (1,116.1) | (460.5) | (755.3) | (1,090.4) | (461.1) | (775.4) | (1,120.0) |
| 1989/90 | (164.0) | (296.1) | (450.5) | (129.8) | (245.1) | (380.3) | (154.4) | (277.7) | (415.4) | (177.6) | (322.6) | (483.7) | (177.0) | (321.4) | (483.1) | (150.8) | (268.8) | (401.9) | (179.9) | (324.3) | (486.5) |
| 1990/91 | (259.5) | (435.9) | (636.1) | (190.5) | (348.3) | (516.0) | (218.2) | (375.4) | (549.7) | (269.9) | (457.0) | (659.0) | (271.0) | (458.3) | (661.5) | (225.1) | (387.2) | (564.4) | (271.3) | (460.4) | (663.5) |
| 1991/92 | (130.1) | (243.9) | (381.9) | (135.3) | (256.0) | (394.4) | (121.2) | (225.0) | (347.8) | (136.0) | (259.1) | (403.2) | (135.9) | (259.1) | (402.8) | (126.7) | (233.9) | (356.8) | (140.3) | (261.6) | (404.9) |

| Fiscal Year 2034/35 Total Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Low | (1,352.4) | | | (1,239.1) | | | (1,249.8) | | | (1,398.2) | | | (1,399.3) | | | (1,289.7) | | | (1,414.3) | |
| Total Ref | | (2,319.9) | | | (2,200.6) | | | (2,145.1) | | | (2,418.0) | | | (2,419.3) | | | (2,195.7) | | | (2,437.6) | |
| Total High | | | (3,419.0) | | | (3,272.1) | | | (3,155.7) | | | (3,543.3) | | | (3,546.4) | | | (3,217.3) | | | (3,567.8) |

| Percentage Change from All Gas Plan (Plan 1) for Fiscal Year 2034/35 Total Net Revenue (Millions of 2014 dollars) - 5 Year Drought | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Low | 11% | | | 2% | | | 2% | | | 15% | | | 15% | | | 6% | | | 16% | |
| Total Ref | | 15% | | | 9% | | | 6% | | | 20% | | | 20% | | | 9% | | | 21% | |
| Total High | | | 18% | | | 12% | | | 8% | | | 22% | | | 22% | | | 11% | | | 23% |

Data taken from MIPUG/MH I-007(a) from NFAT Hearing


Variation of Flow Related to Net Income for 2013/14 ($ Millions)
Mean Outcome as Per IFF12
Net Income
300
200
100
0
-100
-200
-300
-400
-500
1912
1916
1920
1924
1928
1932
1936
1940
1944
1948
1952
1956
1960
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
2004
Historic Flow Year
Net Revenue (M $ Cdn)
Mean Outcome as per IFF12-1

**MIPUG/MH I-35 (Revised based on IFF12)**

**Subject: PUB/MH I-81(a) from 2010 GRA: Energy Supply**

**a) Please file an updated version of the schedule provided in PUB/MH I-81(a) from the 2010 GRA and explain fully the derivation of the "net revenue" column, what is included in the calculations, and how these values are incorporated into IFF forecasts.**

**ANSWER:**

The attached table contains the net revenue for the load year 2014/15 for the entire 99 flow history (1912/13 to 2010/11, inclusive). This update is based on the 2012 Load Forecast and the 2012 forecast of export and import prices as well as all other updates for the 2012 IFF.

The net revenue represents the revenues minus costs. Revenues are inclusive of firm and opportunity export sales and transmission inter-connection revenues. Costs are inclusive of water rentals for Manitoba Hydro hydraulic energy generation, costs of Manitoba Hydro thermal generation, import and wind energy purchases, and transmission inter-connection costs.

The revenues and costs are reflected in Manitoba Hydro's Integrated Financial Forecast Statement of Income. Revenues are reflected in the Extra-provincial Revenue, while the costs are reflected in the Water Rentals & Assessments and the Fuel & Power Purchased.

| Flow Year | Annual System Inflow | MH Hydraulic Energy | Net Revenue | Variation of Net Revenue from Average |
|---|---|---|---|---|
| | Kcfs | (GW.h/yr) | (M $Cdn) | (M $Cdn) |
| 1912 | 112 | 33490 | 141 | 82 |
| 1913 | 119 | 32527 | 123 | 64 |
| 1914 | 98 | 29371 | 57 | -2 |
| 1915 | 105 | 30480 | 81 | 22 |
| 1916 | 136 | 35650 | 174 | 115 |
| 1917 | 119 | 33787 | 147 | 88 |
| 1918 | 105 | 30306 | 76 | 17 |
| 1919 | 98 | 27787 | 12 | -47 |
| 1920 | 103 | 29187 | 48 | -11 |
| 1921 | 114 | 30940 | 94 | 35 |
| 1922 | 106 | 30471 | 78 | 19 |
| 1923 | 112 | 30737 | 84 | 25 |
| 1924 | 99 | 27316 | -2 | -61 |
| 1925 | 120 | 31912 | 114 | 55 |
| 1926 | 111 | 31288 | 106 | 47 |
| 1927 | 155 | 37283 | 181 | 122 |
| 1928 | 114 | 33614 | 140 | 81 |
| 1929 | 87 | 25472 | -73 | -132 |
| 1930 | 89 | 24564 | -117 | -176 |
| 1931 | 87 | 24100 | -143 | -202 |
| 1932 | 96 | 26425 | -30 | -89 |
| 1933 | 101 | 27914 | 20 | -39 |
| 1934 | 119 | 32027 | 117 | 58 |
| 1935 | 118 | 32240 | 120 | 61 |
| 1936 | 96 | 27558 | -3 | -62 |
| 1937 | 99 | 27781 | 11 | -48 |
| 1938 | 89 | 25656 | -63 | -122 |
| 1939 | 79 | 22498 | -218 | -277 |
| 1940 | 55 | 20263 | -367 | -426 |
| 1941 | 92 | 22298 | -232 | -291 |
| 1942 | 101 | 29097 | 44 | -15 |
| 1943 | 108 | 30211 | 73 | 14 |
| 1944 | 107 | 30398 | 78 | 19 |
| 1945 | 119 | 32310 | 121 | 62 |
| 1946 | 114 | 32023 | 117 | 58 |
| 1947 | 126 | 34127 | 148 | 89 |
| 1948 | 113 | 32906 | 106 | 47 |
| 1949 | 116 | 30821 | 92 | 33 |
| 1950 | 144 | 35332 | 159 | 100 |
| 1951 | 132 | 36090 | 176 | 117 |
| 1952 | 107 | 31714 | 107 | 48 |
| 1953 | 124 | 33513 | 145 | 86 |
| 1954 | 143 | 37165 | 187 | 128 |
| 1955 | 133 | 34979 | 148 | 89 |
| 1956 | 119 | 32910 | 119 | 60 |
| 1957 | 111 | 31442 | 97 | 38 |
| 1958 | 96 | 27235 | -4 | -63 |
| 1959 | 137 | 34308 | 156 | 97 |
| 1960 | 102 | 30200 | 59 | 0 |
| 1961 | 75 | 21564 | -280 | -339 |
| 1962 | 119 | 31200 | 101 | 42 |
| 1963 | 111 | 31341 | 102 | 43 |
| 1964 | 113 | 31516 | 111 | 52 |
| 1965 | 157 | 36927 | 185 | 126 |
| 1966 | 151 | 35623 | 158 | 99 |
| 1967 | 115 | 32847 | 105 | 46 |
| 1968 | 133 | 33563 | 145 | 86 |
| 1969 | 148 | 37468 | 183 | 124 |
| 1970 | 145 | 36095 | 173 | 114 |
| 1971 | 140 | 35691 | 166 | 107 |
| 1972 | 125 | 33920 | 131 | 72 |
| 1973 | 116 | 31480 | 108 | 49 |
| 1974 | 164 | 36471 | 168 | 109 |
| 1975 | 138 | 35403 | 158 | 99 |
| 1976 | 91 | 26393 | -77 | -136 |
| 1977 | 99 | 26494 | -29 | -88 |
| 1978 | 122 | 32622 | 128 | 69 |
| 1979 | 135 | 33417 | 113 | 54 |
| 1980 | 93 | 25737 | -58 | -117 |
| 1981 | 86 | 23934 | -151 | -210 |
| 1982 | 115 | 30765 | 88 | 29 |
| 1983 | 111 | 30729 | 79 | 20 |
| 1984 | 100 | 27926 | 15 | -44 |
| 1985 | 136 | 34031 | 146 | 87 |
| 1986 | 125 | 33505 | 123 | 64 |
| 1987 | 82 | 23303 | -182 | -241 |
| 1988 | 72 | 20308 | -364 | -423 |
| 1989 | 91 | 26100 | -46 | -105 |
| 1990 | 86 | 25112 | -99 | -158 |
| 1991 | 91 | 26104 | -45 | -104 |
| 1992 | 114 | 30403 | 83 | 24 |
| 1993 | 105 | 29795 | 60 | 1 |
| 1994 | 101 | 28776 | 31 | -28 |
| 1995 | 103 | 29951 | 65 | 6 |
| 1996 | 141 | 34683 | 147 | 88 |
| 1997 | 150 | 35872 | 167 | 108 |
| 1998 | 105 | 29732 | 17 | -42 |
| 1999 | 109 | 30106 | 71 | 12 |
| 2000 | 126 | 32956 | 133 | 74 |
| 2001 | 126 | 32497 | 90 | 31 |
| 2002 | 105 | 29090 | 39 | -20 |
| 2003 | 72 | 20952 | -317 | -376 |
| 2004 | 141 | 34197 | 155 | 96 |
| 2005 | 173 | 37732 | 192 | 133 |
| 2006 | 112 | 31443 | 62 | 3 |
| 2007 | 149 | 36024 | 172 | 113 |
| 2008 | 140 | 36157 | 170 | 111 |
| 2009 | 150 | 35348 | 153 | 94 |
| 2010 | 160 | 37932 | 192 | 133 |
| **Average** | **115** | **30838** | **59** | **0** |

# TAB 10

of increasing the level of DSM by 50% for Plan 2 (K24/Gas 1.5xDSM). Table 12.9 shows the relative economic ranking of the three development plans: when compared to the 2012 and 2013 reference scenario economics in Table 12.5, the economic ranking remains the same.

**Table 12.9 2013- 1.5x DSM Sensitivity – Incremental Impact on NPVs**

| Development Plan | | Incremental NPV, millions of 2014 Dollars @ 5.40% Discount Rate | |
|---|---|---|---|
| | | 2 - K24/Gas 1.5x DSM | 4 - K19/Gas30/250MW 1.5x DSM |
| 2 | K24/Gas 1.5x DSM | - | |
| 4 | K19/Gas30/250MW 1.5x DSM | 4 -2 | |
| | MP Sale | $429 | |
| 14 | K19/C26/750MW 1.5x DSM | 14 -2 | 14 -4 |
| | MP Sale, WPS Sale & Inv Preferred Development Plan | $771 | $342 |

Table 12.10 provides the incremental NPVs for Plan 2 (K30/Gas 4xDSM), Plan 4 (K19/Gas34/250MW 4xDSM), and the Preferred Plan (Plan 14 and Plan 14a), which were selected for the 4.0 times DSM stress test. The 4.0 times DSM stress test has the effect of deferring the in-service date for Keeyask G.S. in Plan 2 by six years and defers the in-service date of the first natural gas-fired resource in Plan 4 by four years. Plan 14 in Table 12.10 is the Preferred Development Plan with fixed in-service dates for both Keeyask G.S. and Conawapa G.S. Plan 14a is a variant of the Preferred Development Plan in which the in-service date for Conawapa G.S. is deferred four years with 4.0 times DSM. Table 12.10 demonstrates that the relative economic ranking of the three development plans (Plan 2, Plan 4, and Plan 14) remains the same when compared to Table 12.5. Plan 14a, deferring Conawapa G.S. from 2026/27 to 2030/31, shows a net benefit of $11 million when compared to Plan 14, an amount which is small enough to result in indifference between the plans. This indicates that the benefit from

deferring the capital investment in Conawapa G.S. is virtually equal to the lost benefit from surplus power sales.

**Table 12.10 2013 4.0X DSM STRESS TEST – INCREMENTAL IMPACT ON NPV**

| Development Plan | Incremental NPV, millions of 2014 Dollars @ 5.40% Discount Rate | | |
|---|---|---|---|
| | 2 - K30/Gas 4x DSM | 4 - K19/Gas34/250MW 4x DSM | 14a - K19/C30/750MW 4x DSM WPS Sale & Inv |
| 2 K30/Gas 4x DSM | - | | |
| 4 K19/Gas34/250MW 4x DSM | 4 -2 | | |
| MP Sale | $887 | | |
| 14a K19/C30/750MW 4x DSM | 14a -2 | 14a -4 | |
| MP Sale, WPS Sale & Inv Conawapa G.S. Deferred by 4x DSM | $1,083 | $196 | |
| 14 K19/C26/750MW 4x DSM | 14 -2 | 14 -4 | 14- 14a |
| MP Sale, WPS Sale & Inv Preferred Development Plan | $1,072 | $185 | ($11) |

Figure 12.5 compares 1.0 times, 1.5 times and 4.0 times DSM between two development plans under reference scenario assumptions: the Preferred Plan and Plan 2. The in-service date for the Keeyask G.S. under Plan 2 varies according to the level of DSM applied: the date is 2023/24 for 1.0 times DSM, 2024/25 for 1.5 times DSM, and 2030/31 for 4.0 times DSM. The in-service date for the Conawapa G.S. under the Preferred Plan remains at 2026/27 for 1.0 and 1.5 times DSM and is 2030/31 for 4.0 times DSM.

# TAB 11

the new pipeline load will be two (2) times DSM; Level 3 would be approximately five (5) times DSM; and Level 3 after consideration of the pipeline load would be two point seven (2.7) times DSM.

I will just also draw your attention to the development plans at the top of the page. And one of the updates to the -- to Plans 5 and 14 when we undertook this analysis was the removal of the WPS investment. So it's just the sale alone that's in these plans.

So this means that this has the effect of increasing the costs to Manitoba Hydro when we undertook this analysis, as the assumption is that Manitoba Hydro would then be responsible for those costs.

(BRIEF PAUSE)

MS. MARILYN KAPITANY: Can you explain why those -- the WPS investment would have been removed?

MS. JOANNE FLYNN: Because the -- the arrangement with WPS has now been finalized, and there is the sale arrangement with WPS, but they are no longer an investor in the line.

Okay. This next slide identifies the DSM options that we were going to -- or that we have evaluated under the 2013 assumptions under the reference scenario. So there are three (3) plans that we have done this analysis on: the Preferred Plan; Plan 5, Keeyask19/Gas with 750 line; and the All Gas Plan.

So we have the three (3) plans evaluated at four (4) levels of DSM, which gives you twelve (12) cases without the pipeline load, and then the same three (3) plans at Levels 2 and 3 of DSM, which gives us an additional six (6) cases with the expected pipeline load included.

And this analysis has been done based on the 2013 planning assumptions with updated capital costs for Keeyask and Conawapa, and without the investment in -- by WPS in the interconnection.

Okay. And now I'll move on to the topic of economic analysis methodology. In the NFAT business case, Manitoba Hydro has provided three (3) major sets of analysis: economic, financial, and multiple account. Each one (1) of the analyses has a separate and distinct focus and contribution to the overall evaluation.

The economic analysis focusses on the

overall economic value each plan creates over the asset life and, therefore, determines the investment value over the life of the longest-lived assets in the development plan. For the plans that were evaluated, the long -- longest-lived assets are the Hydro assets.

The financial evaluation focusses on rates and financial risk, and specifically on the comparative impact on future customer rates and the comparative exposure to financial risk. Affordability and temporal distribution of costs and benefits are addressed in the financial analysis.

The multiple account benefit-cost analysis focusses on the overall socio-economic benefit and takes into consideration consequences for Manitobans not reflected in the revenues and expenditures of Manitoba Hydro, and provides a comprehensive assessment of all the benefits and costs to Manitobans to address the question of overall socio-economic benefit.

The three (3) analyses together provide an overall robust analysis of the development plans.

Panel 2, this panel, deals specifically with economic analysis, provincial transfers, and reliability and energy security.

Panel 3 will deal -- the next panel will

deal with financial analysis including rate impacts. And the last panel will deal with environmental and social -- socio-economic benefits and impacts and multiple account analysis.

Economic evaluation is specifically intended to determine how much overall economic value each plan creates over the asset life. Manitoba Hydro's approach to economic evaluation is consistent with standard economic analysis methodology.

When evaluating and choosing among alternative development plans, it is appropriate to measure the incremental costs and benefits associates with one (1) plan relative to another plan. This means that costs and benefits that are common to all development plans are not included in the economic analysis, as these values are the same in each development plan.

The evaluation is done on a go-forward basis. This means that sump costs are not included in the economic evaluation, as they represent costs, or money, already spent, or commitments that can't be changed.

For the purpose of the economic evaluation, the net present value approach taken by Manitoba Hydro of discounting cash flows at the real

weighted average cost of capital is appropriate. This method allows for comparison of development plans on an equivalent basis, and is widely viewed as a standard and reliable measure of overall economic value for the plan.

And at this point we're going to have to do a little bit of shuffling to...

(BRIEF PAUSE)

MS. JOANNE FLYNN: Oh, sorry. Mr. Page and mis -- and Dr. Borison will elaborate on the use of net present value and discount rates in their directly evidence.

As the -- as the economic analysis is intended to represent the benefits and costs over the entire life of the assets included in the development, the life of the longest-lived project needs to be considered. This is done through residual value.

Once a study period has been identified, residual value is determined, generally, in one (1) of two (2) ways: by calculating the salvage value of the assets remaining at the end of the study period, and subtracting that value from the asset cost; or by identifying the remaining market value and adding it to

# TAB 12

- Low Water Supply - does not provide any significant benefits because Manitoba Hydro has sufficient shut down generating units that could be run temporarily for operating reserves purposes without relying on Option R load reductions.

Manitoba Hydro will not initiate load curtailments in order to facilitate an opportunity spot market sale[4].

## PERFORMANCE FOR 2011/12

### Curtailment Options:

The Curtailable Rate Program consists of four base curtailment options and three combinations. Options vary dependent on: minimum notice to curtail, maximum duration per curtailment, maximum daily hours of curtailment, maximum number of curtailments per year, and maximum annual hours of curtailment.

The three customers that participated in the Curtailable Rate Program during the April 1, 2011 to March 31, 2012 period designated a total of 228 MW to Manitoba Hydro's reserves, allocated as 80 MW Option AE, 67 MW Option A, 31 MW Option C and 50 MW Option R. The amount each customer designated as curtailable load in relation to their total load varies, and therefore impacts their curtailable credit, as shown on the following table:

| Summary of Curtailment Credit Data<br>April 1, 2011 to March 31, 2012 | | | | | |
|---|---|---|---|---|---|
| **Customer** | **Option(s)** | **CRP Load as % of Total Load** | **Average On-Peak MW** | **Average On-Peak LF** | **Average Monthly Cr.** |
| 1 | A & R & E | 87% | 192.4 | 94.0% | $430,260 |
| 2 | A | 94% | 25.2 | 96.1% | $50,474 |
| 3 | C | 2% | 33.6 | 68.4% | $844 |

Customer 1: 87% of total load represents 41% Option AE, 26% Option R and 20% Option A for 2011/12.

Load designated under Option R must be nominated as a Guaranteed Curtailment, that is, the customer must agree to shed a specified number of MW in order to be compliant with the curtailment request. Under all the other curtailment options, customers can nominate curtailable load as Guaranteed Curtailment or Curtail to Protected Firm Load.

[4] Spot market sales are sales that occur on a day ahead or real time basis. They are not considered to be a firm export sale.

**CURTAILABLE RATE PROGRAM OPTIONS**
**FOR APPLICATION AS OF APRIL 1, 2012**
**UNLESS SUPERCEDED BY FURTHER ORDER OF THE PUB**

Discount to Demand Charge Expressed as Percentage of Reference Discount per kW/month.

| OPTIONS | TERMS AND CONDITIONS | | | | | |
|---|---|---|---|---|---|---|
| | Minimum Notice to Curtail | Maximum Duration Per Curtailment | Maximum Daily Hours of Curtailment | Maximum Number Curtailments Per Year | Maximum Annual Hours of Curtailment | Discount as Percentage of Reference Discount |
| A | 5 minutes | 4-1/4 Hours | 6 Hours (Oct 1 - Apr 30) 10 Hours (May 1 - Sep 30) | 15 Curtailments | 63.75 Hours | 70% |
| C* | 1 Hour | 4 Hours | 8 Hours | 15 Curtailments | 60.00 Hours | 40% |
| E | 48 Hours | 10 Days | 24 Hours | 3 Curtailments | 720.00 Hours | 35% |
| R | 5 minutes | 4-1/4 Hours | 10 Hours (Apr 1 – Mar 31) | 25 Curtailments | 106.25 Hours | 70% + Reserve Discount |
| A & E | Combination | Combination | Combination | 18 Curtailments | 783.75 Hours | 100% |
| C & E* | Combination | Combination | Combination | 18 Curtailments | 780.00 Hours | 70% |
| R & E | Combination | Combination | Combination | 28 Curtailments | 826.25 Hours | 100% + Reserve Discount |

* Options ‘C’ and ‘CE’ will no longer be available as of the sunset date.

The Monthly Reference Discount shall equal A, and shall be adjusted on April 1st of each fiscal year by the annual inflation factor, where:

A = the amount of the Reference Discount which is related to the marginal value of capacity, expressed in Canadian Dollars. The Reference Discount of $3.17 per kW/month as of April 1, 2011 shall be adjusted each year by the Inflation Factor as defined below.

Inflation Factor = at the end of each fiscal year of Manitoba Hydro, the percentage change in the Consumer Price Index for Manitoba as recorded for the most recent set of 12 month periods for which data are available.

Reserve Discount: The fixed price to be paid for energy during curtailment under Option ‘R’ has been set at $0.04 per kW.h.

# TAB 13

# Forecasting Long-Run Electricity Prices

## Dr. Gregory Hamm and Dr. Adam Borison, Stratelytics

## June 30, 2006

### Introduction

With the structural changes in the power industry over the past 10 years, the market price of electricity has become the key determinant of resource value. In the past, resources were evaluated based on the cost to serve a specific load. Today, most resources can be viewed as competing against the (wholesale) market, and thus should be evaluated based on the market price.

Given this situation, long-run (twenty to thirty year) electricity price forecasting is not an academic exercise. These forecasts are absolutely central to many key decisions at power companies and to their success. Decisions must be made regarding assets that may be operated for 50 years; regulators require resource plans that extend 20 to 30 years; and many electricity and fuel contracts last 20 years or more.

Not only is price forecasting increasing in importance, but decision makers increasingly realize that common "single-path," most-likely estimates are inadequate. Single-path estimates, even when unbiased, provide no information on risk exposure. Furthermore, they provide no help evaluating resources that can be adapted, through operational changes and investments, to changes in prices, costs, and other factors. Risk and optionality can only be fully examined with a thorough, quantified picture of future uncertainty.

Current and recent industry experience is replete with examples illustrating the importance of long-run electricity price forecasting, and the problems created with simplistic and/or inaccurate forecasts. In 2001, the State of California signed over $40 billion in long-run electric contracts.[i] These contracts are now considered so expensive, there is considerable effort being devoted to cost allocation, renegotiation, and litigation. Throughout the country, plans to build new capacity have been shelved as prices have not

risen as expected. In Texas, 32 power projects totaling 17,801 MW have been delayed or canceled since 2001[ii]. In Mississippi, the 822 MW Choctaw County combined-cycle plant was commissioned in July 2003 and mothballed in May 2004 because of low wholesale market prices[iii].

The bottom line is that a good long-run probabilistic forecast of electricity prices is required to understand the potential value and risks of many investments. What do we mean by a "good" long-run electric price forecast?

- Accuracy. This is a self-evident criterion, but it is more complex than generally recognized. Decision makers prefer that a point estimate or the expected value of a distribution be closer to what actually occurs rather than farther away. Decision makers prefer narrow bands of uncertainty to wider bands of uncertainty. However, accuracy has other important dimensions. It is important that forecasts be *unbiased*. The median or middle forecast should be over and under the true value in equal proportions. It is important that forecasts be well *calibrated*. By calibration, we mean that the probability distribution on future electric prices should accurately reflect the true level of uncertainty. Or, simply stated, the variance of the future price should be accurate. This is essential for valuing either financial options or "real" options in the management of a resource.
- Usefulness. Decision makers like forecasts that can be used for the widest possible range of decisions – both current and future decisions, and both investment and operations decisions. For options analyses, decision makers need forecasts that include an estimate of how uncertainty changes as time passes. Decision makers also need more than just a number; they need to identify and understand the price drivers.
- Efficiency. While good price forecasts are very valuable, they can also be costly. Of course, decision makers prefer forecasts that cost less, require fewer resources, and can be updated more quickly.

## Common Forecasting Practice

There are four important sources of data that can be used to develop long-run forecasts.

- Historical electricity market prices;
- Forward[iv] electricity market prices;
- Results from supply/demand simulation models; and
- Expert judgments, particularly with respect to future technologies and regulations.

Not surprisingly, considerable effort has been devoted to price forecasting in recent years. However, most forecasts suffer because valuable data are not used appropriately or not used at all. There are two common fundamental problems that lead to inferior forecasts.

1) Forecasters rely almost entirely either on financial data (historical and forward prices) or engineering data (simulation model results and expert judgments); they do not use both as information sources.
2) Whatever data sources are used, forecasters focus too much on the past and present, basing forecasts on extending existing patterns; they do not fully and creatively think about the future.

These two problems are discussed in more detail below.

### *Reliance on Either Financial or Engineering Data*

As noted above, many price forecasts can be characterized as either "finance driven" or "engineering driven."

The finance approach usually begins with the choice of a simple model of price dynamics. A number of models are popular, with the Geometric Brownian Motion model being the best known. After choosing a model, model parameters are determined by fitting the model to past price data, or to forwards, or to a combination.

The major advantage of forwards is that liquid markets reflect data and analyses from many sources, and it is generally believed to be rare that individual analyses can improve on these estimates. Further, forwards reflect both investor price predictions and their attitude toward risk. This helps with the difficult issue of risk adjusting future cash flows, but does complicate calculations when spot price estimates are desired.

The major problem with the financial approach is that the markets are not sufficiently extensive, mature, and stable to rely on the available data. Or said another way, there is just not enough applicable data to produce accurate long-run forecasts. Regional electricity markets may have only existed for a few years, and/or have been in a state of transition during most or all of their existence. For example, the California crisis of 2000-2001 dominates Western historical data but may be a unique disruptive event that will not be repeated. Forward markets are similarly limited as they only go out 5 to 7 years.[v] Accuracy when these data are projected forward 20 to 30 years is questionable at best.

The engineering approach usually begins with the choice of a detailed supply/demand simulation model. A number of models are popular, with FastForward by EPRI/Northbridge, MIDAS and ProSym by Global Energy Decisions, IPM by ICF Consulting, UPLAN by LCG, and MarketPower and ProMod by New Energy Associates all being well known. Typically, these models contain detailed data on generating plants, loads, and the transmission system. They match supplies to demands and can produce hourly, location-specific prices. The detailed description of the real world found in these models provides users with confidence that the results are realistic. Generally it is assumed that if credible 20 or 30 year fuel prices and demands can be provided to the models, the models can provide accurate 20 or 30 year price forecasts.

The major problem with the engineering approach is a strong tendency to understate the uncertainty in technology, system configuration, fuel prices, and demands. This results in a forecast that anchors on a very narrow range that can be inconsistent with market realities. In general, analyses that consider many uncertainties are discouraged by the time and expense of running these models.

The finance and the engineering approaches have contrasting strengths and weaknesses:

- Finance models reflect true market value, engineering models estimate market value;

- Finance models summarize thousands of diverse opinions and analyses, engineering models reflect limited expert opinions and scenarios;
- Engineering models provide a logic applicable to many time frames and locations, finance models are based on limited temporal and regional data.

### *Anchoring on the Past and Present*

The second major problem identified above was a lack of focus on the future, an underlying assumption of little change. While often viewed as extremely stable, the power industry is actually a dynamic and changing industry. A few examples illustrate the risks of assuming that the future will resemble the immediate past.

- The history of electric markets is too short to illustrate major shifts; however, such shifts can be seen in related commodity markets. For example, the average natural gas price was $1.45/Mcf in the 1970's and $4.81/Mcf in the 1980's. While prices in the 1990's were similar to the 1980's, recent, experience suggests that another jump may be occurring.
- U.S. electric demand grew at a rate of 7.3% per year in the 1960's. Growth fell to 4.2% in the 1970's. Growth fell to 2.6% in the 1980's.[vi]
- Figure 1: Technology Changes Over Time illustrates the radical changes over time in the technologies chosen for power generation. In the 1970's coal, gas, nuclear, and petroleum technologies were all highly competitive. In the 1980's, the roles of petroleum and gas technologies were dramatically reduced while nuclear and coal technologies were close competitors. Most dramatically, the 1990's were completely dominated by gas powered plants.[vii]
- Average annual capacity additions in 1970's; 1980's; and 1990's were respectively, 29.4 GW/yr; 17.4 GW/yr; and 9.0 GW/yr. But more startling, capacity additions from 1995 to 1999 averaged 7.8 GW/yr; capacity additions from 2000 to 2004 averaged 44.5 GW/yr.[viii]

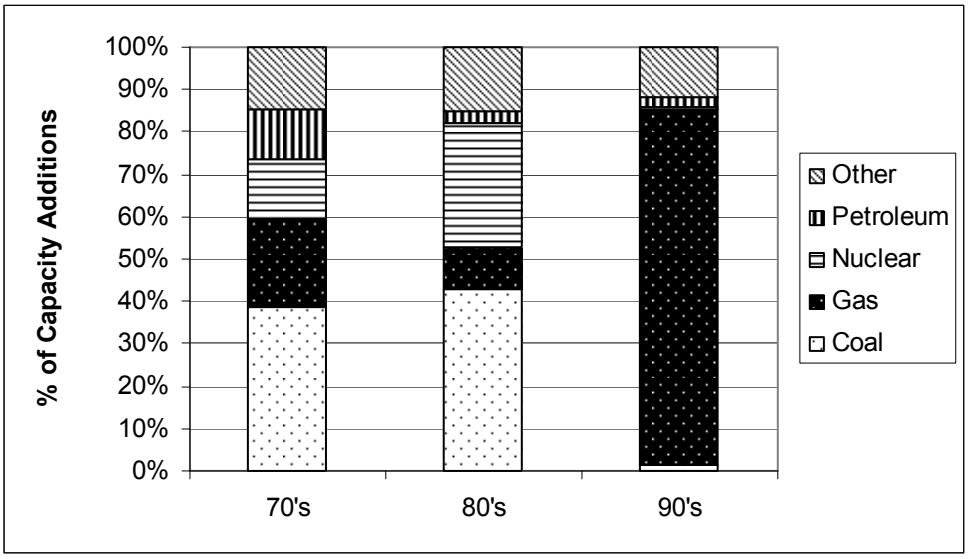



Figure 1: Technology Changes Over Time

In each case above, projecting one decade's trends into the next would have produced dramatically incorrect results. These examples show how blindly projecting current and historical data, whether financial or engineering, out 10 or more years is very likely to produce flawed estimates. Instead, attention to the future and a broad examination of uncertainty is required.

### *Suggested Changes*

We suggest two changes in the common practices of price forecasting:

- Integrate the financial and engineering approaches, and
- Focus much more on the future, rather than the past and present.

Active markets provide the most relevant estimates of prices, but they simply do not provide enough data, particularly for long-run 20 or 30 year predictions. An engineering approach is certainly necessary for the long-run, and where markets are not robust may be needed in shorter time frames. The engineering approach needs to focus not on the details of the structure of the system today, but on the nature of the changes that will occur over the next 20 to 30 years.

## A Compact, Balanced Approach to Long-Run Price Forecasting

We propose an approach with the following steps:

1) Structure the forecasting problem and select an appropriate model of electricity prices based on that structure;
2) Gather judgments about the future, especially factors relevant to the long-term cost of electricity generation;
3) Gather historical data, forward data, and simulation results; and
4) Fit the model to the gathered data.

Below we provide an example of this four-step approach. The example is based on recent projects, but has been modified to rely only on publicly-available data and to produce only illustrative results.

### *Step1: Structure the Problem*

We begin by defining the long-term electricity price to be forecast. For most applications, we suggest the average annual price. Although price variations within a year are important for evaluating resources that will be shut down for a significant fraction of the year, we model these within-year variations separately. This modeling will not be discussed in this paper. We define "average annual price" as "spot" prices averaged over hours. For many markets, "spot" prices will be hour-ahead prices. The specification of prices to be forecast is flexible. It is important that the definition be clear and that historic data, forwards, and/or structural-model data must be temporally consistent with the forecast. We must recognize the different characteristics of weekly averages versus yearly averages, of day-ahead versus hour-ahead, and so on. Second, we must recognize that forwards are not direct estimates of expected spot prices.[ix]

Once price is clearly defined, we select a suitable model of price dynamics. There are a variety of models one can use. As noted above, Geometric Brownian Motion is popular, particularly for equities. However, it is a very specific model that has only limited

applicability to electricity prices. Instead, a more complex model is required to capture three important aspects of electricity price dynamics:

- Medium-term (year-to-year) volatility,
- Reversion to a long-run price path, and
- Uncertainty with respect to the long-run path.

The short-term volatility of electric prices is illustrated in Figure 2: Historical Average Yearly Prices[x].

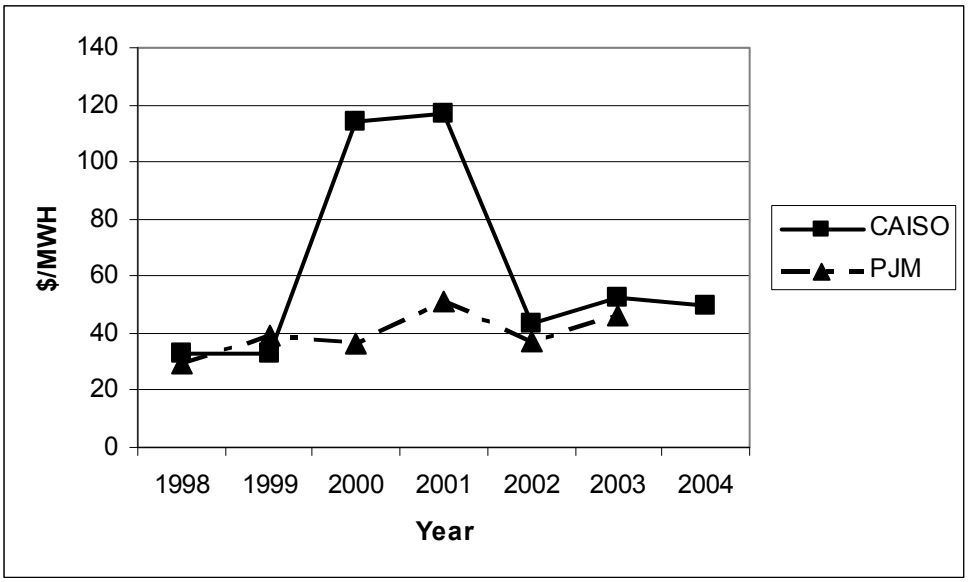



Figure 2: Historical Average Yearly Prices

As this Figure shows, electricity prices can exhibit considerable year-to-year variation, and that variation can differ widely among markets.

Strong statistical evidence is not available for reversion of electricity prices to a long-run path. However, most people find the logical argument for reversion very strong and related markets, such as coal and natural gas, are generally viewed as exhibiting mean-reverting behavior. The argument for reversion is that the underlying price for electricity is set by the cost of generation technology and fuels. Technologies serve as a large scale option for the power industry. In each decade or era, the industry chooses the expected lowest cost technology and market prices will tend to a level that will just support this technology. Significant variations from the underlying price will occur due to supply and demand imbalances. But when supply is "short," prices will rise and encourage new resources that will lower prices. The opposite will occur when supply is "long."

The statistical evidence for uncertainty in the long-run path is also limited. Pindyck, 1999[xi] examined up to 127 years of data for oil, coal, and gas prices. He states that "the behavior of real energy prices suggests reversion to trend lines with slopes and levels that are both shifting continuously and unpredictably over time, …" Smith and Schwartz,

1999[xii] also suggest a model for commodities, including oil, with uncertainty in the rate and level of mean reversion. This research and our own work suggest that the underlying path of electricity prices is uncertain.

The model we suggest is similar to that used by Smith and McCardle, 1999[xiii]. In this model, the logarithm of prices follows what is known as an "Ornstein-Uhlenbeck" process. The model is defined as follows:

- $\pi(t) + \alpha t = \ln(p(t))$, where p(t) is the price at time t and $\alpha$ is an uncertain growth rate,
- $\pi(t)$ is normally distributed,
- the mean of $\pi(t)$ is $\pi' + (\pi(0) - \pi')e^{-\kappa t}$, and
- the variance of $\pi(t)$ is $\sigma^2(1 - e^{-2\kappa t})/2\kappa$. [xiv]

The model is not as formidable as it might first appear. $\pi' + \alpha t$ is simply the long-run path around which prices vary.[xv] As suggested above, we believe this is largely determined by the cost of building and generating electricity with the most economic new technology. The variance term, $\sigma^2(1 - e^{-2\kappa t})/2\kappa$ converges to $\sigma^2/2\kappa$ as we move into the future. This is more reasonable than the constantly-growing variance of the more common Geometric Brownian Motion model. The $(\pi(0) - \pi')e^{-\kappa t}$ term means that if the current price, represented by $\pi(0)$, is away from the long-run path, represented by $\pi'$, there is a force driving future prices back to the long-run path. Finally, $\alpha$, the growth in the long-run price path, is uncertain. We typically represent this by a discrete probability distribution.

The model requires three parameters and a probability distribution on growth, $\alpha$. The three parameters are the current point on the price path, $\pi'$; the volatility parameter, $\sigma$; and the reversion parameter, $\kappa$. As noted above, we will estimate these parameters using all four sources of data.

### *Step 2: Gather Expert Judgments*

Once the underlying model has been selected, we turn to gathering expert judgment regarding the underlying long-run price path. We need to think carefully and broadly about the future, and to recognize the high degree of uncertainty about technology and regulation. Areas of the future that need to be addressed include:

- Regulation, particularly $CO_2$ limits, credits, or taxes;
- Fuel prices, particularly for gas;
- Transmission development, both technology and investment, this will be a powerful determinant of regional price differentials;
- Generation technology, particularly the development of super critical coal, IGCC, renewables, and nuclear.

We use facilitated group brainstorming and assessment sessions to gather data. In these sessions, we have three types of activities: brainstorming with no comments, critical discussion, and voting or assessment exercises to quantify values and uncertainties. Assembling an organization's internal experts to exchange ideas about the future provides benefits beyond data gathering. The exchanges help people understand the

major forces affecting the industry outside their own area of expertise and create a broader, more robust view of the future. Typically, the group will represent such functions as forecasting, strategic planning, regulatory affairs, environmental planning, marketing/trading, engineering, and management.

Outside the organization, there are a number of sources of technology information. Many organizations will have favored sources. One public source is the Energy Information Administration (EIA) "Annual Energy Outlook." This contains both technology and fuel data. Table 1: Advanced Generation Cost Data[xvi] provides some key data from this source. All costs are in 2003 dollars.

**Table 1: Advanced Generation Cost Data**

| Technology | Overnight Cost ($/kW) | Variable O&M ($/MWh) | Fixed O&M ($/kW) | Heat Rate (Btu/kWh) |
|---|---|---|---|---|
| Scrubbed Coal New | 1213 | 4.06 | 24.36 | 8600 |
| IGCC | 1402 | 2.58 | 34.21 | 7200 |
| IGCC w. Carbon Sequestration | 2006 | 3.93 | 40.26 | 7920 |
| Advanced CC | 1114 | 2.6 | 17.60 | 7493 |
| Advanced Nuclear | 1957 | 0.44 | 60.06 | 10400 |

In a recent study, we considered fifteen uncertain variables influencing future electricity production cost. These could be roughly placed in three classifications: 1) economic variables such as discount and tax rates, 2) market prices for inputs and emissions, and 3) technical characteristics such as capital costs and heat rates. In this recent study, we used discrete distributions on these variables, but characterizing them as continuous distributions is also possible.

Table 2: Table 2: Uncertainties provides a few illustrative uncertainties. Gas Price is the price in 30 years in 2003 dollars. $CO_2$ Cost could literally be a $/Ton emissions tax, but could also be the implied costs of traded credits or other controls. The transmission adder recognizes that coal and nuclear plants are more difficult to locate than gas plants and may incur significant costs moving power from production regions to load centers. The nuclear capital costs are construction costs not including financing.

**Table 2: Uncertainties**

| Uncertain Variable | Low | Nominal | High |
|---|---|---|---|
| Gas Price ($/MMBtu) | 2.0 | 4.0 | 8.0 |
| CO2 Cost ($/Ton) | 0.0 | 10.0 | 50.0 |
| Transmission Adder for Coal and Nuclear ($/MWh) | 0.0 | 2.0 | 4.0 |
| Nuclear Capital Cost ($/kW) | 1200 | 1957 | 2400 |

### *Step 3: Gather Historical Data, Forward Data, and Simulation Results*

Once we have thought through the long-term scenarios, we turn to more traditional sources of near and mid-term data.

Figure 2: Historical Average Yearly Prices above shows typical historical price data from CAISO and PJM. For the calculations below, we use the CAISO data. There are often multiple sources for historic data. The best sources are those that represent a market (trading point or hub) and a time frame (hour-ahead or day-ahead) that would realistically be used as a resource. However, the data may often be from other markets or time frames, and statistical or subjective adjustments must be made.

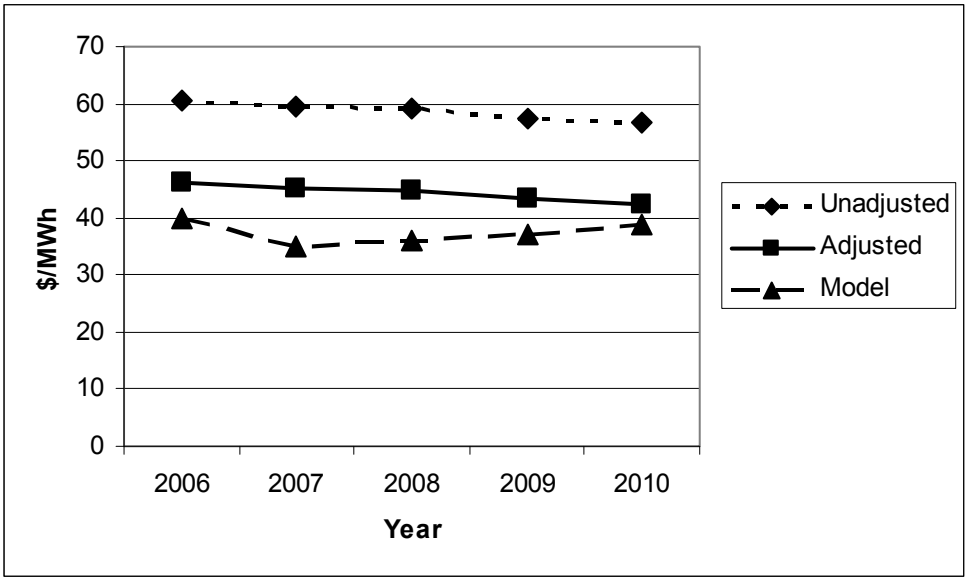



Figure 3: Forwards and Estimated Spot Prices

Figure 3: Forwards and Estimated Spot Prices shows three sets of "forward" data: The "Unadjusted" set is typical "raw" forwards data from the market; these are peak period forwards. The "Adjusted" set has been modified to represent future average annual spot prices rather than current forward prices. For comparison, we also show expected spot prices from a representative supply/demand simulation; this is the "Model" set. Like the historical spot price data, forwards data are selected from a representative market and time frame. Three adjustments are then made to make the forwards data and historic spot price data comparable: 1) risk adjustment between forwards and spot prices, 2) prices adjusted to 2003 dollars, and 3) prices adjusted from peak period prices to average annual prices.

The risk adjustment is the most complex. The key insight is that forwards incorporate market adjustments for risk. Forward prices should equal the *risk-adjusted* expected value of spot prices. The simplest form for this risk adjustment is to discount or inflate prices by a constant factor each year. We examined three ways to estimate this factor.

1) We compared one-year ahead electric forwards to actual spot prices. Very few points were available and the comparison did not show a significant relationship.

2) The capital asset pricing model suggests that the adjustment factor should be related to stock market value correlation. We found no significant correlation between electric spot prices and the stock market.
3) Parkinson, 1999[xvii] looks at the behavior of energy commodities with longer histories of forwards trading, specifically, the ratio of the spot price at delivery and the forward price of the same contract six months prior to delivery for seven oil and gas commodities. On an annualized basis, forwards provided an excess return of 5% to 20% versus a risk-free instrument. This suggests that forwards are lower than non-risk-adjusted spot prices.

Based on this research, we settled on a risk adjustment of 3% per annum from forwards to spot prices. Prices were adjusted to 2003 dollars using the Consumer Price Index, and average prices were assumed to be 80% of peak prices.

As noted above, the "Model" line represents expected spot prices from a supply/demand simulation model. Each point is the expected spot price at that time. We feel that good medium-run (5-10 year) projections can be efficiently derived from supply/demand simulation models. The uncertain factors driving prices in this time frame are not so diverse as to make use of the larger models inefficient and the power system structure in these models is relevant over this time frame. Uncertainties such as fuel prices, allowance prices, plant availability, and demand must be quantified. Enough scenarios and combinations of scenarios must be run to give a full picture of medium-run volatility and its drivers.

When both forwards data and supply/demand model data are available, subjective judgment guides their use – one, the other, or a blend. When the two sources differ widely, we favor using forwards data unless it is clear that forwards markets are too thinly traded to provide reliable data or the data represent markets that are geographically or temporally inappropriate.[xviii] For this example, we will assume that the forwards markets are robust enough to provide meaningful data.

### *Step 4: Fit the Model of Price Dynamics*

Once we have gathered available data from all four sources, we fit the model using that data.

**Table 3: Break-Even Electricity Prices (16% IRR)**

| **Technology** | **Scenario 1**<br>Gas High<br>CO2 High<br>Transmission High<br>Nuclear Nominal<br>**($/MWh)** | **Scenario 2**<br>Gas Nominal<br>CO2 Nominal<br>Transmission Low<br>Nuclear Nominal<br>**($/MWh)** | **Scenario 3**<br>Gas Low<br>CO2 Low<br>Transmission Low<br>Nuclear Nominal<br>**($/MWh)** |
|---|---|---|---|
| Advanced CC | 103 | 46 | **30** |
| IGCC | 72 | 40 | 31 |
| IGCC with sequestration | 41 | 39 | 37 |

| | | | |
|---|---|---|---|
| Scrubbed Coal | 83 | 45 | 34 |
| Nuclear | **38** | **34** | 34 |

We use a simple plant economics model to find break-even costs for various types of generators and scenarios at a target time in the future. Table 3: Break-Even Electricity Prices (16% IRR) shows the baseload electricity prices that provide a 16% IRR for investments in these technologies under three scenarios based on the uncertainties described earlier. The nuclear technology is lowest cost in Scenario 1 and 2 and Advanced CC is lowest cost in Scenario 3.

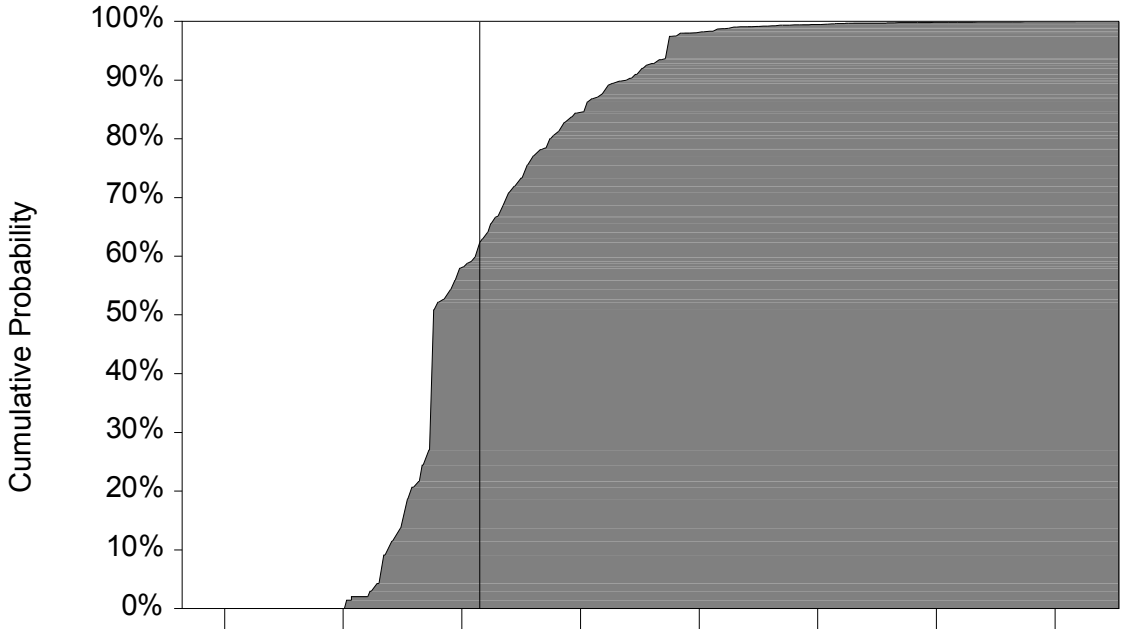



Figure 4: Distribution on Prices Supporting New Generation

Simulation of the interactions of many uncertain variables produces many such scenarios and a detailed distribution on the lowest price that will support new generation at some specified point in the future. Figure 4: Distribution on Prices Supporting New Generation shows such a probability distribution. While this curve represents millions of potential combinations of technology and business environments, usually we can identify informative patterns. For example, we might see the following pattern in dominant uncertainty outcomes and decisions:

- Low end of curve, low gas prices or a renewable breakthrough, gas turbines or renewables.
- Mid-portion of curve, moderate gas and coal prices, mix of gas and coal technologies
- High-portion of curve, high fuel and emissions costs, nuclear.

We discretize the future price distribution for calculation of the parameters of the dynamic price model and to simulate future price paths.

We settled on a three branch discretization of long-run (30 years out) prices: High, $90; Nominal, $48; and Low, $30. We place probabilities of 30%, 40%, and 30% on these scenarios. Having established these future cases, it will be straightforward to solve for the distribution on growth, $\alpha$, after the current point on the price path, $\pi'$, is estimated.

The next step in our approach is to determine the long-run constant volatility, $\sigma^2/2\kappa$. We assume that the historic year-to-year price changes provide the best estimate of this term. We find the standard deviation of the natural logarithm (ln) of the year-to-year price change. For example, using the yearly price data from Figure 2: Historical Average Yearly Prices for CAISO (adjusted to 2003 dollars) and a current price estimate of $49/MWh, we estimate a long-run constant volatility of 65%.[xix]

Given the stream of expected spot prices as shown in Figure 3: Forwards and Estimated Spot Prices, we have two remaining parameters to fit, the current point on long-run price path, $\pi'$ and the reversion parameter, $\kappa$. Using our mean and variance expressions, we can write a likelihood for each expected price. We can then use maximum likelihood estimation to determine $\pi'$ and $\kappa$.

The results of the model are shown below in Figure 5: Price Distribution for Long-Run Prices. These prices are shown in constant 2003 dollars.

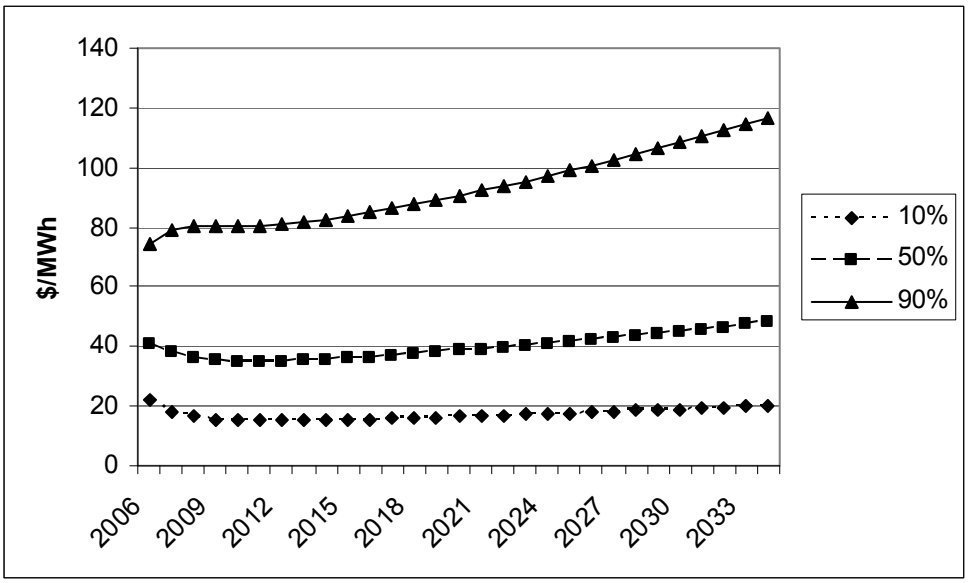



Figure 5: Price Distribution for Long-Run Price

In any given year, there is a 90% probability that the price will be below the 90% line and a 10% probability it will be below the 10% line. Correspondingly, it is equally likely to be above or below the 50% line.

What does this forecast tell us about electricity prices? First, the short run uncertainty is quite high. Even one year out, the 10-90% confidence bands cover a factor of three in prices. Consequently, it would not be a shock if prices doubled or were halved from year

to year. This is a direct reflection of the considerable year-to-year volatility that has been observed historically in the chosen market, and ties the forecast to the available financial data. Second, the uncertainty grows only moderately over a longer time horizon, unlike the "expanding cones" that one typically sees with Geometric Brownian Motion and equity prices. This is a direct reflection of the strength of reversion to the long-run resource costs, and ties the forecast to the long-term engineering data.

Is this a good forecast per the criteria outlined above? We think so.

- The forecast is likely to show greater accuracy because we use all types of available data appropriately and a more sophisticated price dynamics model.
- The forecast is likely to be well-calibrated without false accuracy because we have recognized the high short-run volatility evident in recent price history, as well as the long-run changes in electric power technology and regulation.
- The model explicitly addresses the evolution of uncertainty over time, so that it is useful for both flexible and inflexible resources.
- The model development process is efficient. It requires time to meet and think creatively about the future, and time to gather and process available financial and engineering data. But it does not require hundreds or thousands of runs of complex supply/demand models.

## Summary

Estimation of long-run, 20 to 30 year, electricity prices is extremely important and difficult. It is important because of the high cost and long lives of electric power resources. It is difficult because of the many uncertainties that will determine future prices, and because of the lack of sufficient historical and forwards data. The difficulty is further compounded when forecasters ignore part of the available information or unnecessarily limit their thinking about the future.

We have presented a practical approach that addresses these problems.[xx]

- Accuracy is improved by using all types of data and a flexible model of price dynamics. We use historical prices, forwards prices, supply/demand modeling, and expert judgment. The dynamic model of prices we use is logically sound and as simple as practical. The key characteristics of the model are dynamic volatility, reversion to a long-run path, and uncertainty with regard to the long-run path. In our experience if any of these are left out, illogical results that can be directly traced to the missing element occur.
- Our emphasis on intense, open, and clear thinking about the future improves the estimation of short- and long-run variance (calibration).
- The model is very useful in resource evaluation, producing both unconditional and conditional distributions on prices for option analysis, it is relatively easy to simulate, and it can be discretized to analyze options in a decision tree framework.
- Finally, the modeling process is very efficient.

The result is a better forecast.[xxi]

[i] California Legislative Analysts Office, Analysis of the 2002-03 Budget Bill, Department of Water Resources, California Energy Resource Scheduling (3860).
[ii] Texas PUC, July 18, 2005, www.puc.state.tx.us/electric/maps/gentable.pdf
[iii] Houston Business Journal, May 4, 2004.
[iv] We assume that at any point in time forwards contracts and futures contracts for the same date will be priced the same. While realizing that futures contracts dominate trading, the potential confusion of "electric futures prices" and "future electric prices" was judged to justify the use of the term forwards for both forwards and futures contracts.
[v] Some analysts assume that 5 years of data provide thousands of data points, and that no problem exists in fitting complex models. We believe that the data have strong serial correlations not accounted for in the models. Thus dividing years up into small pieces to create more data points is a not a feasible analysis strategy.
[vi] From http://www.eia.doe.gov/neic/a-z/electrica-z.htm, Table 8.9 Electricity End Use, 1949-2004.
[vii] From http://jec.senate.gov/_files/NaturalGas.pdf, The Pressures on Natural Gas Prices, Joint Economic Committee, October 6, 2004 for capacity additions 1970 through 2002. Electric Power Annual 2003, Table 2.6, EIA, 2004 for 2003 capacity additions. www.platts.com, Platts for 2004 capacity additions. Note that Platts data has minor differences with EIA data.
[viii] Ibid.
[ix] Note that these prices, unlike forwards, will not account for market attitudes toward risks. In evaluating resources, risk will need to be taken into consideration.
[x] CAISO prices from **CAISO, 2004 Annual Report**, Table 2.3 Wholesale Energy Market Cost Index for 2004 and Previous Years. PJM prices from **Electricity Prices in PJM**, June 3, 2004, Table 2.7. 1998 PJM price is estimated based on energy price in Table 2.7.
[xi] Pindyck, Robert S., "The Long-Run Evolution of Energy Prices," **The Energy Journal**, Vol. 20, No. 2.
[xii] Smith, James E. and Schwartz, Eduardo, "Short-Term Variations and Long-Term Dynamics in Commodity Prices," **Management Science**, Vol. 46, No. 7, July 2000.
[xiii] Smith, James E. and McCardle, Kevin F., "Options in the Real World: Some Lessons Learned in Evaluating Oil and Gas Investments," **Operations Research** 47 (1999), 1-15.
[xiv] In practice, we work with this model in discrete time. In discrete time, this is a first-order autoregressive model on the log of price with a random growth rate.
[xv] The long-run path is the long-run mean of the log of price. This is the median, not the mean of the price. With high volatility, the mean price can be much higher than this median. This can create serious confusion when interpreting prices.
[xvi] Energy Information Administration, Assumptions to the Annual Energy Outlook 2005, Table 38: Cost and Performance Characteristics of New Central Station Electricity Generating Technologies
[xvii] Parkinson, T.W., **Forward Price Forecasting for Power Valuation**, p. 2-2 to 2-5, EPRI TR-111860-R1, Final Report, March 1999.
[xviii] If forwards markets were established that actively traded 20 years into the future, we would recommend using the estimates from these markets for resource decisions and the forecasting problem would be very simple. At the same time, we understand that markets may be so thinly traded that they have no significant information more than 12 or 18 months out. In this circumstance, further reliance on historical data or on dispatch model simulations may be the best source of medium-run forecasts.
[xix] The seven price points in the figure are a very limited amount of data. The volatility might also be calculated from structural model runs or financial instruments such as options or futures.
[xx] We should note that this paper has not been a full presentation of our approach. We limited our long-run price paths to three. We would certainly suggest exploring and perhaps using more long-run price paths. We have not discussed fuel and electric price correlations. Similar analyses can be applied to long-run fuel price forecasting. Assuming that the probability distributions derived are the marginal distributions on electric and fuel prices, it is not difficult to add correlations to the analysis. We have not discussed the estimation of within year prices. We believe that this can be dealt with as a problem separate from long-run yearly average price estimation.
[xxi] Any errors in this paper are the sole responsibility of the authors. The authors would like to thank Tom Parkinson of The Northbridge Group for very kindly commenting on an earlier draft.