

## CHAPTER 4 KEY MODEL INPUTS

### Commodity Price Forecasts Used in the 2015 Plan

Forecast commodity prices represent the market price NorthWestern will pay for energy purchased to balance its portfolio. There is significant risk and volatility associated with reliance on the market, and while the energy procured from the market can meet short-term energy requirements, it does not contribute to peak capacity needs. NorthWestern requires a significant amount of capacity to meet its peak load, and new thermal resources can provide both energy and capacity.

#### **Commodity Forward Prices**

NorthWestern relies on current expectations of forward/forecast prices, market expectations of price implied volatility, fundamental market relationships, rate of mean reversion, and correlations of simulated prices through time in order to capture variability in the simulation of commodity prices. The simulated forward/forecast commodity prices include power at the Mid-Columbia trading hub (“Mid-C”), natural gas at the Alberta Energy Company Trading Hub (“AECO”), and coal used for generation at Colstrip. The forecasted commodity prices provide the expected values from the average of simulation results. The forecasts that are used in this plan will be utilized in evaluation of other potential future resources.

#### **Natural Gas Price Forecast**

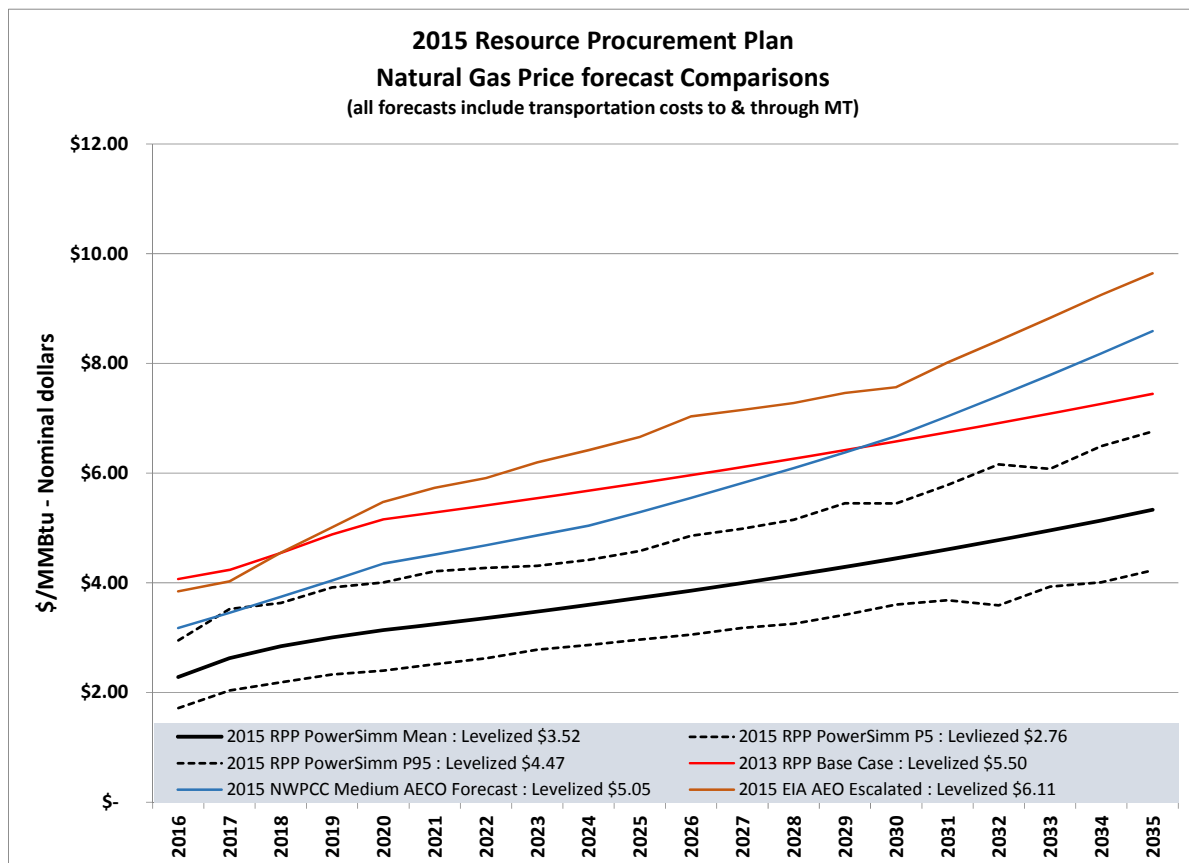
NorthWestern’s long-term natural gas forecast is a combination of current forward market prices and the application of long-term price escalation factors. The near-term Henry Hub and AECO basis forward prices are obtained from New York Mercantile Exchange (“NYMEX”), Intercontinental Exchange (“ICE”), and Natural Gas Exchange (“NGX”). These sources are used to compose a forward price curve for AECO from January 2016

until July 2020, at which time liquidity is deemed insufficient to support the extension of forward price quote information. The forward curve is then escalated after July 2020 through the remainder of the planning horizon at the average escalation rate from the Energy Information Administration (“EIA”) 2015 Annual Energy Outlook nominal Henry Hub gas price projection.

Natural gas prices have declined substantially since the filing of the 2013 Electricity Supply Resource Procurement Plan (“2013 Plan”). Figure 4-1 reflects the mean, P5, and P95 natural gas price forecasts simulated in PowerSimm for the 2015 Plan (in black), along with comparisons from the EIA Annual Energy Outlook for 2015, the NWPCC Medium price forecast update in December 2015, and the mean natural gas price from the 2013 Plan.

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**Figure 4-1 Natural Gas Price Forecast Comparisons**



### Electricity Price Forecast

NorthWestern uses the same methodology for its electricity price forecast that it is used for its natural gas forecast. Forward market electricity prices are provided by ICE and utilized through the same time period as in the natural gas forecast. The electricity price is then escalated using the same escalation rate as the natural gas forecast in order to maintain the structural relationship between natural gas and electricity going forward through time.

Figure 4-2 details NorthWestern’s average annual electricity price forecast along with the December 2015 Medium price forecast update provided by the NWPCC and the 2013 average annual electricity forecast. NWPCC does not include a carbon price in its 2015

electric forecast. For comparison purposes, NorthWestern removed carbon from the electricity forecast from both the 2013 and 2015 Plans.

**Figure 4-2 Electricity Price Forecast Comparisons**

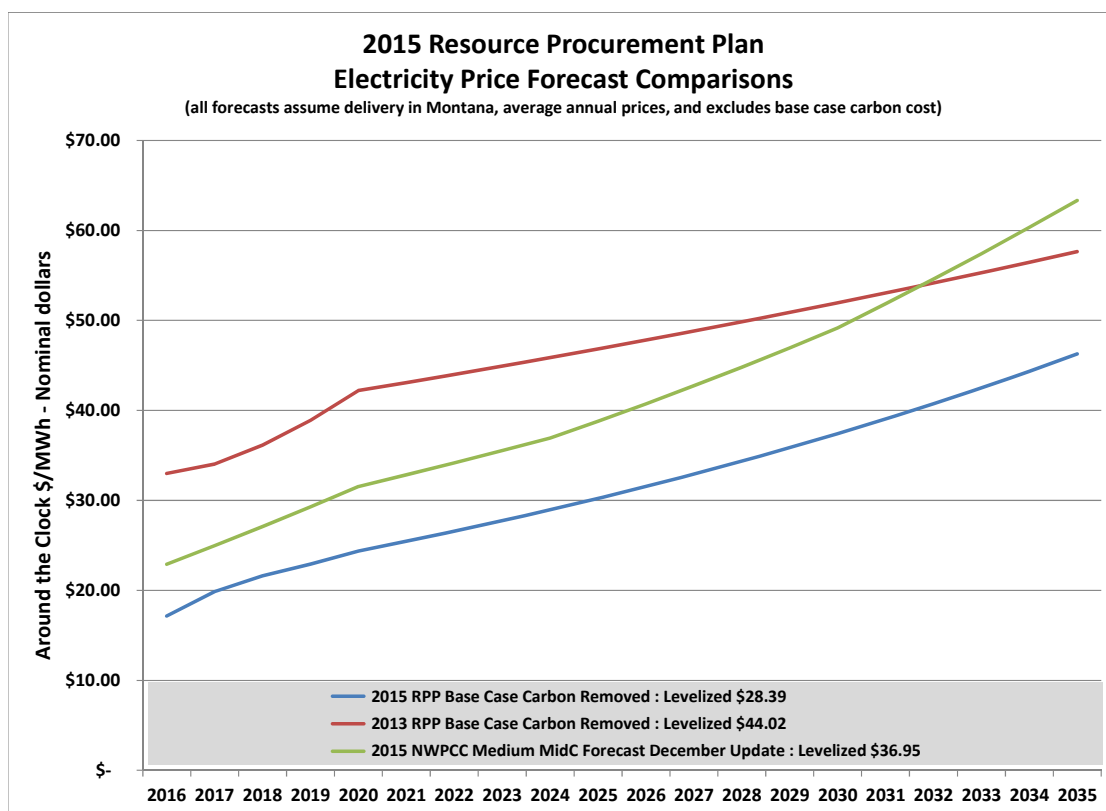


Table 4-1 details the mean heavy load, light load, and around the clock electric and natural gas price forecasts that are modeled in PowerSimm. The electricity prices include the base carbon price forecast that begins in 2022 and results in a significant increase in market prices for electric power and no impact to natural gas prices. The carbon price forecast is discussed in greater detail in Chapter 6.

**Table 4-1 Base Case Electricity and Natural Gas Price Forecasts  
(Including base case carbon price for electricity)**

<b>Mean Electricity &amp; Natural Gas Price Forecasts</b>				
<b>Montana Delivery (includes base case carbon cost for electricity)</b>				
	<b>HL - On Peak</b>	<b>LL - Off Peak</b>	<b>Around the Clock</b>	<b>Natural Gas</b>
<b>Year</b>	<b>(\$/MWh - Nominal)</b>	<b>(\$/MWh - Nominal)</b>	<b>(\$/MWh - Nominal)</b>	<b>(\$/MMBTu - Nominal)</b>
2016	\$19.38	\$14.19	\$17.10	\$2.28
2017	\$22.27	\$16.91	\$19.91	\$2.63
2018	\$24.18	\$18.66	\$21.75	\$2.84
2019	\$25.73	\$19.85	\$23.14	\$3.00
2020	\$27.34	\$21.30	\$24.68	\$3.14
2021	\$28.60	\$22.31	\$25.83	\$3.24
2022	\$41.91	\$35.36	\$39.03	\$3.36
2023	\$43.78	\$36.95	\$40.77	\$3.47
2024	\$45.72	\$38.60	\$42.59	\$3.60
2025	\$47.74	\$40.33	\$44.48	\$3.72
2026	\$49.85	\$42.13	\$46.45	\$3.86
2027	\$52.04	\$44.01	\$48.51	\$4.00
2028	\$54.33	\$45.96	\$50.65	\$4.14
2029	\$56.71	\$47.99	\$52.88	\$4.29
2030	\$59.19	\$50.11	\$55.19	\$4.45
2031	\$61.77	\$52.31	\$57.61	\$4.61
2032	\$64.46	\$54.61	\$60.12	\$4.78
2033	\$67.26	\$57.00	\$62.75	\$4.95
2034	\$70.18	\$59.49	\$65.48	\$5.14
2035	\$73.21	\$62.08	\$68.32	\$5.33
20-Year Lev	\$40.43	\$33.32	\$37.30	\$3.52

### **Colstrip Coal Price Forecast**

The Colstrip coal price forecast used estimated prices for 2016 through 2021. After 2021, the coal price is escalated throughout the remainder of the planning horizon using the 20-year average inflation escalation for Gross Domestic Product (“GDP”) as provided by the U.S. Bureau of Economic Analysis (“BEA”). Table 4-2 details the projected coal forecast. Coal price was escalated using GDP because coal prices from the Rosebud mine are tied more closely to costs of production under provisions of a negotiated term contract spanning multiple years.

**Table 4-2 Colstrip Coal Price Forecast**

<b>Colstrip Coal Price Forecast</b>	
<b>Year</b>	<b>(\$/ton - Nominal)</b>
2016	\$23.60
2017	\$23.47
2018	\$22.52
2019	\$24.61
2020	\$23.80
2021	\$27.60
2022	\$24.07
2023	\$24.55
2024	\$25.04
2025	\$25.55
2026	\$26.06
2027	\$26.58
2028	\$27.11
2029	\$27.65
2030	\$28.20
2031	\$28.77
2032	\$29.34
2033	\$29.93
2034	\$30.53
2035	\$31.14
<b>20-Year Lev</b>	<b>\$25.64</b>

### **Renewable Energy Credits**

The Montana Renewable Resource Standard, commonly referred to as RPS, requires that NorthWestern procure 15% of its annual supply from eligible renewable resources, such as wind, solar, biomass, and small hydroelectric. NorthWestern utilizes the renewable energy credits from these eligible renewable resources to satisfy its RPS obligation.

To date, NorthWestern has fulfilled its obligation through the use of RECs from owned and contracted resources. However, NorthWestern expects that it will need to acquire additional resources or RECs to meet its obligations under the RPS within the 20-year

planning horizon. Contracted resources provide both energy and associated environmental attributes, and NorthWestern has not needed to purchase additional RECs to satisfy its RPS obligation. The market for RECs in Montana is illiquid, with limited information, and few market participants due to the fact that NorthWestern bears primary responsibility for Montana renewable standards. NorthWestern's forecast of future prices for RECs is provided in Table 4-3.

It is difficult to construct a long-term estimate of REC prices with a high level of confidence. Estimates of REC prices are based upon broker quotes that do not extend more than a couple years into the future. An REC price increase of \$0.25/REC/year was employed where we assumed an annual increase to provide a modest level of price escalation over the 20-year planning horizon. If a more active market for RECs develops, NorthWestern will presumably be in a better position to forecast REC prices applicable to RECs for use in Montana with a higher level of confidence.

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**Table 4-3 Renewable Energy Credit Price Forecast**

<b>REC Price Forecast</b>	
<b>Year</b>	<b>(\$/REC - Nominal)</b>
2016	\$0.65
2017	\$0.90
2018	\$1.15
2019	\$1.40
2020	\$1.65
2021	\$1.90
2022	\$2.15
2023	\$2.40
2024	\$2.65
2025	\$2.90
2026	\$3.15
2027	\$3.40
2028	\$3.65
2029	\$3.90
2030	\$4.15
2031	\$4.40
2032	\$4.65
2033	\$4.90
2034	\$5.15
2035	\$5.40
20-Yr Lev	\$2.48

Besides commodity prices, other inputs to the PowerSimm analysis for NorthWestern are shown in Table 4-4 below. An inflation rate of 2.0% per year is used to scale current costs (e.g. generator variable operating costs) to future year (nominal) values. This is provided by the BEA and is the average of the 20-year quarterly percentage changes in GDP. NorthWestern’s nominal weighted average cost of capital (“WACC”) is used to discount all costs back to present value, in order to compare portfolio cash flows in the future.



**Table 4-4 Fundamental Inputs to PowerSimm Analysis**

<b>Fundamental Inputs to PowerSimm Analysis for NorthWestern Energy</b>	
<b>Input</b>	<b>Value</b>
Inflation	2.0%/year
Weighted average cost of capital (WACC)	7.03%
RPS compliance	15% of retail sales
Load growth	0.8%/year average (net of DSM)

Table 4-5 provides the WACC used in this Plan. NorthWestern is maintaining the same capital structure (48% debt and 52% equity) and cost of equity (10%) that was used in the 2013 Plan. The incremental cost of debt is updated at 4.29% to reflect current financial conditions.

**Table 4-5 Weighted Average Cost of Capital**

<b>NorthWestern WACC</b>			
	<b>Rate</b>	<b>Structure</b>	<b>Weighted Cost</b>
Cost of Equity	10.00%	48.00%	4.80%
Incremental Cost of Debt	4.29%	52.00%	2.23%
		WACC / ROR	7.03%