SECTION 6

AVOIDED COSTS

Overview

As part of the IRP process, Cascade calculates a 20-year forecast and 45 years of avoided costs. The avoided cost is the estimated cost to serve the next unit of demand with a supply side resource option at a point in time. This incremental cost to serve represents the cost that could be avoided through energy conservation. The avoided cost forecast can be used as a guideline for comparing energy conservation with the cost of acquiring and transporting natural gas to meet demand. Cascade evaluates the impact that a range of environmental externalities, including CO_2 emission prices, would have on the avoided costs in terms of cost adders and supply costs. The Company produces an expected avoided cost case based on the expected case peak day.

As discussed in Section 7 (Demand Side Resources), when calculating the avoided cost figures, the Company includes an incremental cost advantage for conservation resources to recognize the non-quantifiable benefits associated with conservation such as price certainty and a hedge value against future carbon costs.

Costs Incorporated

The following costs are included in the avoided cost calculation:

- The long term gas price forecast compiled from a consultant's gas price forecast (which is the majority of the cost);
- A price for carbon included in the gas price forecast, which has been embedded by the price forecast consultant;
- Gas storage variable and fixed costs;
- Upstream variable and fixed transmission costs;
- Peak related on-system transmission costs; and
- A 10 percent adder for unidentified environmental benefits, as recommended by the Northwest Power and Conservation Council ("NPCC").

The following parameters are also used in the calculation of the avoided cost:

- The most recent load forecast (9/8/2016);
- The inflation rate used 1% (EIA); and
- The discount rate used 3.52% (30-year mortgage rate),

Price Elasticity

Price elasticity is an economic concept which recognizes that customer consumption changes as prices rise or fall. The amount of this change (or "elasticity") is a function of other available products (i.e., substitutes) or the ability for customers to go without or use less with no meaningful impact on their personal life or in commerce.[1,2] "Price signals" is a term used to describe how customers see or expect future pricing to affect them.[3]

Price elasticity is expressed mathematically as a coefficient describing the amount of change in consumption per change in price. For example, a price elasticity factor of negative 0.10 means a consumer will reduce usage by one percent if the price increases by 10%. Conversely, a positive 0.10 coefficient factor for a 10% price decrease would predict customers would increase consumption by 1.0%. For products with high substitutability, the coefficient factors are high (e.g., greater than 0.50) and vice versa.

Price elasticity can be highly temporal. Consumers may not be able to make changes with short-term price increases or decreases. Yet, several years out, that same customer may replace equipment or make behavioral changes to use significantly less or more of a product depending on whether, over the long term, the product is more or less expensive.

The importance of price elasticity to natural gas integrated resource planning lies in the twenty year period over which the demand forecasts are estimated. This forecast (or range of forecasts under scenario planning) is a key determinant of the avoided cost. Low price elasticity in a rising natural gas price environment would suggest forecasted higher load would not change customer behavior and more natural gas would need to be acquired with corresponding delivery infrastructure. However, if usage materially decreases with higher prices, then less purchases and capital investment by an local distribution company (LDC) would be necessary. Therefore, price elasticity has some effect on the avoided cost.

Because avoided costs are integral to conservation planning, among other components, the impact of price elasticity on consumer consumption is of interest to all stakeholders in the planning process.

Several attributes of the regulated utility environment cause price elasticity calculations to be difficult to calculate with precision. Within customer classes, the type of customer usage varies:

- Residential—heating and non-heating
- Commercial—heating and processing

[1] An example of substitutes for a commodity is transportation fuels. As gasoline prices rise, commuters may carpool more or use public transportation. Conversely, in a low-cost gasoline environment, people may take longer driving vacations rather than fly or stay closer to home. In the long term, higher gasoline prices could steer customers to changing out their choice of their automobiles towards electric vehicles or compressed natural gas (CNG) vehicles, thereby reducing to zero their gasoline consumption. Conversely, some drivers such as taxi cab owners may have no near-term choices regarding amount of miles driven; rather, they pass the higher cost of gasoline to their customers.

[2] An example of going without or using less is movies at a cinema. Many entertainment alternatives are present, including waiting until a certain film is released to DVD or Blu-ray.

[3] "A price signal is information conveyed to consumers and producers, via the price charged for a product or service, which provides a signal to increase/decrease supply and/or that the demand for the priced item has increased/decreased." -- Wikipedia

Additionally, regulatory protocols may reduce direct signals because the annual purchased gas adjustment (PGA) may result in price increases or decreases of unknown magnitude. Further, customers assume general rate cases and price changes wil occur annual or biannually. As a result, customers are more likely to be uncertain of future pricing than to have the preconception that prices will rise.

Several items reduce load growth over time, regardless of price elasticity and price signals. Changes in economic conditions, added conservation, revised building codes and appliance standards, and advances in technology can lead to historical data that includes reduction in usage irrespective of pricing. This causes difficulty for customers to receive meaningful price signals and difficulty for utilities to isolate primary factors for long term price elasticity calculations (other than inflation). Regardless, customers may not return (or rebound) to historic usage after experiencing higher or lower price excursions.

A review of price elasticity leads to the following findings relevant to Cascade's current IRP process.

- Price elasticity exists, yet determining specific coefficient factors for linear modeling is inexact.
- A range of coefficient factors should be used to test sensitivities of the factors and impacts to the forecasts.
- Given Cascade's diverse geographical territory, statistical significance of price elasticity coefficients is uncertain.
- Several complicating factors call into question the accuracy and application of price elasticities. These include:
    - Regulatory mechanisms (e.g., PGAs and general rate cases) which dampen price signals or information to customers about future pricing.
    - Historical data (embedded with effects of conservation, technology advances, and changing economic conditions) renders reliance on this data imperfect for precise price elasticity determination.

- The retail price of most "substitutable" fuel—electricity—moves with the cost of natural gas, thereby lessening the economic value of alternative fuels to customers.
- Evolution of modeling suggests that future IRP modeling should incorporate iterative quantitative equations to allow built-in price elasticity effects.

Regardless, the Company believes price elasticity must be taken into account. For Cascade's 2016 IRP, a short-run coefficient factor of -0.10 and a long-run factor of -0.12 with ranges of plus or minus 0.07 is justifiable, given regional studies and other utilities' modeling efforts.

Incorporation of Carbon Adder

Federal, Washington, and Oregon agencies are proposing a series of regulations and policies to address greenhouse gas (GHG) emissions to regulate carbon dioxide CO_2 emissions. While focused on the Pacific Northwest electric industry, the Northwest Power and Conservation Council (NPCC) exhaustively examines CO_2 in its Seventh Power Plan (Plan) released in May 2016. This Plan builds on the Council's previous work and has become the recognized standard for carbon analyses. Cascade's IRP is best informed by the Council's survey of approaches, sensitivity analyses, and scenarios, with attention to Cascade's customers regarding cost-effectiveness and the results of other local distribution companies (LDCs). Cascade is addressing CO_2 in its energy efficiency programs, encouragement of the direct use of natural gas; and, methane capturing and leak prevention. Regarding expectations, customers have a smaller carbon footprint from their natural gas usage than from their electric usage.

Regardless, there is a high level of uncertainty about the impact of carbon legislation will have on natural gas prices, and it turn, on the avoided cost. Therefore, the Company has included a 10% carbon adder in its 2016 IRP's 20-year price forecast as a carbon adder proxy.

More in-depth discussion regarding the impacts of carbon legislation can be found in Section 5 (Environmental Considerations).

Application

The 2016 IRP makes several changes in calculating and applying the avoided costs. With the 2016 IRP, Cascade now calculates an avoided cost by each of the three Washington conservation zones. The DSM chapter has habitually operated as a stand-alone process wherein the Company reduces consumption in the near term through the existing programs, and the conservation team then forecasts its savings potential into the 20-year horizon at a state level. This is further described in Section 7 (Demand Side Resources). Once the savings potential forecasts are available at a statewide level, the savings forecasts are provided to the supply resource planning group in the final stages of the load forecast, where they are treated as a must take supply resource, reducing the load demand that must be met by more costly supply resources. Since the Company now forecasts avoided costs by conservation zone, this provides another level of granularity to assist the Conservation group in determining the cost-effectiveness of various programs.

Results

Table 6-1 displays the avoided cost by each conservation zone over the 20-year IRP horizon. For the 2016 IRP, the avoided cost ranges from approximately $5.19 per dekatherm in 2017 to approximately $7.18 per dekatherm in 2037.

As mentioned earlier, the avoided cost is based what we have determined is the 20 year expected case scenario. Overall, avoided costs for the 2016 IRP are lower than our more recent IRPs. Other than the fixed cost increases due to the inclusion of several alternative resources selected as part of the expected case portfolio, commodity costs—the biggest driver of avoided costs—are down. The 45-year avoided costs that are referenced in Chapter 7 (Demand Side Management) and other detailed tables of avoided costs, including various carbon scenarios, are found in Appendix H.

Table 6-1: Avoided Costs by Conservation Zone (cost per therm)

Year	Zone 1 Avoided Cost	Zone 2 Avoided Cost	Zone 3 Avoided Cost
2017	$ 0.542800	$ 0.494000	$ 0.522900
2018	$ 0.518900	$ 0.507000	$ 0.522100
2019	$ 0.525200	$ 0.490000	$ 0.512600
2020	$ 0.523200	$ 0.483400	$ 0.504500
2021	$ 0.536300	$ 0.494300	$ 0.511500
2022	$ 0.557300	$ 0.518800	$ 0.527300
2023	$ 0.557600	$ 0.503400	$ 0.518200
2024	$ 0.576600	$ 0.515900	$ 0.537100
2025	$ 0.580000	$ 0.523200	$ 0.537700
2026	$ 0.576600	$ 0.528400	$ 0.542700
2027	$ 0.591100	$ 0.539000	$ 0.554200
2028	$ 0.616300	$ 0.561800	$ 0.572500
2029	$ 0.628500	$ 0.551000	$ 0.571000
2030	$ 0.653400	$ 0.568700	$ 0.595700
2031	$ 0.668600	$ 0.605700	$ 0.609900
2032	$ 0.669400	$ 0.612300	$ 0.607400
2033	$ 0.694800	$ 0.641600	$ 0.635900
2034	$ 0.679800	$ 0.673500	$ 0.637600
2035	$ 0.691800	$ 0.675400	$ 0.646600
2036	$ 0.710600	$ 0.647200	$ 0.665400
2037	$ 0.717706	$ 0.653672	$ 0.672054