Cost-Benefit Analysis of Expanding Natural Gas Pipeline Capacity to Eureka, Utah Area

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Introduction

This document presents a cost-benefit analysis of Dominion Energy Utah's (DEU) Eureka Expansion Project. I analyze 25 cases based on current and historical price differences between natural gas and propane, and cost estimates provided by DEU to the State of Utah Public Service Commission. The project fails a cost-benefit in all but the most optimistic case. In order for the project to pass a cost-benefit analysis many more customer connections than are currently projected by DEU would be required. In fact, the number of connections required exceeds the current population of Eureka, UT in the majority of cases.

Project Costs

Dominion Energy Utah (DEU) has provided cost estimates associated with construction of the infrastructure required to deliver natural gas to consumers in Eureka, Utah to the State of Utah Public Service Commission on April 15.[1] Those costs vary depending on whether the natural gas is sourced from the Dominion Energy Questar Pipeline (DEQP) or the Kern River Gas Transmission pipeline (KRGT). The costs provided by DEU range from $16,165,514 to $18,013,506. The preferred option is connection to DEQP with a cost estimate of $17,898,072.

The cost estimates provided by DEU do not cover costs faced by individual consumers past the meter. This means a consumer would need to pay the costs of converting to natural gas inside their home or business. At minimum, these costs will include the costs of converting furnaces, water heaters and stoves using conversion kits. This is also likely not possible for older appliances. For example, furnaces or hot water heaters that are more than 10 years old would likely need to be completely replaced. Further, consumers heating with wood, coal, heating oil,

[1] See State of Utah Public Service Commission Docket No: 19-057-31. (https://psc.utah.gov/2019/11/21/docket-no-19-057-31/). Redacted Supplemental Direct Testimony of Michael L. Gill for Dominion Energy Utah.

or electricity, conversion to natural gas will require installation of gas lines and duct work, which would be considerably more expensive. Finally, consumers will need to pay to have their old propane tank removed if they convert from propane to natural gas. These costs are likely to vary considerably from consumer to consumer.

Due to the uncertainty associated with total costs of the Eureka project, I will apply several costs cases provided in Table 1.

***Table 1**. Cost cases for DEU Eureka Project Cost-Benefit Analysis*

Cost Case	DEU Cost	Consumer Conversion Cost
Very Low Cost	$16,000,000	$0
Low Cost	$16,000,000	$1,000
Medium Cost	$17,000,000	$2,000
High Cost	$18,000,000	$2,000
Very High Cost	$18,000,000	$3,000

As will be seen below, the benefits to consumers are unlikely to outweigh these costs even in the "Very Low Cost" case and assuming very cost-saving benefit to consumers.

Consumer Benefits

The total individual benefit to a consumer in a year of switching from propane (or another fuel) to natural gas derives from the price differential between propane and natural gas multiplied by the total consumption of that consumer in a year. The total lifetime benefit will be the discounted sum of these annual savings over the years that the consumer gets this savings benefit. The total benefit to all consumers will be this individual lifetime benefit multiplied by the number of consumers who choose to switch from propane to natural gas.

The United States Energy Information Administration (EIA) provides data on average residential prices of fuel delivered to residential consumers in the state of Utah.[2] Weekly propane prices are only provided for October to March and measured per gallon. Natural gas prices are provided monthly for the entire year and are measured per thousand cubic feet (Mcf). These prices need to

[2] See https://www.eia.gov/. For residential propane prices see https://www.eia.gov/dnav/pet/pet_pri_wfr_dcus_SUT_w.htm. For natural gas prices see https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm.

be converted to heating unit terms in order to make an apples-to-apples comparison. On average, a gallon of propane has 0.09133 million British thermal units (MMBtu), while on Mcf of natural gas has 1.036 MMBtu.[3,4] The average residential price of a gallon of propane delivered to consumers in Utah during February 2020 was $1.75 per gallon, which implies an average price of propane of $1.75/0.09133 = $19.16 MMBtu. The average residential price of natural gas delivered to consumers in Utah during February 2020 was $8.20 per Mcf, which implies an average price of natural gas of $8.20/1.036 = $7.92 per MMBtu. All prices for this analysis are converted to MMBtu in this manner.

Individual consumers might save money after they switch from propane to natural gas, but this does not imply that it is worth switching for an individual consumer, or that the total savings of consumers will outweigh the total cost of the Eureka project, due to costs of conversion for individual consumers and the costs of expanding the pipeline system to Eureka. In fact, it is unlikely that the Eureka project passes a cost-benefit analysis given DEU's own projections of the number of consumers that will switch to natural gas as indicated below.

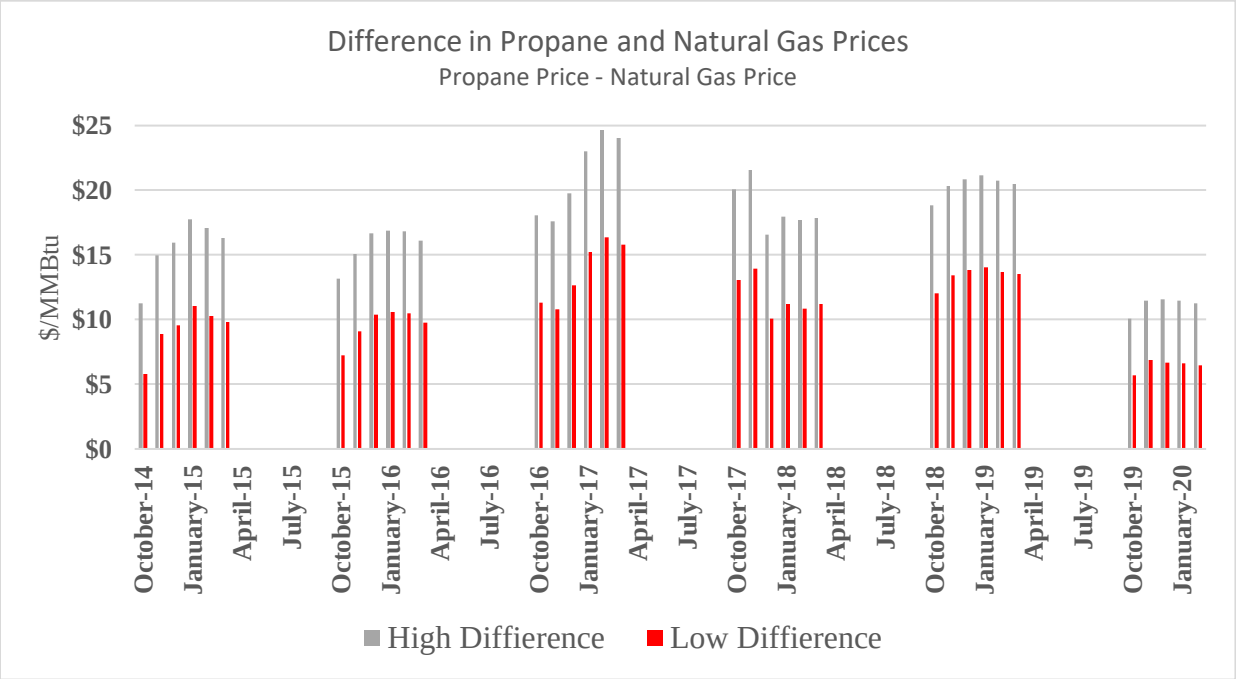
One important contrast between residential use of propane and natural gas is that propane users store propane onsite. This means it would be incorrect to directly compare the February 2020 propane price to the February 2020 natural gas price in the calculations above. This comparison is only accurate if customers tend to fill their propane tanks in February. However, the highest propane prices tend to occur in the winter months, so customers are more likely to try to fill their propane tanks when prices are lower. The Mayor of Eureka mentions this tendency in his testimony to the Public Service Commission.[5]

[3] See https://www.eia.gov/energyexplained/units-and-calculators/british-thermal-units.php.

[4] DEU delivers natural gas with a slightly lower heat content to consumers in Southern Utah, but also compensates customers for this lower heat content, so this should not affect these calculations. However, this could have implications for any environmental benefit calculations as it will require more gas to flow through the system to generate a fixed amount of heat.

[5] See State of Utah Public Service Commission Docket No: 19-057-31 (https://psc.utah.gov/2019/11/21/docket-no-19-057-31/). Direct Testimony of Nick Castleton in Support of Dominion Energy Utah's Application.

Figure 1. Residential price differences between propane and natural gas. The "High Difference" series assumes consumers purchase propane at its most expensive during the year which is unlikely and the "Low Difference" series assumes consumers purchase propane at its lowest price during the year. (Summer residential propane prices are not available from EIA but the wholesale price is 25% lower in the summer than the winter on average, so I apply this discount to derive the low summer price). Source: Energy Information Administration (eia.gov).



There is also uncertainty related to how natural gas and propane prices will fluctuate in the future and, therefore, how the difference in these prices will fluctuate in the future. Natural gas prices have been extremely low in recent years relative to historical averages. Figure 1 shows differences in residential propane and natural gas prices during the winter months from 2014 to 2020. The high difference assumes that consumers buy propane at its most expensive during the year, while the low difference assumes that consumers buy propane when it is least expensive. Figure 1 shows a recent declining trend in the premium for propane. The cost savings associated with using natural gas rather than propane reached their lowest point in the winter of 2019-2020.

The possibilities of consumer behavior and future price volatility in propane and natural gas markets make it more difficult to calculate the cost-savings benefits related to switching from propane to natural gas that will accrue to consumers. Therefore, I apply several different cases in order to perform the cost-benefit analysis. These cases are shown in Table 2. In order to calculate savings per consumer, I apply DEU's total annual load estimate for the Eureka area and divide

by 360, which is the number of connections DEU assumes when making their load estimate.[6] This results in a per connection consumption estimate of 92 MMBtu (Dth) per year (33098/360 = 92).

The different price/savings cases displayed are as follows. The "Low" price-differential case assumes that consumers will receive the minimum price savings, i.e., the lowest price differential between summer propane prices and natural gas prices observed since October 2014. This differential occurred in October 2019. The "Mid-Low" case assumes that consumers fill their propane tanks at the best time each year (July or August) and uses the average of the implied price differential from October 2014 to February 2020. The "Mid-High" case assumes consumers fill their propane tanks at the worst possible time each year (January or February) and uses the average of the implied price differential from October 2014 to February 2020. The "Medium" case is the midpoint between the "Mid-Low" case and the "Mid-High" case. The "High" case assumes that consumers will receive the maximum price savings, i.e., the highest differential between winter propane prices and natural gas prices observed since October 2014. This differential occurred in February 2017. I see the "Medium" price differential case as the most likely. It assumes that consumers buy propane at low summer prices to the extent that they can, but allows for capacity constraints and that consumers do not perfectly optimize their propane purchases. The "High" price differential case is very unlikely. However, we will see below that the DEU Eureka expansion almost always fails a cost-benefit analysis with 360 connections even in the unlikely "High" price differential case, which leads to the largest consumer benefits associated with the Eureka project.

Table 2. *Price differential cases for DEU Eureka Project Cost-Benefit Analysis.*

Price Differential Case	Average Savings per MMBtu	Annual Savings per Connection	Perpetual Savings per Connection	Total benefit with 360 Connections (Millions of $)
Low	$5.69	$523.26	$10,465.20	$3.767
Mid-Low	$10.81	$994.62	$19,892.38	$7.161
Medium	$14.05	$1,292.60	$25,852.00	$9.307
Mid-High	$17.29	$1,590.47	$31,809.41	$11.451
High	$24.64	$2,266.64	$45,332.90	$16.320

[6] See State of Utah Public Service Commission Docket No: 19-057-31. (https://psc.utah.gov/2019/11/21/docket-no-19-057-31/). DEU Exhibit 2.05 – Estimated Load Consumption.

The second column of Table 2 shows the average consumer cost savings per MMBtu of fuel consumed in each of the price differential cases. The third column of Table 2 shows the annual cost savings per consumer, while the fourth column shows perpetual cost savings using a 5% discount rate to adjust for the time value of money and uncertainty. Future savings must be discounted because the current value of dollars is greater than the value of dollars in future time periods. Uncertainty includes possibilities like new technologies that decrease the value of switching to natural gas or the possibility of vacancies in households that switch to natural gas.

Net Benefits of the DEU Eureka Project

An important conclusion can be immediately drawn by comparison of the cost cases in Table 1 and the price-differential cases in Table 2: the DEU Eureka Project produces positive net benefits with 360 connection only if the "Very Low Cost" and "High" price differential cases hold. However, both of these cases are unlikely. The "Very Low Cost" case assumes infrastructure costs that are lower than any of the options presented by DEU, and assumes consumers will not face any costs in switching to natural gas, while the "High" price differential case assumes that the highest price differential between propane and natural gas observed since October 2014 will prevail for perpetuity even though more recent differentials have been much lower (see Figure 1). The project produces negative net benefits in all other cases examined here, i.e., the costs of the project are likely to outweigh the benefits. The upshot is that the DEU Eureka Project is unlikely to pass a cost-benefit analysis at DEU's current projected number of connections as it fails a cost-benefit analysis is all but the most extreme and unlikely case.

The net benefits associated with all of the price-differential and cost cases are presented in the third column of Table 3. Table 3 makes clear that DEU's Eureka Project results in negative net benefits in all cases examined here other than the most optimistic and unlikely case. In fact, the project could result in large losses to rate payers. Even in the relatively "Mid-High" price-differential case that implies large savings to consumers who connect to the system losses are expected to be between $4 million and $8 million. In pessimistic cases, net economic losses could be as high as $15 million.

Table 3. Net benefits associated with different price-differential and cost cases.

Price-Differential Case	Cost Case	Net Benefits with 360 Connections	Breakeven Number of Connections
Low	Very Low Cost	($12,232,528)	1529
	Low Cost	($12,592,528)	1691
	Medium Cost	($13,952,528)	2009
	High Cost	($14,952,528)	2127
	Very High Cost	($15,312,528)	2412
Mid-Low	Very Low Cost	($8,838,744)	805
	Low Cost	($9,198,744)	847
	Medium Cost	($10,558,744)	951
	High Cost	($11,558,744)	1007
	Very High Cost	($11,918,743)	1066
Medium	Very Low Cost	($6,693,280)	619
	Low Cost	($7,053,280)	644
	Medium Cost	($8,413,280)	713
	High Cost	($9,413,280)	755
	Very High Cost	($9,773,280)	788
Mid-High	Very Low Cost	($4,548,613)	503
	Low Cost	($4,908,613)	520
	Medium Cost	($6,268,613)	571
	High Cost	($7,268,613)	604
	Very High Cost	($7,628,613)	625
High	Very Low Cost	$319,843	353
	Low Cost	($40,157)	361
	Medium Cost	($1,400,157)	393
	High Cost	($2,400,157)	416
	Very High Cost	($2,760,157)	426

One critical and uncertain parameter in analyzing the economic efficacy of DEU's Eureka Project is the number of connections. As mentioned above, DEU uses an estimate of 360 connections in its materials presented to the Public Service Commission based on the population in the Eureka area and the results of a survey asking resident if they would connect to the natural gas system. The net economic benefits of the project improve when more connections are made. The fourth column of Table 3 presents the number of total connections required for the project to achieve positive economic benefits in each of the price-differential and cost cases presented above. In the most optimistic case, the number of connections required is 353, which is less than DEU's projected 360 connections. This is how positive economic benefits are achieved in that case. However, in all other cases, more than 360 connections are required to achieve positive net economic benefits. For example, the "Medium" price-differential, "Medium" cost case would require 713 customer connections to break even. [7]

[7] On May 27, 2020 the commission received comment that DEU should provide details related to potential customers taking service. The amendment would require a limited time window for customers to sign up for service

Employment and Environment

My research into the environmental and employment implications indicate no substantial costs or benefits in either case. Changes in employment and environmental quality are likely to be unsubstantial relative to the calculations based on consumer savings relative to project costs above. Job losses are most likely to occur in the propane industry in the Eureka Expansion project goes forward. Approximately 200 workers are employed in the retail, transportation, storage, and wholesale industry in the state of Utah, and the Eureka market likely makes up a relatively small share of the total market.[8] However, any one who is employed in this industry in the Eureka area is likely to be negatively affected by the Eureka Expansion Project. On the other hand, the construction of the project will create temporary jobs related to construction and a small number of permanent jobs related to the management of the expanded system. The net change in jobs related to the project is unlikely to be substantial in either direction.

Propane and natural gas are both clean burning fuels. Given the relatively small size of the Eureka Expansion Project total changes in environmental quality are unlikely to be substantial related to changes in consumption from the project. The largest environmental costs are likely be from the construction of the project itself from increased traffic and use of large machinery. However, these environmental costs are unlikely to be substantial relative to the direct costs and benefits of the project analyzed above.

Conclusion

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and actually begin taking natural gas. If the customers do not begin taking the natural gas they will still be responsible for paying their part in the reimbursement of the service line cost. While this will not substantially change the total project costs, it might decrease the number of customers willing to sign up for service relative to the 360 projected especially for customers that face substantial upfront conversion costs. Any decrease in the number of eventual connections will decrease the economic efficacy of the project. On the other hand, if the amendment were not adopted many consumers might sign up for the expansion and delay taking natural gas for long periods of time, which would also decrease the economic efficacy of the project. See State of Utah Public Service Commission Docket No: 19-057-31 (https://psc.utah.gov/2019/11/21/docket-no-19-057-31/). Supplemental Direct Testimony of Alex Ware on behalf of the Office of Consumer Services.

[8] See "Impact of the U.S. Consumer Propane Industry on U.S. and State Economies in 2015." *Propane Education and Research Council*. http://www.npga.org/wp-content/uploads/2018/02/2015-Propane-Industry-Impact-on-US-and-State-Economies-FINAL.pdf

This analysis calculates the net economic benefits of Dominion Energy Utah's (DEU) Eureka expansion project. The analysis applied several different cost cases based on DEU's cost calculations. The analysis finds that the costs of the Eureka Expansion Project are likely to outweigh the benefits to consumers based on DEU's own projection of customer connections to the natural gas system in Eureka. DEU's project fails a cost-benefit analysis in all but one of the 25 cases analyzed here. Further, in many cases the net losses associated with the project are substantial. For example, in the "Medium" cost and "Medium" consumer saving case, net losses are expected to be approximately $8.5 million. In order for the project to have positive economic benefits, many more consumers connections to the system would be required and in several cases the number of connections would need to be larger than the current population of Eureka, UT.