Cascade Natural Gas Corporation

2016 Integrated Resource Plan
Presentation to WUTC Commissioners and Stakeholders

Wednesday, March 29, 2017

WUTC

Olympia, WA

AGENDA

- OPENING REMARKS
- PURPOSE OF IRP
- PROCESS FOLLOWED
- DEMAND FORECAST
- GAS SUPPLY OVERVIEW
- ENVIRONMENTAL CONSIDERATIONS
- AVOIDED COST
- DEMAND SIDE MANAGEMENT
- DISTRIBUTION SYSTEM PLANNING
- INTEGRATION RESULTS
- ADDITIONAL QUESTIONS

CASCADE NATURAL GAS CORPORATION
A Subsidiary of MDU Resources Group, Inc.
In the Community to Serve®

Purpose of the IRP Process

Bruce Folsom

Bruce W Folsom Consulting LLC

March 29, 2017

All Formal Explanations Aside…

- The purpose of an IRP is to depict the overall company plan more transparently …
  - For immediately-contemplated actions (i.e., in the next two years),
  - To characterize emerging issues and related approaches for mitigation, if necessary, and
  - To outline the long-term direction a company is headed *vis-a-vis* the industry, including economic trends, industry structure (partners such as the pipeline(s) and their impact/actions), technology, customer usage, etc.

IRP Objectives

- Present a transparent roadmap of the overall corporate plan per the previous slide
- Promote internal coordination
- Describe to key stakeholders and the public the complex utility system unique to the local distribution company and management decision-making processes
- Provide previews of future projects and issues which can lead to improved regulatory filings
- Meet regulatory requirements

Benefits

- A company can describe its unique circumstances, opportunities and challenges over the planning horizon
- More specifically, while commissions do not approve the IRP—and, hence future actions—the description of potential actions generally provides for an improved process of future filings, because stakeholders have a basis, in advance, for what is driving those decisions

In Conclusion

- An IRP Provides an understanding of industry and utility-specific practices

- That the Commission acknowledges the plans, rather than approve them, does not lessen the process's regulatory importance

- The commitment from Cascade's senior leadership has been outstanding and recognized by stakeholders

Process Followed

IRP GUIDELINES AND CONTENT

WASHINGTON
IRP Guidelines from WUTC WAC 480-90-238

CASCADE'S PHILOSOPHY
Primary purpose of Cascade's long-term resource planning process has been, and continues to be, to inform and guide the Company's resource acquisition process, consistent with state regulatory requirements.

Input and feedback from the Company's Technical Advisory Group (TAG) is an important resource to help ensure that CNGC's IRP is developed from a broader perspective than Cascade could have on its own.

In response to the issues identified with the 2014 IRP, Cascade has strengthened its commitment to securing and supporting the appropriate internal and external resources necessary to work with all stakeholders to produce a 2016 Integrated Resource Plan that meets the requirements of Washington Administrative Code 480-90-238.

Stakeholder Engagement Process

- Input and feedback from Cascade's Technical Advisory Group (TAG) is an important resource to help ensure the IRP includes perspectives external to the Company and is responsive to stake-holders.
- Six TAG meetings were held in SeaTac and Kennewick.
- Multiple opportunities for public participation were available.
- Several walkthroughs of technical components (e.g SENDOUT® modeling) were conducted upon request.

Resource Decision Making Process Overview

- Construct a range of possible demand forecasts for the core market.
- Calculate avoidable distribution system enhancement costs.
- Provide the optimization model the existing supply side and demand side resource options to meet demand.
- Run the optimization model to identify resource needs including the types of resources and their timing requirements. The existing portfolio is modeled under a range of demand forecast conditions.
- Identify incremental supply and demand side resources to satisfy a range of incremental growth scenarios.
- Run the optimization and Monte-Carlo simulation models to identify the best fit portfolio given an expected range of forecasted core loads and operating conditions.

RESOLVING THE 2014 ISSUES WITH THE 2016 IRP

- The lack of clear explanation of the timing of resource needs and how capacity deficits at specific city gates would be met (WAC 480-90-238(3)(g))
  - **CASCADE WORKED WITH STAKEHOLDERS TO CLEARLY IDENTIFY THE SPECIFIC TIMING, POTENTIAL EXCEPTIONS, AND METHOD OF DEALING WITH UPSTREAM PIPELINE CAPACITY DEFICITS AT DEMAND AREAS IN TAG 5 .**

- The lack of detailed load forecast information by class and state (WAC 480-90-238 (3)(a))
  - **DURING TAG 2, CASCADE WORKED WITH STAKEHOLDERS TO DEFINE THE SPECIFIC EXPECTATIONS FOR THIS ISSUE.**

- Insufficient analysis and explanation of conservation potential (WAC 480-90-238 (3)(b))
  - **CASCADE WORKED WITH STAKEHOLDERS DURING THE 2016 IRP PROCESS TO IDENTIFY STAFF'S SPECIFIC CONCERNS REGARDING THE INSUFFICIENT ANALYSIS AND EXPLANATION OF CONSERVATION POTENTIAL.**

RESOLVING THE 2014 ISSUES WITH THE 2016 IRP

- The lack of a description of the company's stakeholder engagement process (WAC-480-90-238(5))
  - **WITH THE PUBLICATION OF THE 2016 IRP, CASCADE HAS PROVIDED AN IMPROVED DESCRIPTION OF THE STAKEHOLDER PARTICIPATION PROCESS THROUGH INCLUSION OF TAG MEETING PRESENTATIONS, MINUTES AND RESPONSES TO COMMENTS.**

- Unclear explanation of the company's risk management rationale and hedging strategy (WAC 480-90-238(3)(f))
  - **ON MARCH 13, 2017 CASCADE RECEIVED THE WUTC POLICY & INTERPRETIVE STATEMENT ON HEDGING (DOCKET UG-132019). CASCADE WILL BE WORKING WITH STAFF, STAKEHOLDERS AND OTHER LDCS ON HOW BEST TO IMPLEMENT THE EXPECTATIONS THE COMMISSION IDENTIFIED IN THE POLICY. THE COMPANY WILL CONTINUE TO PARTICIPATE IN ANY FUTURE UG-132019 ACTIVITIES. PER THE WUTC POLICY, CASCADE WILL PROVIDE THE COMPANY'S INITIAL HEDGING PLAN WITH THE FILING OF THE 2017 PGA**

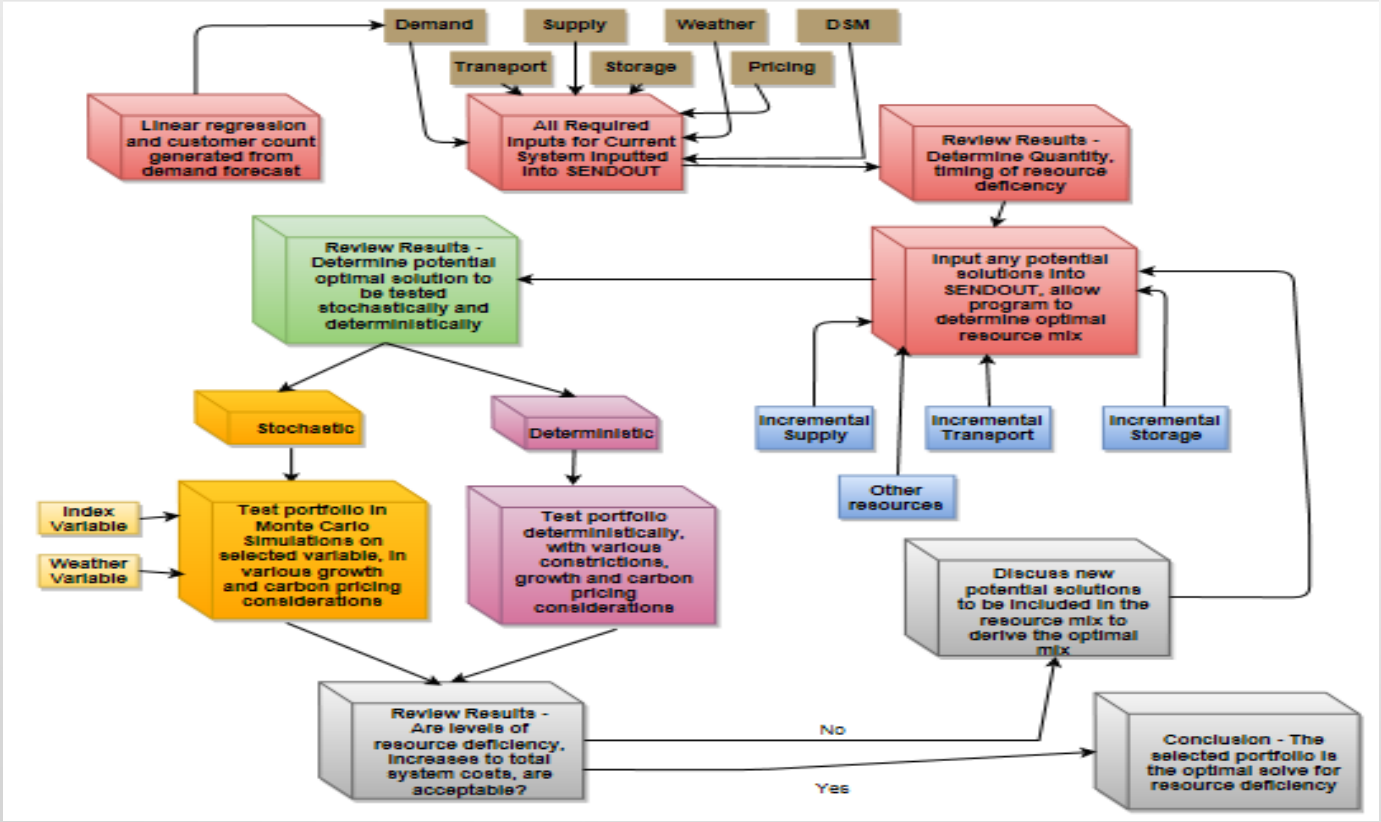
- In addition to the above-listed rule requirements, the commission also identified a general lack of organization and presentation that made the plan difficult to read and understand
  - **CASCADE IS COMMITTED TO WORKING ON AN IMPROVED NARRATIVE TAKING INTO ACCOUNT COMMENTS MADE BY STAKEHOLDERS IN REFERENCE TO THE 2014 IRP. THE NARRATIVE IN THE 2016 IRP IS A SIGNIFICANT IMPROVEMENT.**

"Original" 2016 IRP TIMELINE

Date	Process Element	Location (Subject to change)
Thursday, June 09, 2016	TAG 1 slides distributed to stakeholders	
Thursday, June 16, 2016	TAG 1: Process, Key Assumptions, IRP Team, Timeline, Latest Economic Indicators, Price Forecast and Demand Forecast, Plan for dealing with issues raised in 2014 IRP	
Thursday, July 14, 2016	TAG 2 slides distributed to stakeholders	
Tuesday, July 19, 2016	TAG 2: Drilling down into segments of demand forecast, Current Supply Resources, Transport Issues, Alternative Resources, Update on 2 Year Plan	Seattle Airport Conference Center
Friday, August 12, 2016	TAG 3 slides distributed to stakeholders	
Thursday, August 18, 2016	TAG 3: Conservation, Distribution System Planning, Planned Scenarios and Sensitivities	Seattle Airport Conference Center
Thursday, September 08, 2016	TAG 4 slides distributed to stakeholders	
Thursday, September 15, 2016	TAG 4: Preliminary Resource Integration Results, Avoided Costs, Proposed new 2 year Plan	Seattle Airport Conference Center
Tuesday, October 04, 2016	TAG 5: Final Integration Results, finalization of plan components	Seattle Airport Conference Center
Monday, October 17, 2016	Draft of 2016 IRP distributed	Kennewick, WebEx
Monday, November 07, 2016	Comments due on draft from all stakeholders	
Thursday, November 17, 2016	TAG 6, if needed	Seattle Airport Conference Center
Wednesday, November 23, 2016	Final IRP goes to press	
Thursday, December 01, 2016	Executive Summary Presentation to Senior Management	Kennewick, WebEx
Thursday, December 15, 2016	IRP filing in Washington	

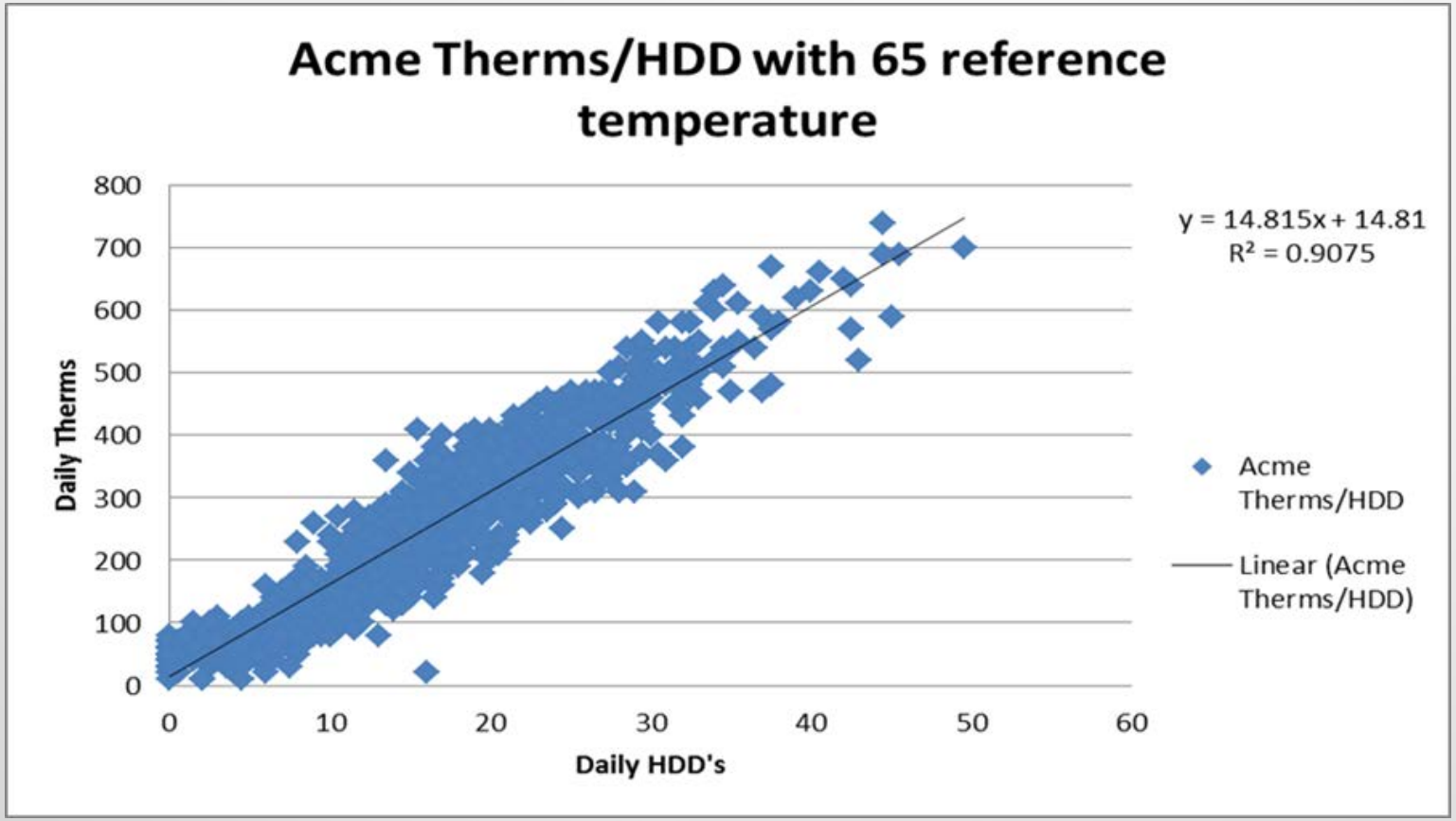
Demand Forecast

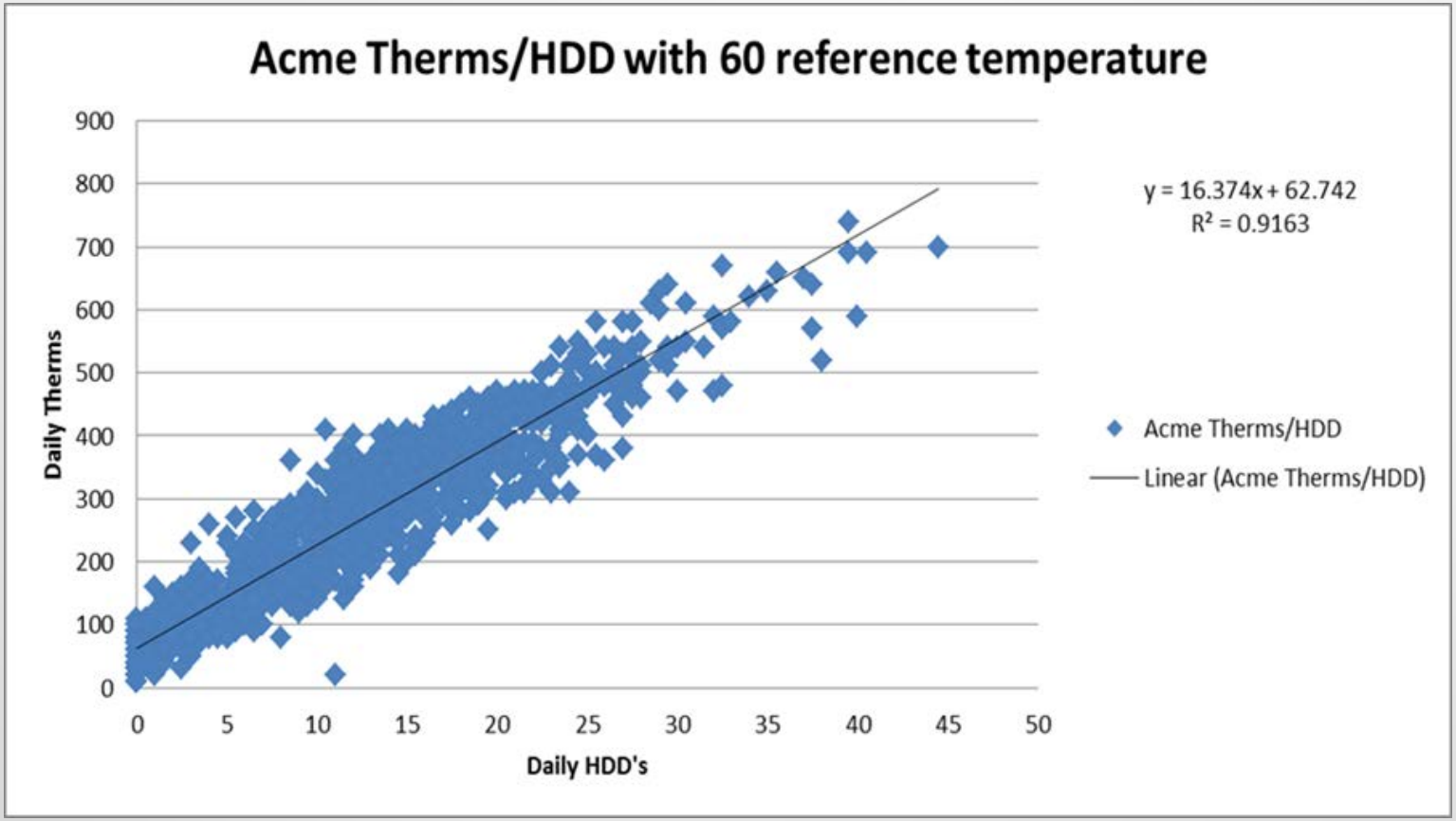
Current Methodology – Flow Chart



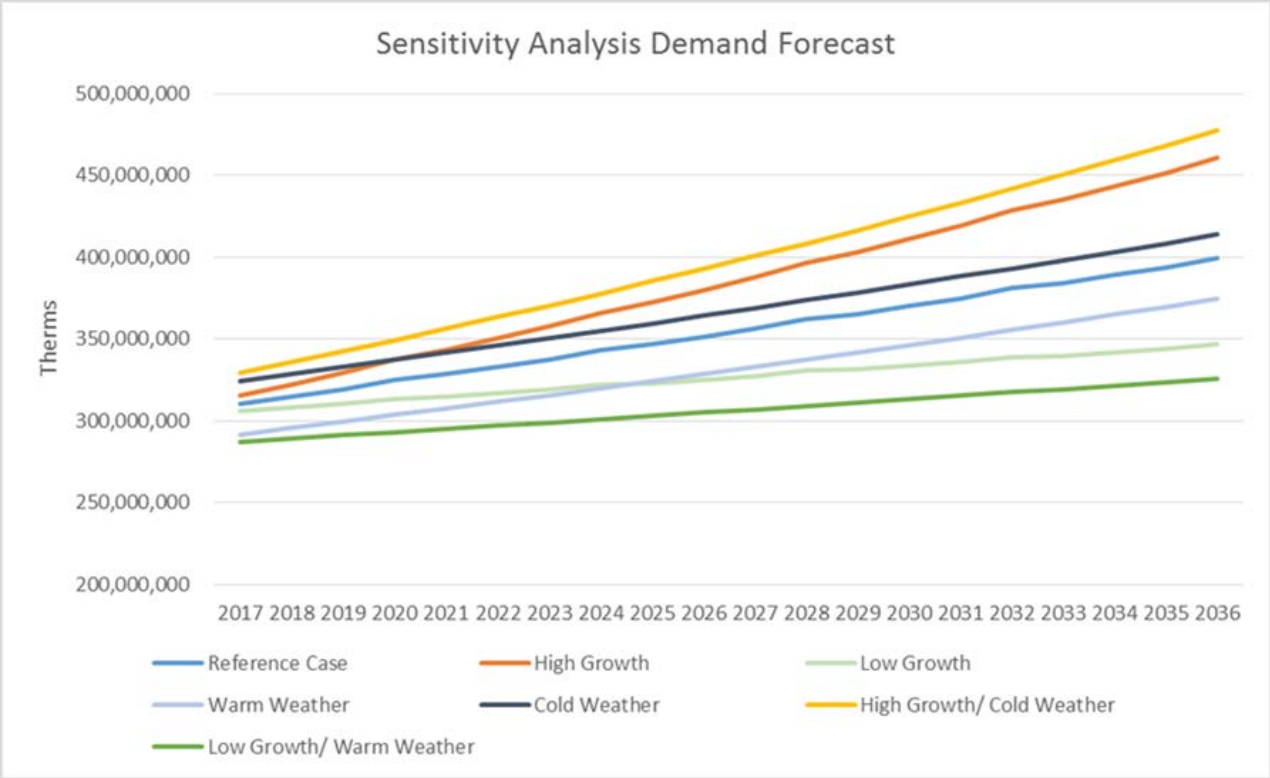
Forecast Model

- The Company currently utilizes an ordinary least squares (OLS) regression to predict customer usage.
- Cascade uses a 60 degree reference temperature to calculate HDDs.
- Multiple scenarios are analyzed such as high/low growth, warm/cold weather, peak day events, etc.
- Cascade analyzes 3 peak day events; average peak day, system-wide peak day, and max at each weather location peak day.
- The Company utilizes an average year of demand with a system-wide peak event for deterministic analysis in SENDOUT®.

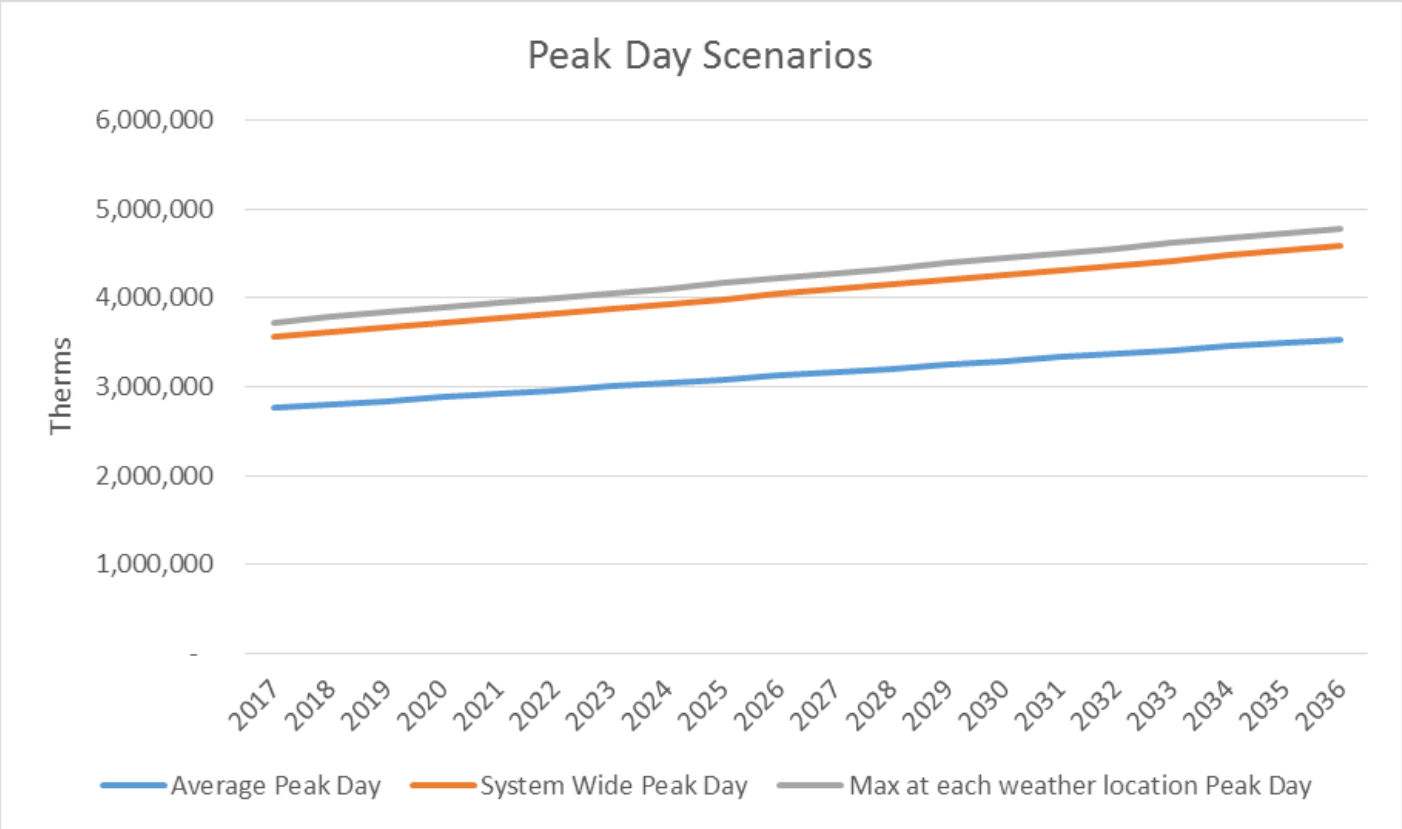

Acme Therms/HDD with 65 reference temperature
Daily Therms
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
Daily HDD's
y = 14.815x + 14.81
R² = 0.9075
Acme Therms/HDD
Linear (Acme Therms/HDD)


Acme Therms/HDD with 60 reference temperature
Daily Therms
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
50
Daily HDD's
y = 16.374x + 62.742
R² = 0.9163
Acme Therms/HDD
Linear (Acme Therms/HDD)

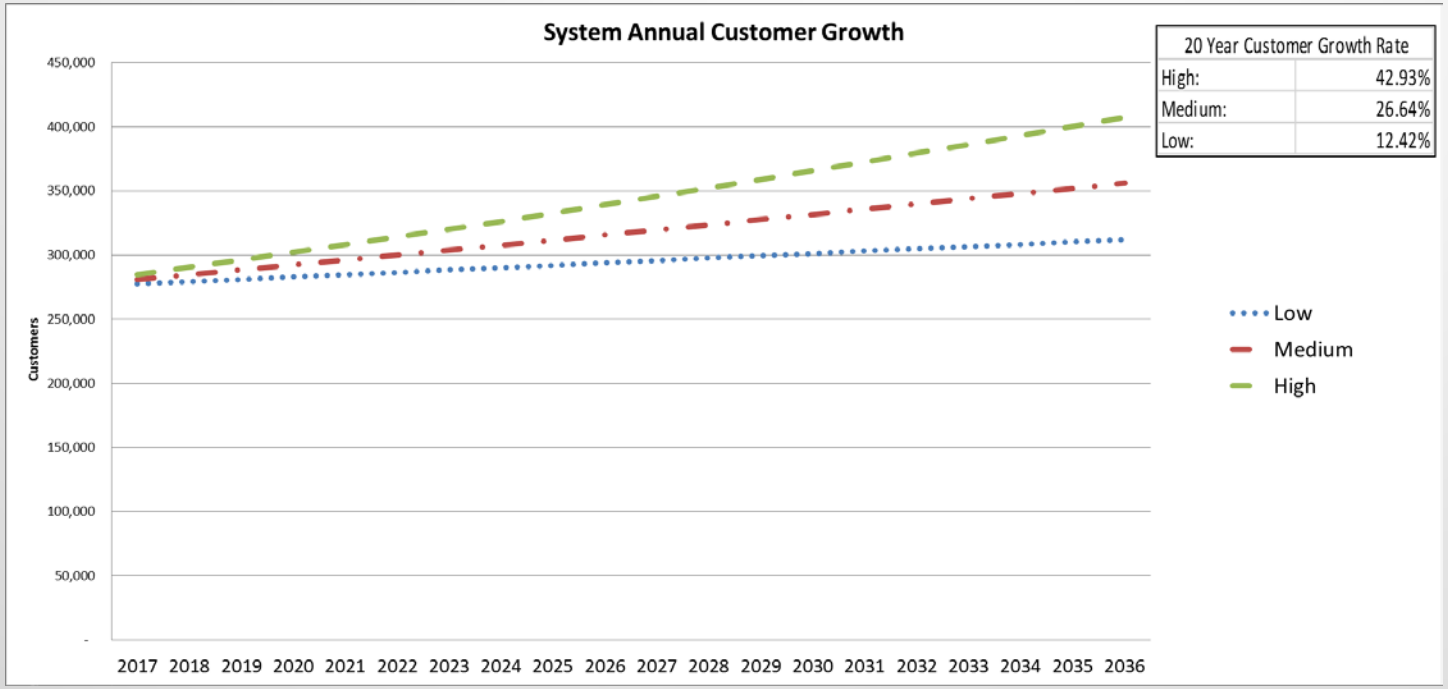
Scenarios


Sensitivity Analysis Demand Forecast
Therms
500,000,000
450,000,000
400,000,000
350,000,000
300,000,000
250,000,000
200,000,000
2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036
Reference Case
High Growth
Low Growth
Warm Weather
Cold Weather
High Growth/ Cold Weather
Low Growth/ Warm Weather

Peak Day Scenarios

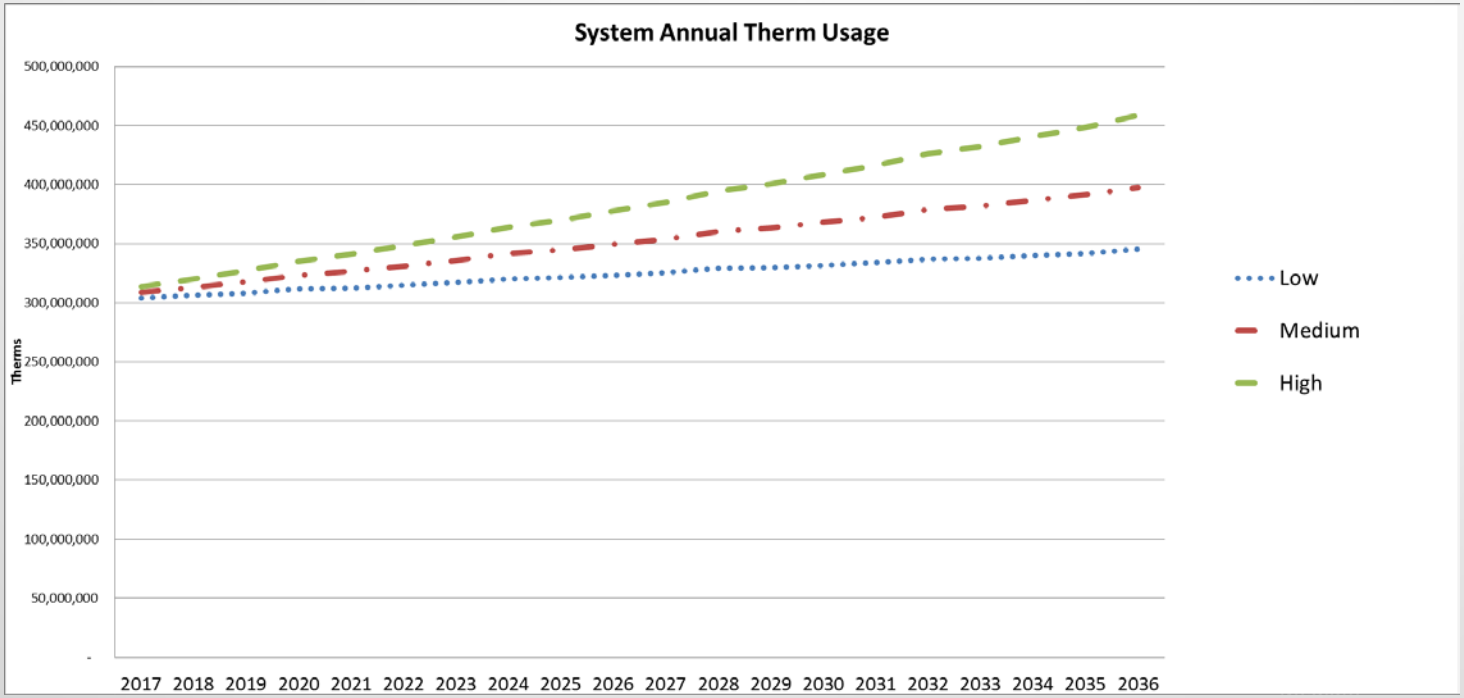


- Cascade expects system load growth to be 1.25% per year, or 26.6% over the 20 year planning horizon.

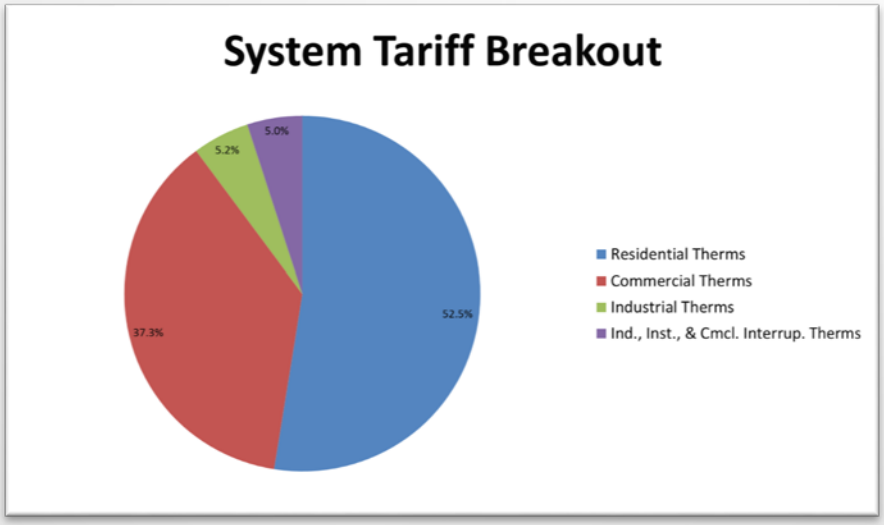


20 Year Customer Growth Rate	
High:	42.93%
Medium:	26.64%
Low:	12.42%

- Usage expects to be approximately 308 million therms in 2017 and grow to just under 400 million therms in 2036.

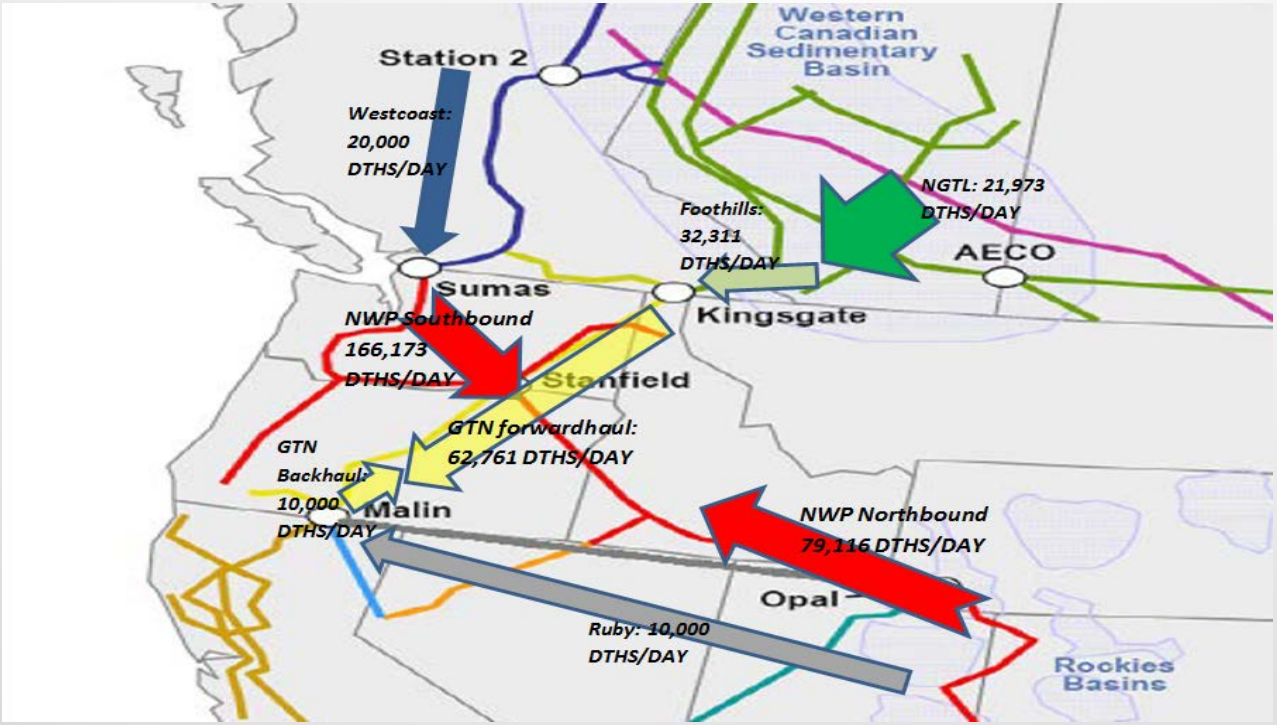


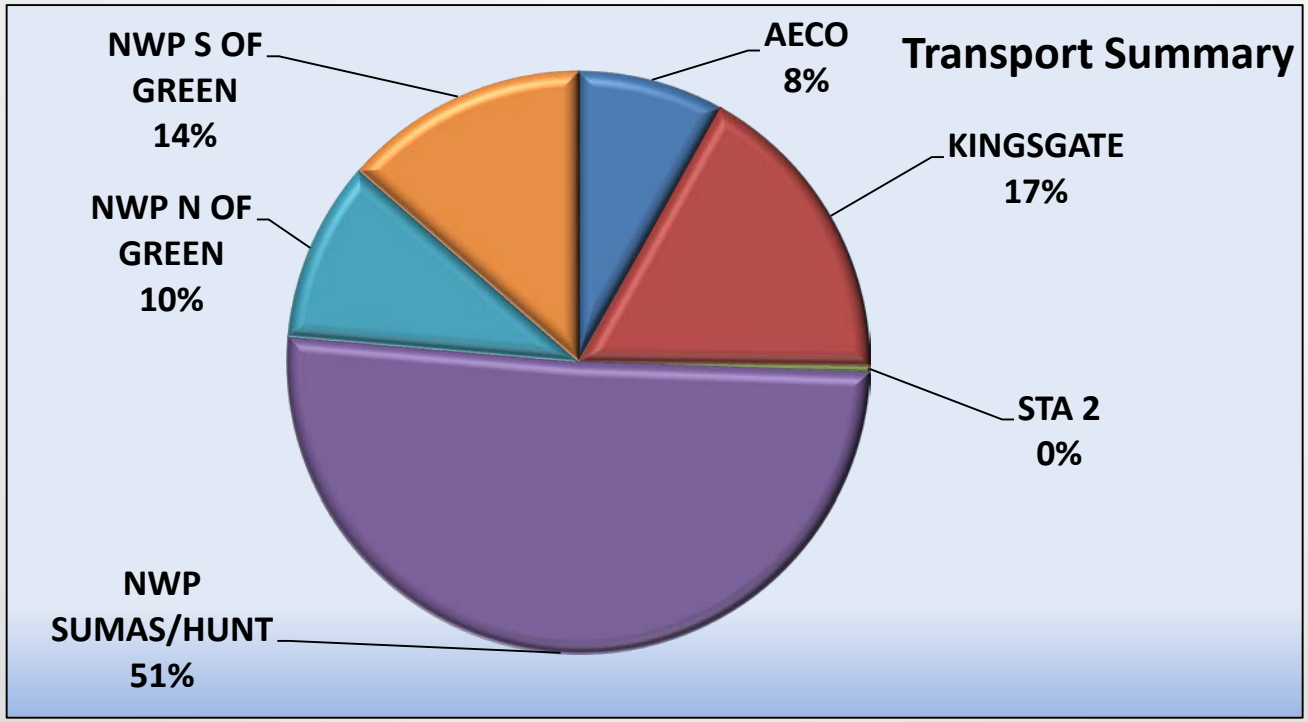
System Tariff Breakout



Cascade Gas Supply Overview

EXAMPLE OF POSSIBLE CNGC WINTER TRANSPORT CAPACITY FLOW



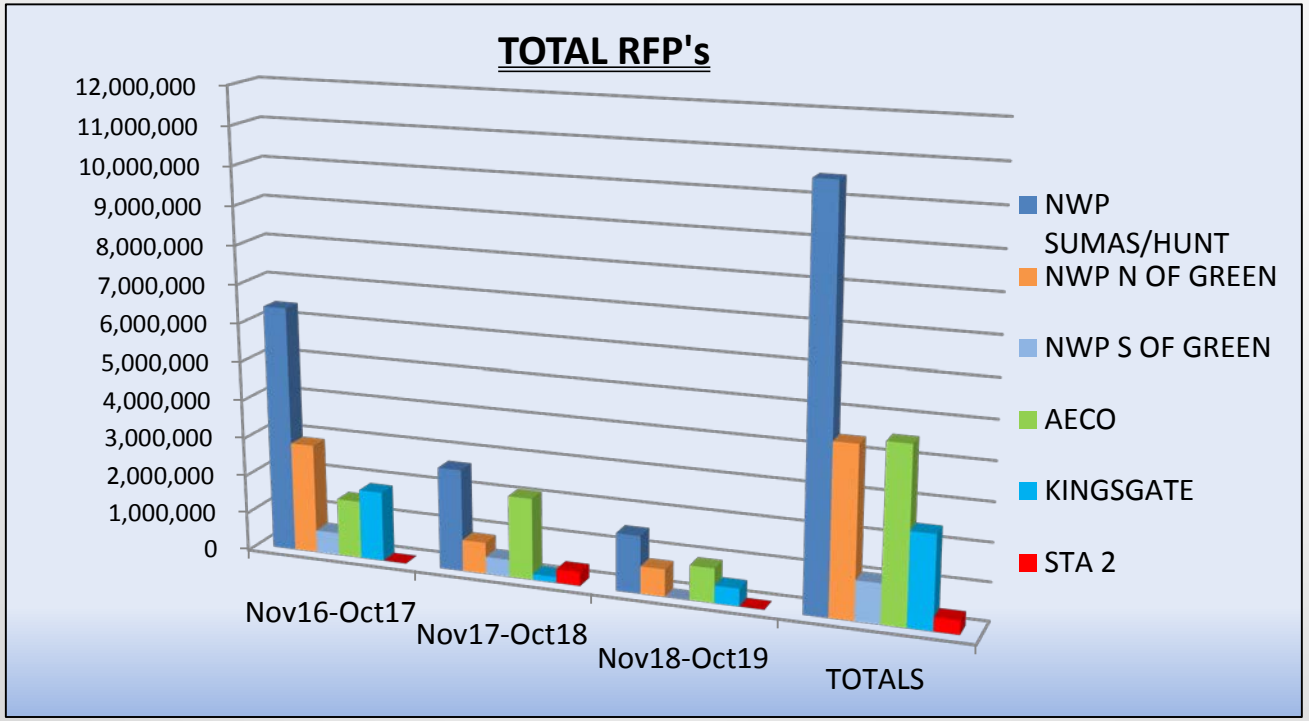

Transport Summary
AECO
8%
KINGSGATE
17%
STA 2
0%
NWP
SUMAS/HUNT
51%
NWP N OF
GREEN
10%
NWP S OF
GREEN
14%

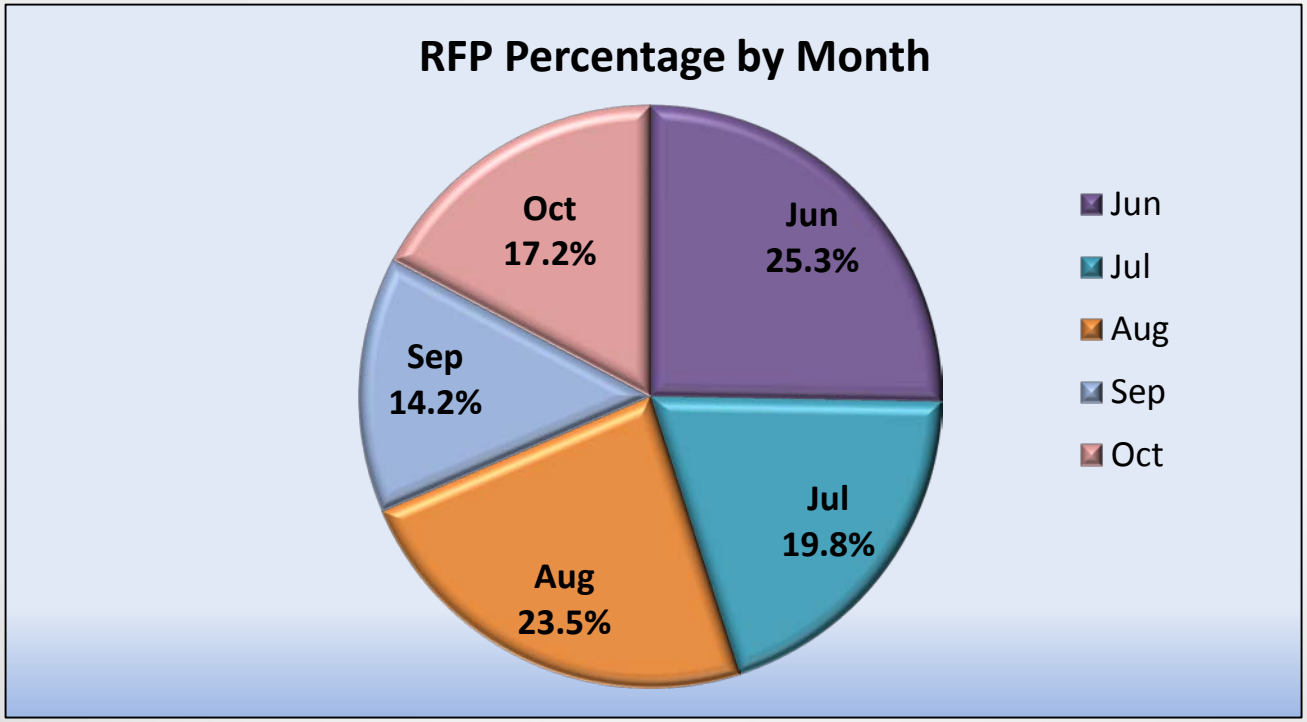
Storage Resources

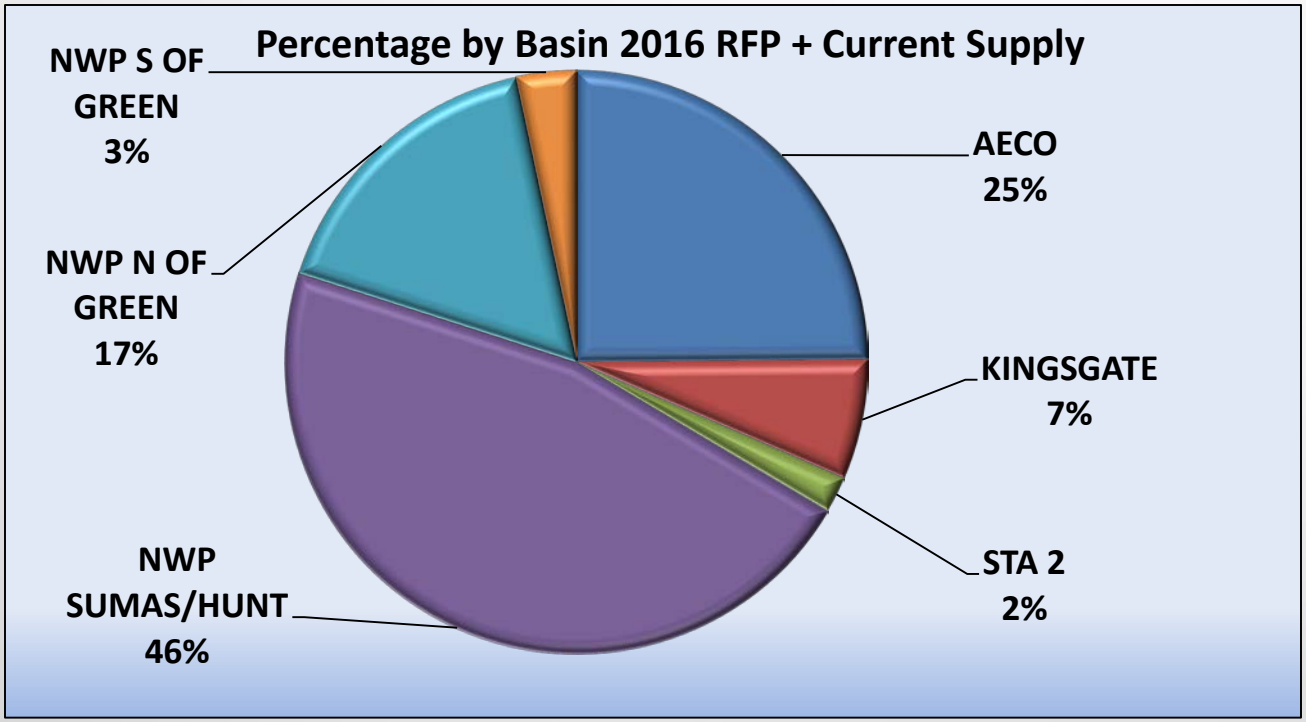
- Jackson Prairie-
  - 4 accounts with 1,235,593 dths capacity
  - CNGC cycled approximately 90% of Jackson Prairie storage over the past winter season
  - CNGC remains committed to cycling Jackson Prairie
- Plymouth-
  - 2 accounts with 662,200 dths capacity
  - New account of 100,000 dths added for the upcoming season
  - In addition to above we acquired TF-2 (Firm Redelivery Transportation) of 10,675 dths
  - Plymouth returned to fully functional operation on 04/01/2016.
  - CNGC remains committed to using Plymouth as a peaking resource.

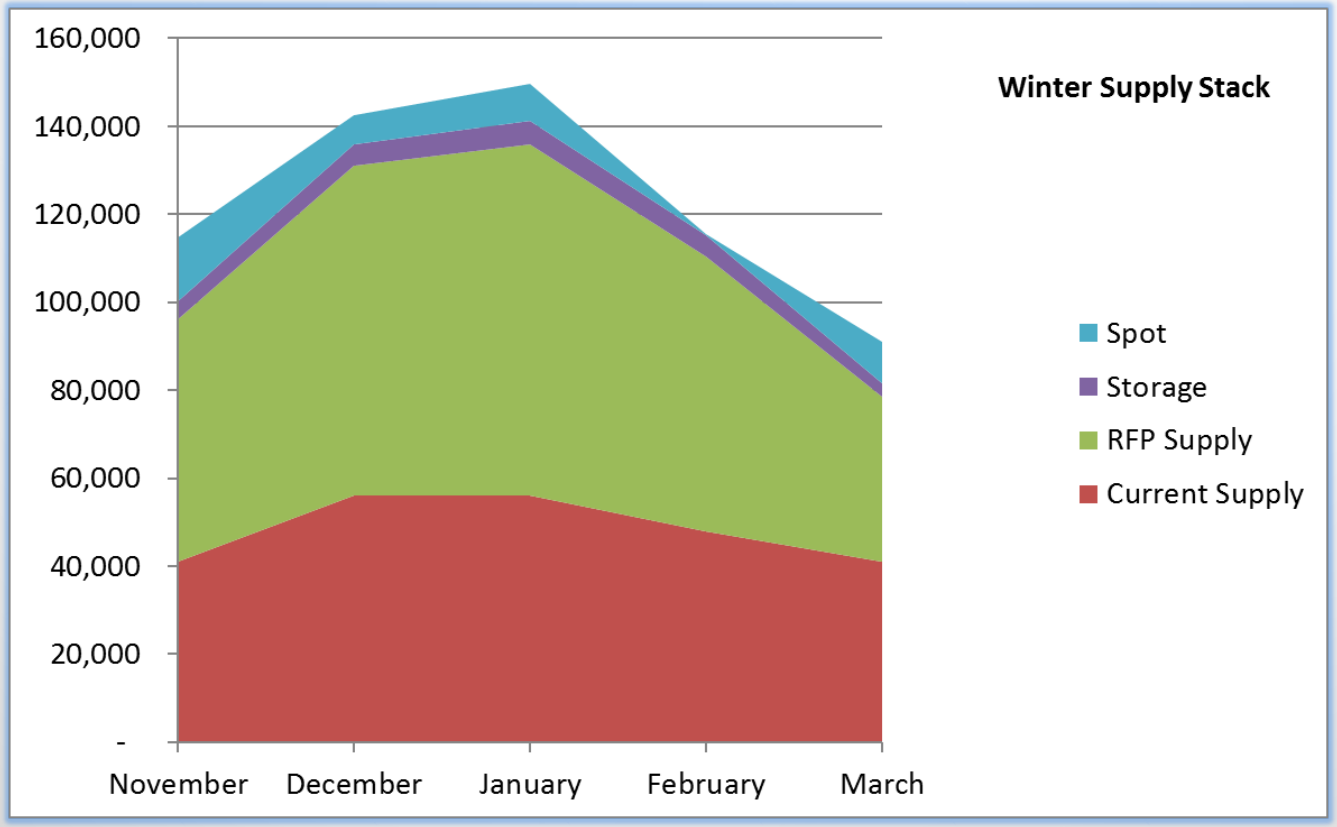
HIGHLIGHTS FOR THE 2016 PORTFOLIO DESIGN

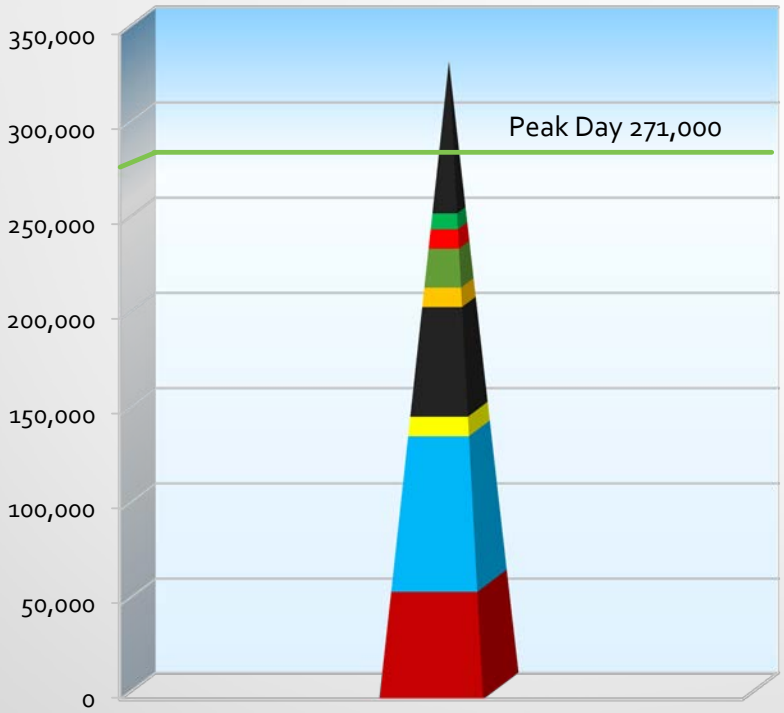
- PORTFOLIO PROCUREMENT DESIGN BASED ON A DECLINING PERCENTAGE EACH YEAR, ACCORDINGLY: Year 1: Approximately 80% of annual requirements; Year 2: 40%, Year 3: 20%.
  - 80% allows more flexibility operationally
  - Allows us to be in the market monthly through FOM purchase or Day Gas purchases
- Hedged Percentages (fixed-price physical) Currently max 40% of annual requirements. Second year should be set at 25%, and 20% hedged volumes for year three.
- CNGC's Gas Supply Oversight Committee (GSOC) would consider a modification of this plan if the outer year 3 year forward price is 20% higher/lower than the front month over a reasonably sustained period.
- Annual load expectation (Nov-Oct) is approximately 30,000,000 dths, consistent with recent load history.


TOTAL RFP's
12,000,000
11,000,000
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Nov16-Oct17
Nov17-Oct18
Nov18-Oct19
TOTALS
NWP
SUMAS/HUNT
NWP N OF GREEN
NWP S OF GREEN
AECO
KINGSGATE
STA 2


RFP Percentage by Month
Jun
25.3%
Jul
19.8%
Aug
23.5%
Sep
14.2%
Oct
17.2%
Jun
Jul
Aug
Sep
Oct


Percentage by Basin 2016 RFP + Current Supply
NWP S OF GREEN 3%
AECO 25%
NWP N OF GREEN 17%
KINGSGATE 7%
NWP SUMAS/HUNT 46%
STA 2 2%


Winter Supply Stack
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
November
December
January
February
March
Spot
Storage
RFP Supply
Current Supply



Peak Day Stack

78,125	LS Storage
8,156	Pipeline Pack
10,000	3rd Party Citygate
20,000	Peaking Deal
10,000	Daily Spot Gas
56,366	SGS Storage
10,000	FOM Spot Gas
80,000	RFP Supply
56,000	Current Supply

ENVIRONMENTAL CONSIDERATIONS

Presented by Allison Spector
Mgr., Energy Efficiency Policy

Purpose of Environmental Considerations

- Demonstrates Cascade's awareness of any legislation, policy, or rules that might impact the carbon scenarios modeled by the Company
  - *Discusses GHG policies mandated at the state and federal level that have the potential to impact Cascade as a natural gas distribution company, as well as presence of regional and national environmental regulations as required.*
  - *Examines methodologies for applying a cost of carbon in the Company's IRP planning efforts.*
  - *Reports voluntary efforts to address GHG emissions.*

Regulations

- IRP acknowledges presence of environmental rules and guidelines including:
  - *Clean Power Plan (CPP)*
  - *Oregon's "Coal to Clean" legislation (SB 1547)*
  - *Washington Clean Air Rule (CAR) - WAC-173-422, and*
  - *Northwest Power & Conservation Council's Seventh Power Plan*

- No direct impacts from electric rules, but were listed per previous UTC expectation

  - Company incorporated *Northwest Power & Conservation Council Plan's* survey of approaches, sensitivity analyses, and scenarios for modeling cost of carbon.
  - CO_2 costs used in modeling cost impacts with Carbon Cost Risk at $0 - $110/ton.

Clean Air Rule (CAR)

- On September 15, 2016, Washington Dept of Ecology issued the final CAR (WAC-173-442) to reduce GHG emissions

- CAR requires GHG reductions from three classes of entities in Washington
  - *Stationary sources*
  - *Natural gas distributors*
    - Indirect CO_2 emissions from end-use customers' combustion of natural gas
  - *Petroleum product producers in or importing to Washington*

- Cascade Natural Gas has an obligation to serve and will need to purchase emissions offsets for compliance with required emissions reductions:
  - *In-state emission reduction units ("ERUs")*
  - *Limited out-of-state allowances from states or provinces that have established multi-sector greenhouse gas programs (availability reduces over time)*

CAR (Cont.)

- On September 27, 2016, and September 30, 2016, Cascade and three other natural gas distribution utilities jointly filed complaints in the United States District Court for the Eastern District of Washington and the State of Washington Thurston County Superior Court, respectively, challenging the legal underpinnings of CAR

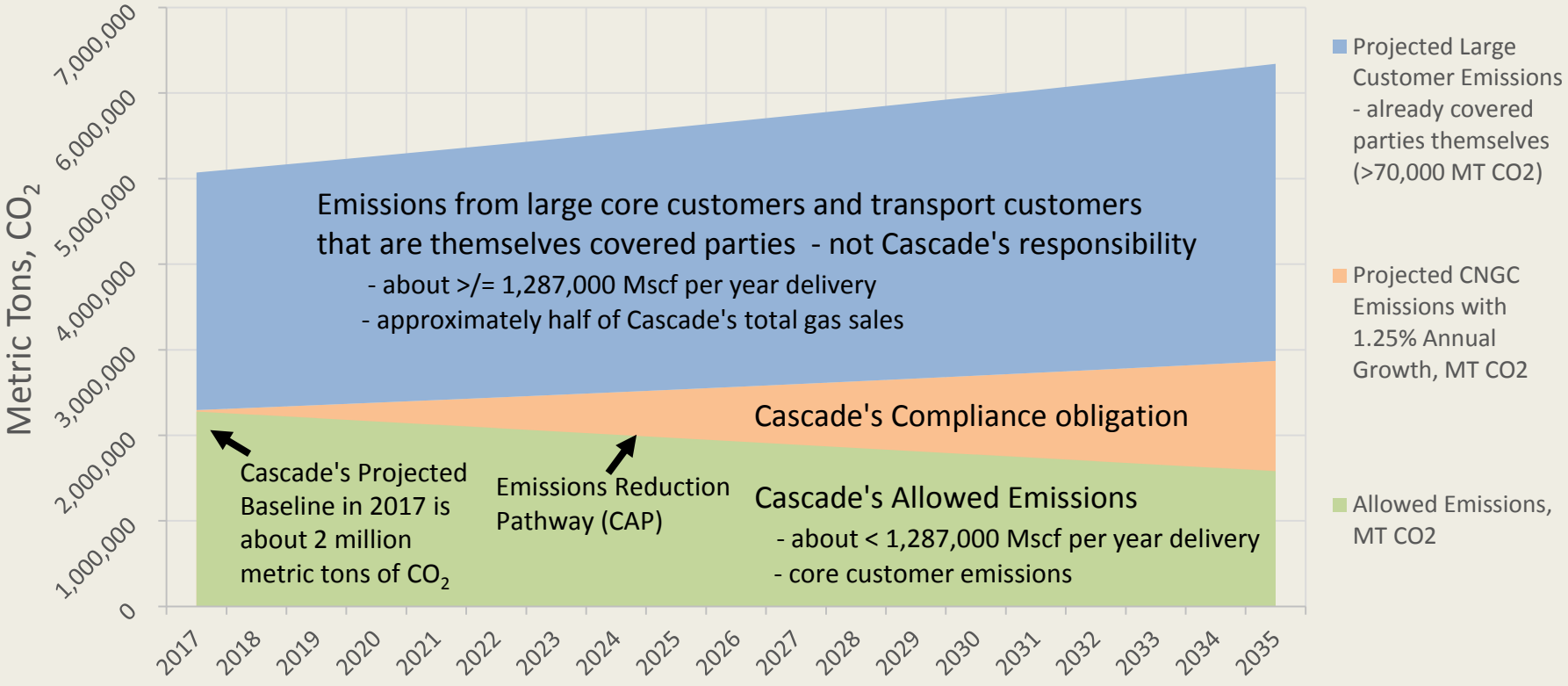
  - *Ecology does not have authority to regulate non-emitting sources for their customers' emissions*

  - *Ecology does <u>not</u> have authority to implement a program to limit statewide greenhouse gas emissions, particularly a trading program based on ERUs*

CAR (Cont.)

- In 2017, CAR is projected to cap CO_2 emissions for Cascade at about 2 million metric tons – Cascade's Baseline Emissions Value
  - *Baseline Emissions Value for Cascade is the annual average CO_2 emissions from the combustion of natural gas supplied to end-use customers between 2012 and 2016*
  - *Subtract out emissions from customers that are covered parties themselves*
  - *Pending consultation with Ecology in 2017 on adjustment of EITE industry emissions responsibility in 2017-2019 compliance period*
- In 2018 to 2035, Cascade's emissions reduction pathway decreases 1.7% each year from its baseline emissions value
- In 2036 and beyond, the emissions reduction pathway is equivalent to 2035's emission reduction pathway

Cascade's Preliminary Emissions Reduction Obligation Projection Under CAR



CAR (Cont.)

- Compliance period is a three-year period
- Compliance must be demonstrated at the
  end of each compliance period
- Cascade must submit compliance reports
  within a year after the end of each
  three-year compliance period.
- Each report must include third party verification that sufficient qualifying ERUs have been purchased to cover emissions above Cascade's emission reduction pathway.

Compliance Report and Verification Due Date

Compliance Period (Calendar year)	Due December 31
2017 through 2019	2020
2020 through 2022	2023
2023 through 2025	2026
2026 through 2028	2029
2029 through 2031	2032
2032 through 2034	2035
2035 through 2037	2038
Every 3 years	Every 3 years

CAR (Cont.)

- Cascade will continue to evaluate options for purchasing ERUs and allowances to cover emissions above the projected emission reduction pathway.

- Cascade notes that the price of ERUs is unknown at this time and that Ecology's constraints on ERUs makes it difficult to project their cost.

- As an alternative, Cascade has applied NPCC's prices to model preliminary cost impacts from CAR.

Fugitive Methane Emissions

- There is no EPA rule governing the reduction of methane emissions for natural gas distribution utilities, but fugitive emissions are of interest to our regulators

- Cascade's voluntary efforts in this area:
  - *In March, 2016 Cascade became a founding partner of EPA's Natural Gas Star Methane Challenge Program*
    - Participating under Best Management Practice (BMP) Commitment – Excavation Damages
  - *Cascade is also exploring other voluntary actions which could reduce methane emissions resulting from excavation damage*

Carbon Cost Risk Approach

- All Washington and Oregon LDCs follow the protocols of the Council's Carbon Cost Risk approach

- Utilized in the IRP
  - *Results in a $10/ton carbon cost adder to Cascade's avoided costs in 2018*
  - *Rising to $30/ton in 2035*

Carbon Cost Risk Approach (Cont.)

- Since Cascade's modeling applies a price of CO_2 from NPCC analysis to all emissions from natural gas delivered to all customers while CAR only requires compliance with a portion of these emissions, Cascade's modeling is expected to be conservative.

- Cascade will further evaluate ERU and compliance costs as Ecology establishes Cascade's baseline emissions value.

- Further expansion of this analysis in future years is pending Washington Superior Court for Thurston County on the legality of CAR.

Avoided Cost

Overview

- As part of the IRP process, Cascade calculates a 20-year forecast and 45 years of avoided costs.
- The avoided cost is an 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.
- We produce an expected avoided cost case based on the medium forecast (base case) peak day.

Costs 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 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).

METHODOLOGY

- The SENDOUT® resource planning model is used to generate the avoided costs.
- SENDOUT® contains a marginal cost report which lists the daily incremental cost to serve the next unit of demand for each demand region.
- The model determines the lowest cost method for serving the next unit of demand and computes a marginal cost.

ALTERNATIVE RESOURCES CONSIDERED

- With regards to alternative resources considered in the optimization of the portfolio, there is a level of uncertainty as to when certain alternative supply side resources will materialize and yet a base case needs to be created to calculate the avoided cost.
- Using the base case demand parameters as inputs, including the design weather pattern, and base case customer and gas price forecasts, in addition to existing supply side resources, the Company's resource portfolio for purposes of the avoided cost calculation include:
  - Incremental NGTL, Foothills, GTN and NWP transport (all of which are allocated between Oregon and Washington).
  - Also, a small level of satellite LNG and biogas is also included in the base case—however; these two alternative resources are assigned directly to Washington.

Avoided Costs by Conservation Zone (9/14/2016 draft 2016 IRP), cost per therm

	Zone 1 Avoided	Zone 2 Avoided	Zone 3 Avoided
2016	$ 0.331007	$ 0.332405	$ 0.333519
2017	$ 0.376641	$ 0.378231	$ 0.379499
2018	$ 0.374966	$ 0.376549	$ 0.377812
2019	$ 0.386840	$ 0.388473	$ 0.389776
2020	$ 0.406234	$ 0.407949	$ 0.409317
2021	$ 0.426303	$ 0.428103	$ 0.429538
2022	$ 0.458433	$ 0.460368	$ 0.461912
2023	$ 0.496455	$ 0.498551	$ 0.500223
2024	$ 0.520204	$ 0.522401	$ 0.524152
2025	$ 0.525322	$ 0.527539	$ 0.529308
2026	$ 0.547107	$ 0.549417	$ 0.551259
2027	$ 0.582635	$ 0.585095	$ 0.587057
2028	$ 0.617658	$ 0.620266	$ 0.622345
2029	$ 0.648015	$ 0.650751	$ 0.652933
2030	$ 0.668615	$ 0.671438	$ 0.673689
2031	$ 0.669892	$ 0.672720	$ 0.674976
2032	$ 0.663548	$ 0.666349	$ 0.668583
2033	$ 0.705535	$ 0.708514	$ 0.710889
2034	$ 0.722589	$ 0.725640	$ 0.728073
2035	$ 0.750226	$ 0.753394	$ 0.755919
2036	$ 0.761681	$ 0.764896	$ 0.767461

CASCADE NATURAL GAS CORPORATION®
A Subsidiary of MDU Resources Group, Inc.
In the Community to Serve®

Demand Side Management

March 29th, 2017 @ 1:30pm
IRP WUTC Presentation

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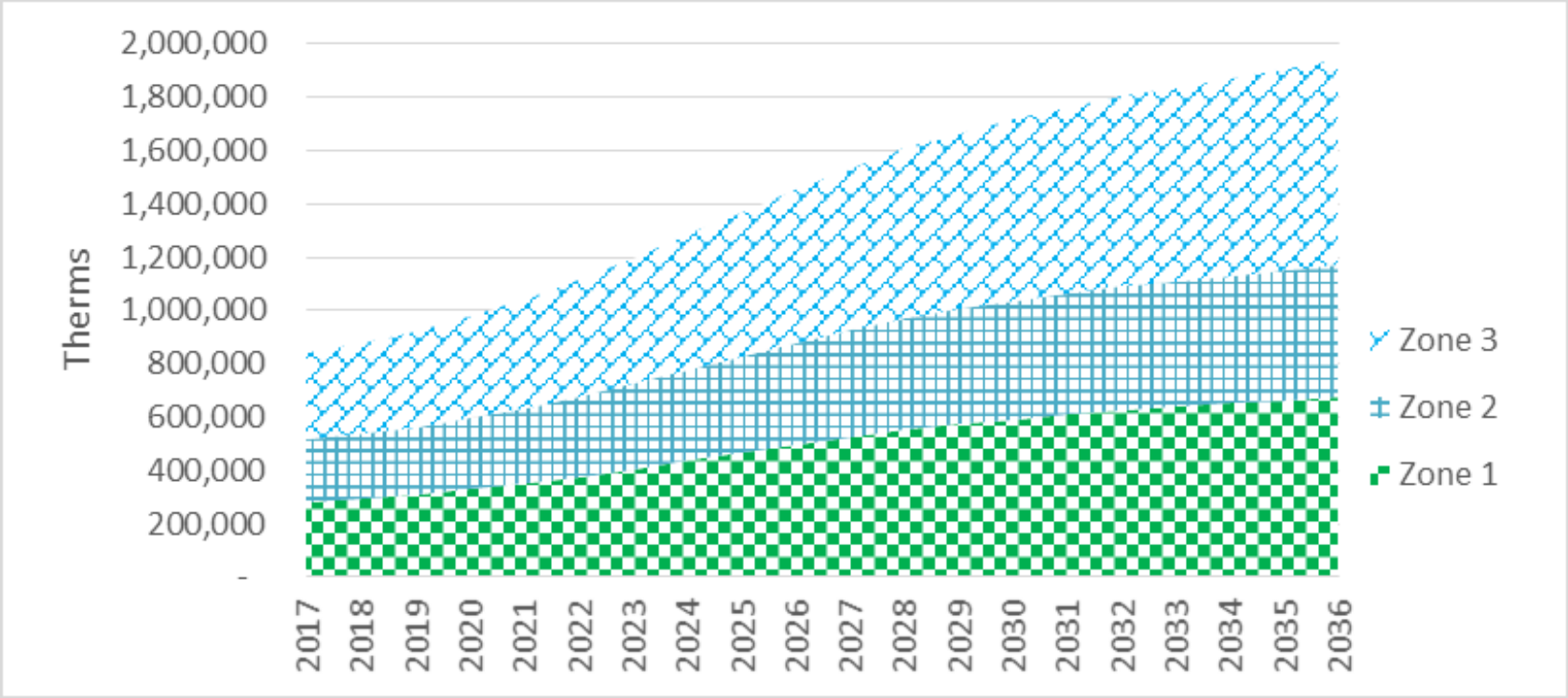
Elements of the DSM Chapter

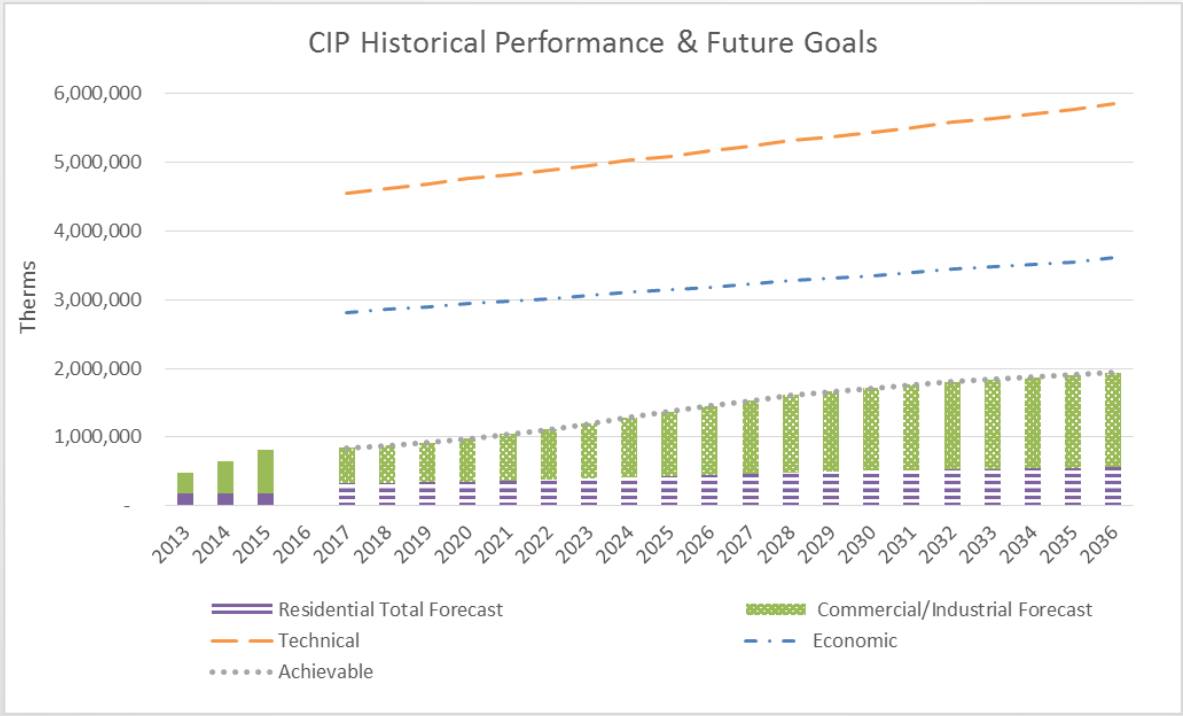
- The DSM Chapter includes the following topics relevant to the Energy Efficiency programs:
  - Overview
  - Conservation Planning
  - Pathways to achieve goals for the next 10 years
  - A progress report of where we've been and where we're going
  - Goals at a glance (developed from the potential forecast) & abridged budget estimates
  - Cost test and market segmentation information relevant to cost-effectiveness discussions
  - Target Development (Climate Zone modeling) – discussed on next slide
  - Assessing future potential
  - Conservation 2- year action plan including paths to increase forecast precision
  - Action Plan Addendum
    - New Conservation Potential Assessment & revision/replacement of current modeling tool
  - Outreach & Messaging
    - Community Partnerships & Targeted Outreach

Climate Zone Map



Full Portfolio by Climate Zone

Full Portfolio by Customer Class



The Cascade Conservation Potential is represented in the IRP under three levels of possible savings - with goals set at the Achievable level (dotted line)

Action Plan Addendum

1. **Q2 – 2017** – Develop an RFP (in consultation with the CAG) for a new CPA (Conservation Potential Assessment) paired with a new or revised modeling tool using the Northwest Power & Conservation Council's methodology
2. **Q4 – 2017** - The Company will submit a work plan with the Commission outlining the method for assessing potential resources, including conservation
3. **Q1- 2018** – Consultant will finalize the CPA which will be included in the 2018 IRP
4. **Q2 – 2018** – Using the NPCC methodology Cascade will calculate its economic potential within the IRP. The Company will work with its CAG to evaluate moving towards using the TRC and will incorporate the TRC in its model revisions.

Cascade filed the Addendum to the 2016 Action Plan on March 10th, 2017 after discussions with Staff

Distribution System Planning

Chris Bolton, Engineer II

WUTC IRP Presentation
March 29th, 2017

Summary

I. Company overview

II. Interstate Pipeline Companies

III. Network Design Fundamentals

IV. Synergi Modeling Software

Input Data → Model Output

V. System Enhancement Techniques

VI. Future Projects

Synergi Outputs

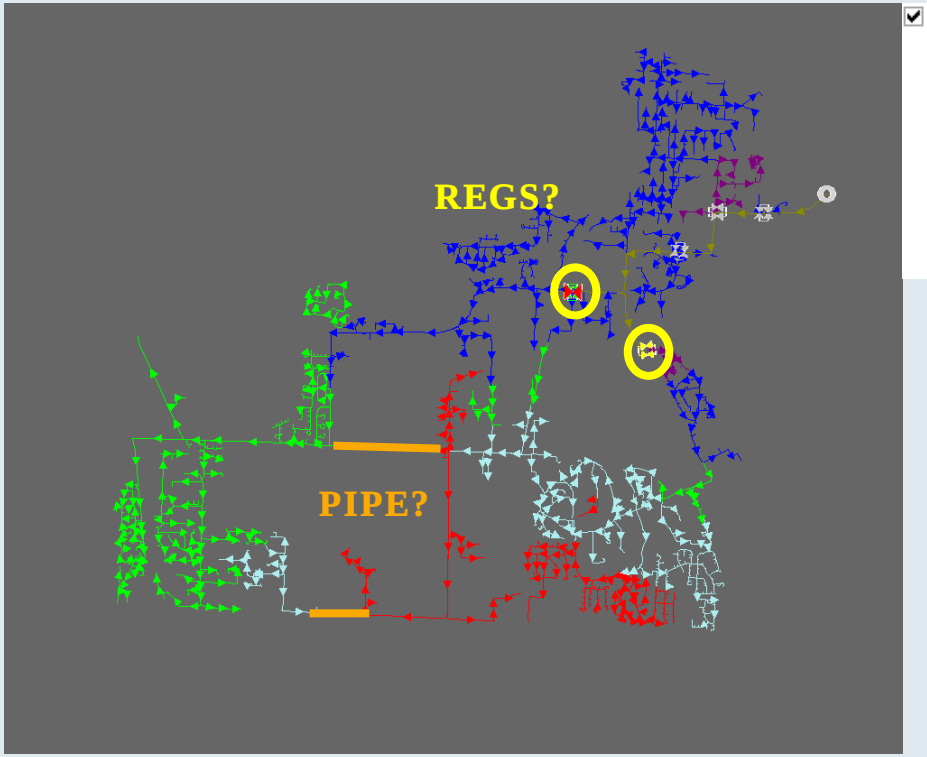
- Calibrated model – model to represent a specific date and time
- Design Day Model – Uses the peak HDD for selected areas to simulate a cold weather day (worst case scenario)
- Growth model - Uses design day model along with growth data to predict future constraints

System Modeling (cont.)

- All customers are loaded based upon base and heat trend
- Benefits of the models:
  - customer requests
  - future planning
  - system reliability
  - optimizing potential reinforcement

SYNERGI

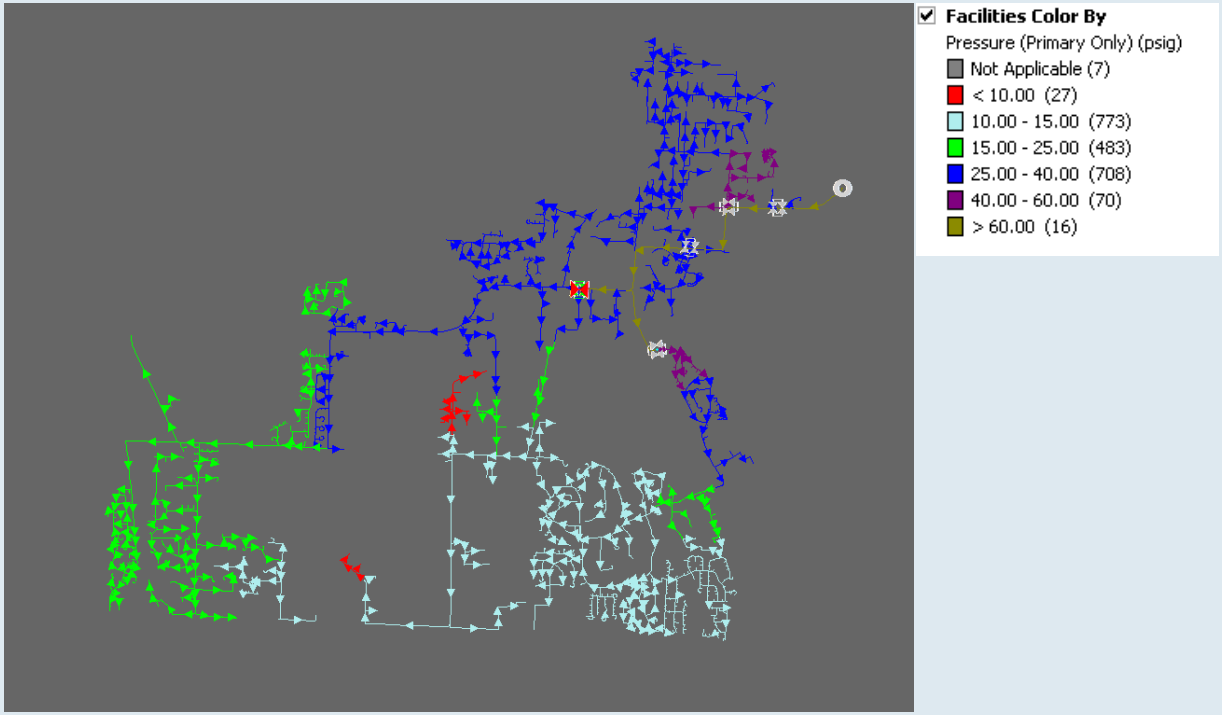
- LOW PRESSURE SCENARIO



- POSSIBLE SOLUTIONS ?

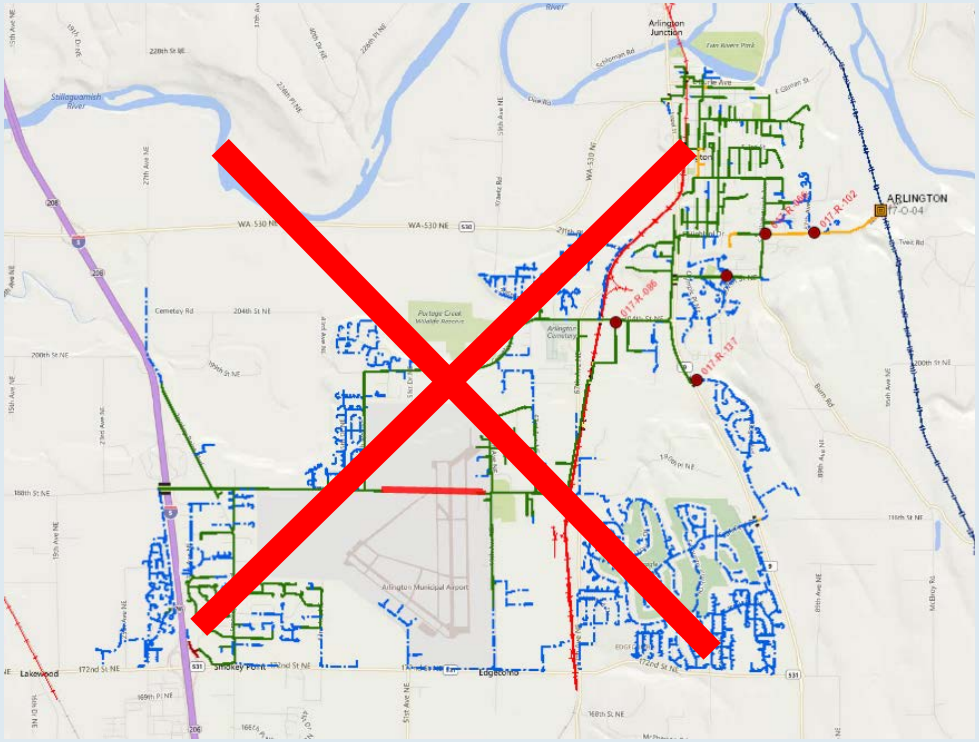
SYNERGI

- POSSIBLE SOLUTIONS – RAISING REG STATION SET POINTS



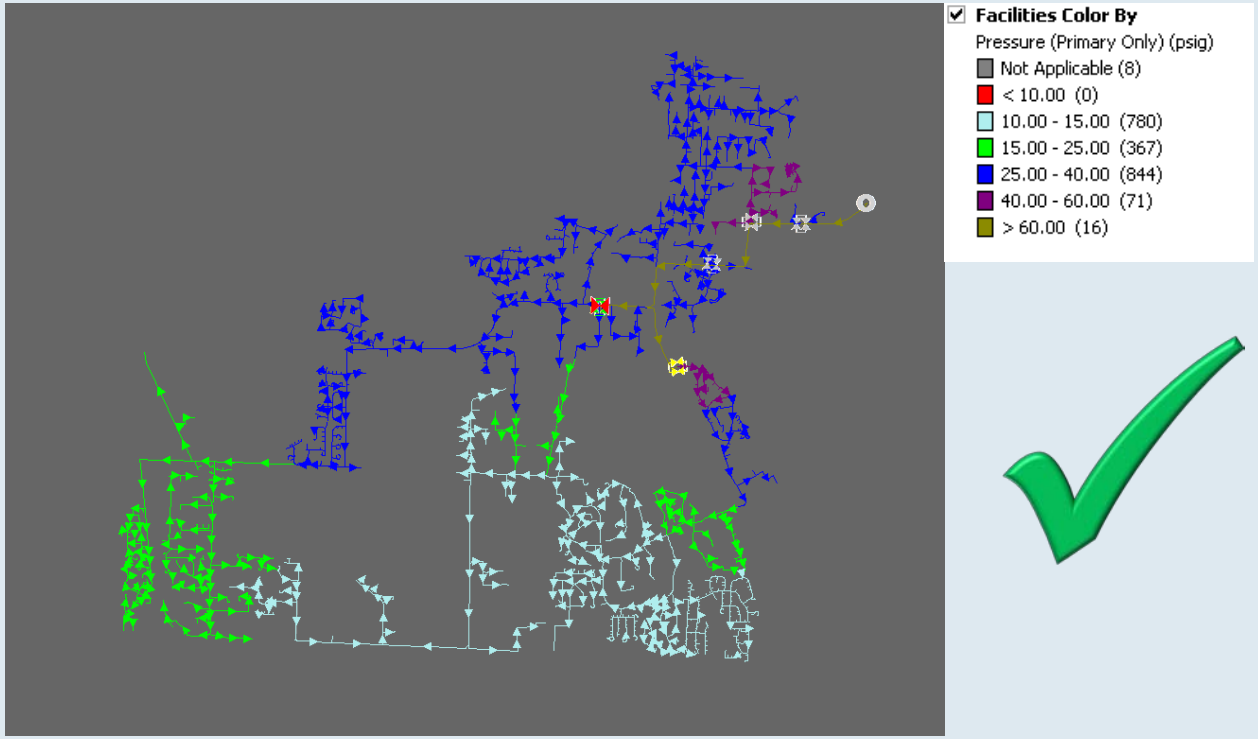
SYNERGI

- REINFORCEMENT OPTION #1



SYNERGI

- REINFORCEMENT OPTION #2



PROJECT PROCESS FLOW

INFO & DATA

PROJECT & SCHEDULES

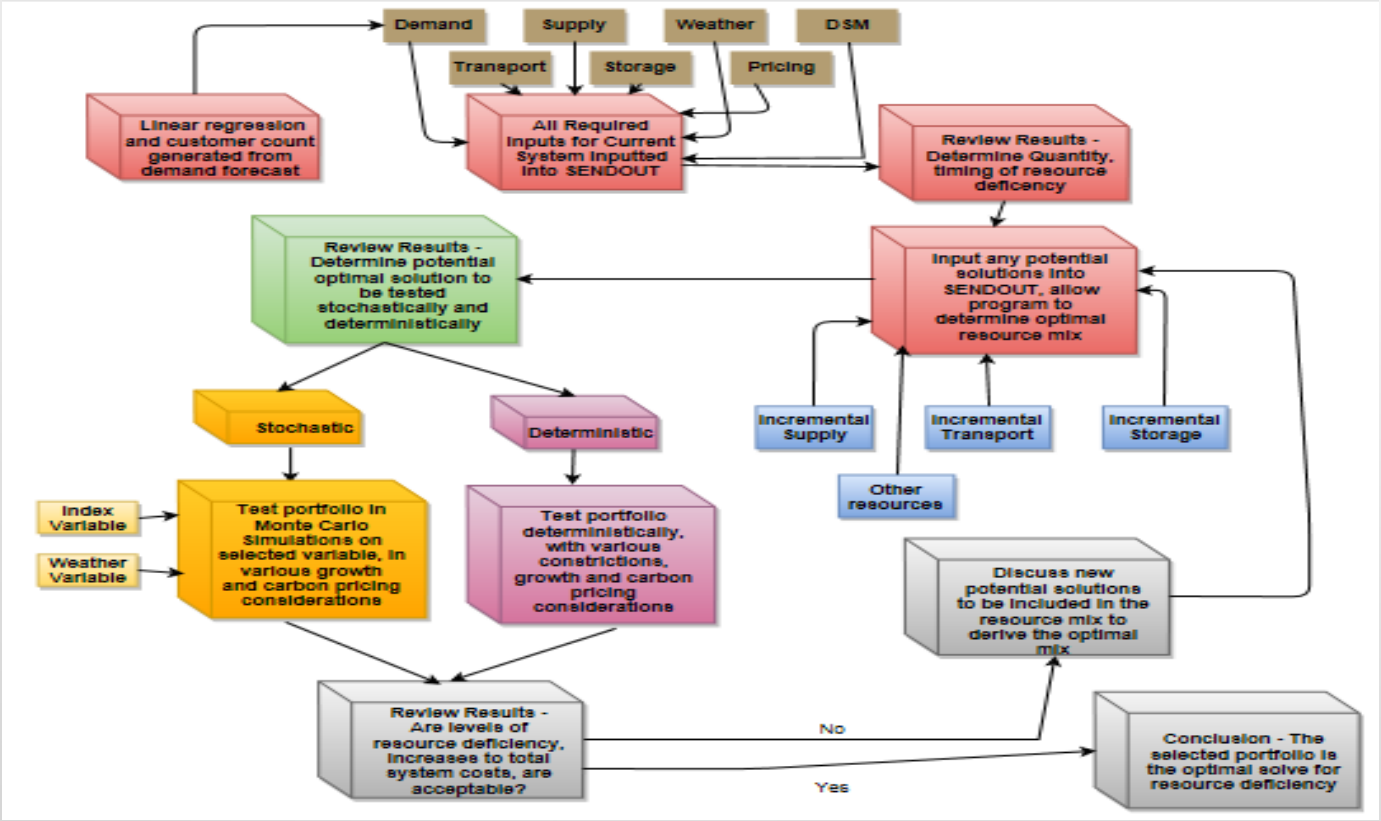
CNG Future Projects

- Example upcoming growth projects

Location	2017	2018	2019
Stanwood 4” PE Reinforcement	$116,130		
Manchester 4” PE Reinforcement		$245,870	
South Walla Walla Gate & HP Line		$3,356,259	$2,190,610

Integration Results

Current Methodology – Flow Chart



Integration Results – As Is

- As Is Scenario: Using currently available Supplies, Transportation, and DSM, this scenario informs us where we expect deficiencies.
- For modeling purposes, we assume all contracts run through the 20-year planning horizon.
- Goal is to find the optimal mix of incremental supply, storage, transportation and other resources to "solve" for the best way to eliminate deficiencies at the lowest reasonable cost.
- While Cascade aims to serve the demand of all of its customers, we take the approach that we will not pick up incremental transportation if the sole purpose of it is to serve customers on an interruptible tariff.
- The mix of existing and incremental resources that SENDOUT® selects as the optimal solve for our deficiencies is defined as our expected scenario.

Integration Results – As Is

Load Centers with Potential Peak Day Unserved Demand in dekatherms– As Is Scenario

Gate	2017	2020	2025	2030	2035	2036
Bend Loop	2,114	6,470	14,077	22,116	30,555	32,285
BREMERTON (SHELTON)	-	-	-	1,810	3,991	4,030
HERMISTON	-	-	-	1,127	1,852	1,859
Kennewick Loop	-	-	-	752	5,262	6,564
NYSSA-ONTARIO	-	-	-	923	1,063	1,062
Sedro-Woolley Loop	-	-	-	137	4,381	5,970
ZILLAH (TOPPENISH)	-	-	-	-	1,301	1,504
WENATCHEE	806	1,041	1,410	1,766	2,098	2,161
Yakima Loop	3,224	4,163	5,639	7,063	8,394	8,645
Total	6,144	11,674	21,126	35,694	58,897	64,079

Integration Results – Incremental Resources

Incremental Transportation & Supply Acquired, in dekatherms

Resource	2017	2020	2030
Incremental GTN	-	20,472	11,814
I-5 Expansion	-	990	9,010
Wenatchee Expansion	-	5,810	1,500
Zone 20 Expansion	-	440	6,120
Incremental Starr Road	-	-	9,327
Eastern OR Expansion	-	3,920	1,170
Yakima LNG Plant	-	5,000	-
3rd Party Citygate Deliveries	6,144	-	-
Incremental Transport Acquired	6,144	36,632	38,940

Integration Results – Incremental Resources Selected

Transport

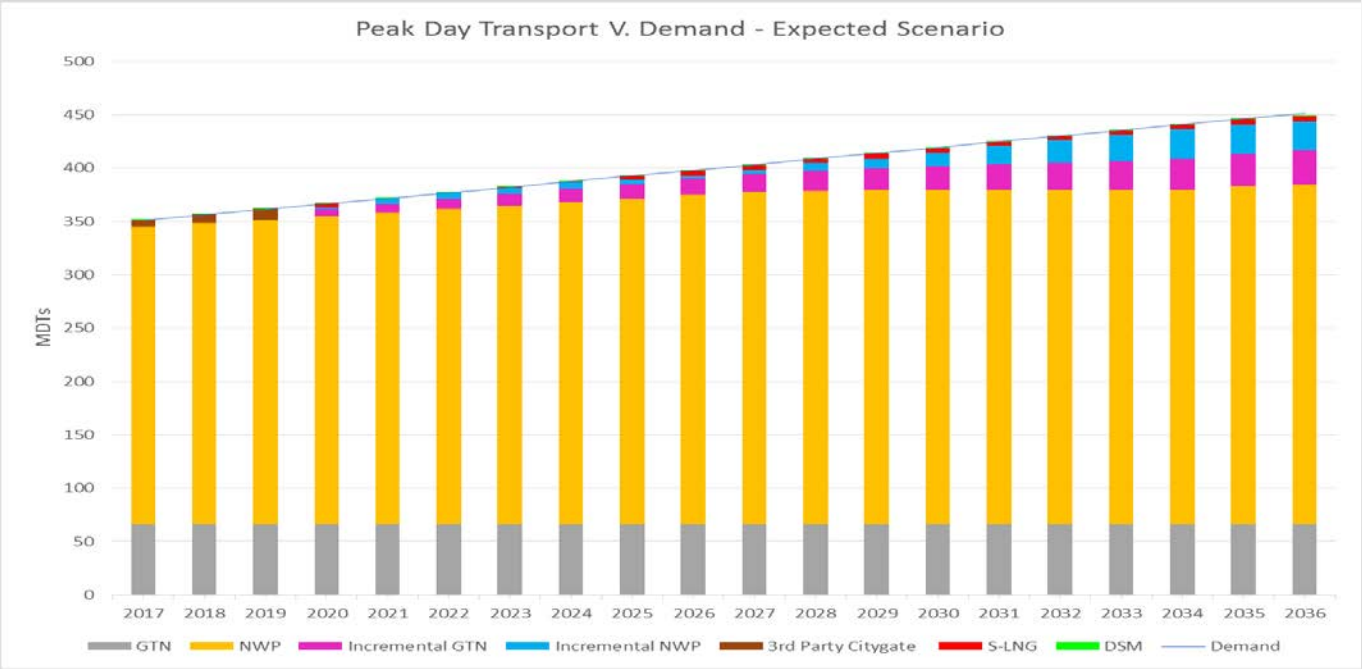
- 3rd Party Citygate Deliveries – Allows Cascade to purchase delivered natural gas from a 3rd party. 6,144 dth/day.
- Incremental GTN – Allows Cascade to continue to serve customers as the Company's core load grows in citygates that are fed by GTN capacity, specifically around Bend, Oregon where the Company expects shortfalls. 32,285 dth/day.
- I-5 Expansion – Allows Cascade to continue to serve customers as the Company's core load grows around the I-5 corridor, specifically in the Sedro-Woolley area. 10,000 dth/day.
- Wenatchee Expansion – Allows Cascade to continue to serve customers as the Company's core load grows in Central Washington in areas such as Wenatchee and Yakima. 7,310 dth/day.
- Zone 20 Expansion – Allows Cascade to continue to serve customers as the Company's core load grows in Eastern Washington in areas such as Kennewick. 6,560 dth/day.
- Incremental Starr Road – Allows Cascade the flexibility to move gas off of GTN and onto NWP through Starr Road when needed, displacing the need for potential incremental NWP capacity. 9,326 dth/day.
- Eastern Oregon Expansion – Allows Cascade to move gas from NWP to serve Eastern Oregon in areas such as Nyssa-Ontario. 3,950 dth/day.

Integration Results – Incremental Resources Selected

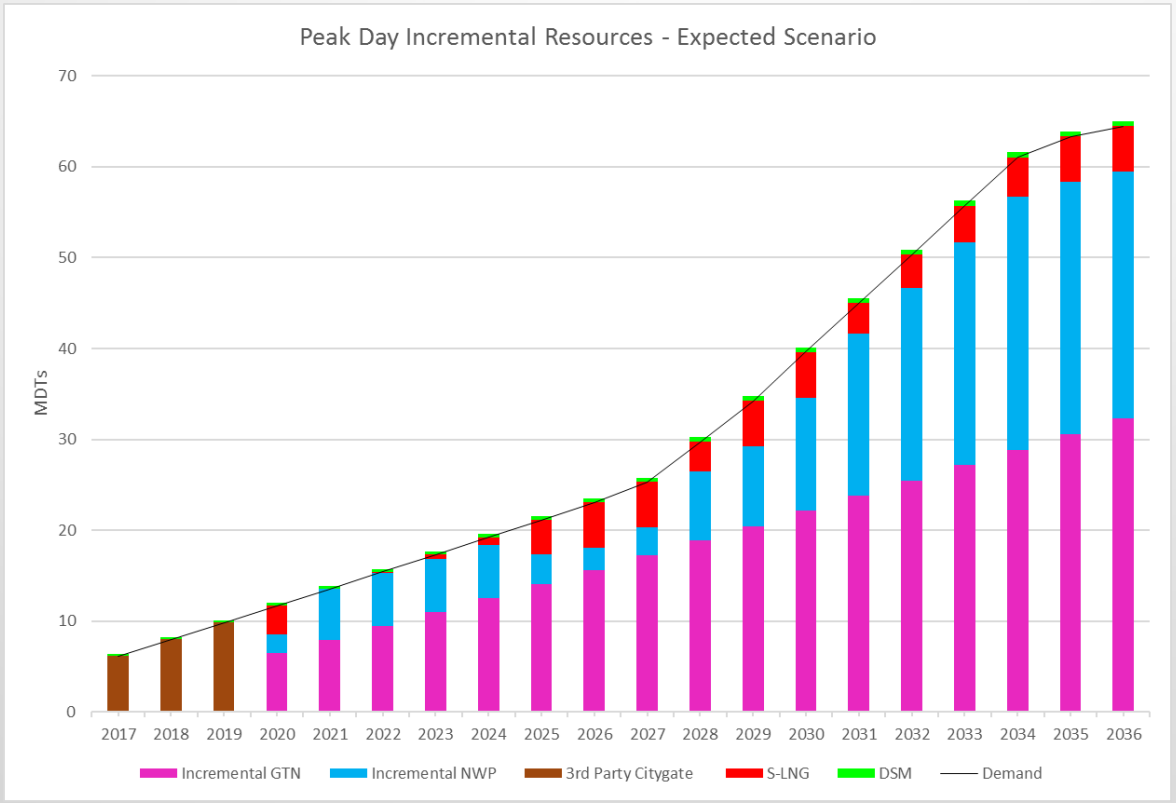
Supply

- Yakima Satellite LNG Plant – Allows Cascade the opportunity to serve demand in a cost effective way directly to Yakima, WA without new transport, which in turn helps increase served demand system wide through a displacement of Maximum Daily Delivery Obligations (MDDOs) among existing contracts. 5,000 dth/day.

Integration Results– Impact of Additional Transport/supply



Integration Results– Impact of Additional Transport/supply



Conclusion – Expected Scenario

Load Centers with Potential Peak Day Unserved Demand in dekatherms – Expected Scenario

Gate	2020	2025	2030	2035	2036
Bremerton (Shelton)	0	0	0	0	794
Kennewick Loop	0	0	0	0	362
Nyssa-Ontario	0	0	0	0	247
Othello	0	0	0	0	157
Pendelton	0	0	0	0	812
Umatilla	0	0	0	0	365
Total	0	0	0	0	2,736

INCREMENTAL RESOURCE COSTS and CHARACTERISTICS

Resource	Daily MDQ Acquired in 2017 for the Next 10 Years, in Dekatherms	Daily MDQ Acquired in 2020 for the Next 10 Years, in Dekatherms	Daily MDQ Acquired in 2030 for the Next 10 Years, in Dekatherms	Total Implementation Time (years)	Cost of Acquisition Over IRP Planning Horizon	Source
Incremental GTN - Daily MDQ	-	20,472	11,814	1	$ 2,356,878.00	Capacity Available confirmed Nov 2016
I-5 Expansion - Daily MDQ	-	990	9,010	3	$ 37,412,500.00	NWP Presentation April 8th, 2014
Wenatchee Expansion - Daily MDQ	-	5,810	1,500	3	$ 27,348,537.50	NWP Presentation based on CNGC Capacity Presentation May 2014
Zone 20 Expansion - Daily MDQ	-	440	6,120	3	$ 24,542,600.00	NWP Presentation based on CNGC Capacity Presentation May 2014
Incremental Starr Road - Daily MDQ	-	-	9,327	2	$ 2,553,266.25	NWP Presentation based on CNGC Capacity Presentation May 2014
Eastern OR Expansion - Daily MDQ	-	3,920	1,170	3	$ 19,042,962.50	NWP Presentation based on CNGC Capacity Presentation May 2014
Yakima LNG Plant - Daily MDQ	-	5,000	-	2	$ 20,500,000.00	June 2005 Northstar Report
3rd Party Citygate Deliveries - Daily MDQ	6,144	-	-	N/A	N/A	N/A

DSM RESOURCE COSTS AND CHARACTERISTICS

	Estimated 2017 Dekatherms	Estimated 2020 Dekatherms	Estimated 2030 Dekatherms	Estimated 2017 Savings from DSM Source - Appendix H of CNGC 2016 IRP	Estimated 2020 Savings from DSM Source - Appendix H of CNGC 2016 IRP	Estimated 2030 Savings from DSM Source - Appendix H of CNGC 2016 IRP
DSM - Daily Allocation on Peak Day from Section 8-18 of CNGC 2016 IRP	279	305	527	$ 1,455	$ 1,538	$ 3,259
DSM - Annual Washington Achievable from Section 7-22 of CNGC 2016 IRP	83,988	97,960	171,585	$ 440,515	$ 496,951	$ 1,051,475

Conclusions

- Cascade has identified potential deficiencies starting in 2017.
- From 2017-2020, Cascade uses 3rd party citygate deliveries to solve this shortfall.
- From 2020 through the end of the planning horizon, Cascade uses a mix of incremental Transportation and Supply to solve the deficiency.
- With the resource mix that is designated the "Expected Scenario" Cascade projects only a slight deficiency in 2036, all of which is from customers on an interruptible tariff.

ADDITIONAL QUESTIONS?

Cascade Natural Gas Corporation

2016 Integrated Resource Plan
Presentation to WUTC Commissioners and Stakeholders

Wednesday, March 29, 2017

WUTC

Olympia, WA