CASCADE NATURAL GAS
C O R P O R A T I O N ®
A Subsidiary of MDU Resources Group, Inc.

2nd External TAG Meeting - OPUC

<u>07/18/2017, 9:00 – 11:19 AM</u>

Presenters:	Mark Sellers-Vaughn, Brian Robertson, Devin McGreal, Eric Wood, Ashton Davis & Chris Bolton
In attendance:	Mark Sellers-Vaughn, Brian Robertson, Devin McGreal, Ashton Davis, Eric Wood, Bruce Folsom, Debb Glosser, Geoffrey Ihle, Dan Kirschner, & Jon Kreider
Called in:	Garret Senger, Miki Bode Jones & Laura Flanders – NWP, Monica Cowlishaw, Jim Abrahamson, Chris Robbins, Carolyn Stone, Kary Burin, Jeremy Ogden, Jennifer Gross, Isaac Myhrum, & Tom Pardee
Minutes by:	Carolyn P Stone

Mark Sellers Vaughn started the meeting by welcoming everyone and stating that there is a lot of material to cover today.

Presentation #1 – Mark Sellers-Vaughn
IRP Action Plan Update

Mark stated there would be an "open comment period" and an "IRP Action Plan Update", Chris Bolton will present "Distribution System Planning", Eric Wood will discuss "Current Supply Resources & Transportation Issues", Ashton Davis will present "Major Issues on the Horizon", Devin McGreal will present "Market Outlook & Long-Range Price Forecast", and Brian Robertson will discuss the "SENDOUT Model".

Mark asked Garret Senger if he had any opening comments. Garret welcomed everyone and said he was looking forward to the discussion & interaction and the presentation.

Slide #3 thru 5 - Mark stated that the IRP group committed to providing an IRP Action Plan Update at each and every TAG meeting. If Staff has questions or comments on the update, please state them.

Presentation #2 – Chris Bolton
Distribution System Planning

Slide #8 – "CNG System Overview" - Chris presented the CNG system. In Washington, we have 4,744 miles of distribution line and Oregon, 1,605 miles. We have over 700 regulator stations and over 1600 valves.

Slide #10 – "Where do we get our gas?" Chris explains primarily pipelines Williams, TransCanada & Enbridge.

Slide #12 – "GIS" (Geographic Information System)" - Chris explains that the GIS system helps keep up to date records of pipe, facilities and is completed with all system attributes. CNG uses GIS to model its system.

Slide #14 – "Synergi" Chris explains that this is engineering software that models piping and facilities to represent pressure & flow to help predict future events & growth.

Slide #15 thru 18 "Data Gathering" – The data gathering used to feed Synergi comes from:

1. CC&B
2. SCADA
3. Resource Planning

Slide #19 – "CNG Weather Zones" - Chris said Resource Planning provides them with CNG Weather zones.

*Mark pointed out that historical weather data availability is limited!

Slide #20 – "Customer Management Module. "
- Chris explained this works with the Synergi to input customer data helping them to see pressures and flows.
- The module takes in CC&B Data, HDD and growth information.

Question: Does this model include past or future data?
Answer: Conversion of CC&B to Synergi. Involves the following:
1. Grabs data and matches what we see.
2. Then ramps up customer usage and shows trends.
3. Growth model uses severe temperature data and other growth data to predict future projects.

Question: Do you have a "Summer Plan"?
Answer: Chris said "Not really, we don't really look at summertime load, maybe for large customer load only.

Slide #24 – Shows a "Synergi" low pressure scenario…

Slide #25 – "Capacity Enhancement Options"

Question: Is there a minimum pressure that you would assume there were problems?
Answer: Anything under 15/20 we will evaluate thru prioritization.

Question: Do you evaluate economic solutions vs engineering solutions?
Answer: We will be talking about that topic a little later.

Slide #26 - Shows the pros and cons of various "Pipe enhancements"

Slide #33 – "Project Process Flow"
- The process starts with input of information and data and finishes with the projects and schedules.
- Chris said they determine the feasibility and costs associated, then identify the best project, and rank it. Then it is put into the budget.

Slide #34 – "Future Projects"
- This is a sample of upcoming projects needed for growth.
- Project #2 requires 6,400 feet of 8-inch steel in Bend.
- Chris said Bend is a district with high growth!

Slide #41 – Conclusion

Question: How is the final decision for projects made?
Answer: Chris said upper management decides based on budget. Chris's group comes up with 2 solutions, then go through them in a step by step decision making process with the different options. They talk with the district and city personnel on the importance of each project.

Mark asked if Jeremy Ogden had anything to add to this answer. Jeremy said Chris covered it well, but, in general, when pressures dip to 20 PSI it gets on their radar! Decisions are also based on growth and where the project is located.

Question: Mark asked a question of Staff. For future projects, what is the criteria for how many projects you would want to see in the narrative or appendix of the IRP, all projects or a small "picture"?
Answer: Staff doesn't need to see all the projects but would like to see ones with a "typical analysis".

Presentation #3 – Eric wood
Current Supply Resources & Transport Issues

Slide #43 – "Pipeline Transport Flow"
- Eric highlighted flow from South to North on Ruby (for Oregon transport) and stated Oregon gas comes from AECO.
- Eric also said gas can also be put on at Stanfield for Oregon.

Slide #44 – "Transport Summary" – Eric said this slide shows the % of our transport at each location.

Question: Are these long-term firm contracts?
Answer: Yes, out until 2023.

Slide #45 – "Storage Resources"
- Plymouth is used as a "peaking resource".
- Eric said 50% of Plymouth was used last year!

Question: Do you cycle storage in summer for winter?
Answer: Yes

Question: Are we able to negotiate smaller lease rates?
Answer: No, the rates are tied to long-term transport contracts.

Mark stated that CNG relies on storage to balance the system because of Cascade's diverse structure, it provides price "arbitrage" and we would be remiss not to use it.

Slide #46 – "Highlights for the 2017 Portfolio Design"

Question: How is the "20% in the third year" decided? Is the risk tolerance higher than other LDC's?
Answer: The GSOC sets the lower % based on a tolerance level.

Mark stated that there are currently 2 open dockets on financial hedging. CNG will comply with the Washington Hedging Policy and provide something back to them, but there will be no dramatic changes until both policies for both states are issued. CNG may need a split portfolio between the 2 states. In August CNG will be filing its policy for the Washington Hedging Strategy with GSOC and then update that at TAG #3.

Question: Potential options seem "thorny". Options are like an insurance product. You pay the extrinsic option premium, but is this useful? Did you read the "Gettings" paper?
Answer: 5% of our portfolio at this time is structured projects. We have not entered into any financial options at this time. We are familiar with the Gettings paper.

Devin advised that you can't look at where a financial option price goes or whether they are "profitable" or not because the job of the derivative transaction is to create a risk "barrier" of how much you are willing to lose due to the market conditions and how much hedging losses you are willing to take.

Slide #47 – Shows "Total RFPs" per basin coinciding with transport available in those regions.

Slide #51 – "Winter Supply Stack" shows the supply type/volume by month using RFP's, storage and spot purchases.

Slide #52 – "Peak Day Stack Example"
- Eric stated that CNG has a "peaking deal" for 20,000 per day we can call on and we could use 10,000 of 3rd party citygate deliveries.
- Our tolerance level is at 3%.
- The red line is 275K for expected peak day.

There was a bit of discussion on tolerance levels. Eric said CNG tries to always stay within our tolerance levels but at times we go outside of them, but at the end of the month we are usually within levels.

Mark announced that this is Ashton Davis' first tag meeting. He will present the next section of the presentation.

Presentation #4 – Ashton Davis
Major Resource Issues on the Horizon

Slide #57 – "Incremental Transport – North to South" – This is incremental or additional capacity to move gas at NGTL (NOVA) from AECO to Alberta/BC border, Foothills to move gas from AB/BC Border to Kingsgate and GTN North to South moves gas from Kingsgate to various citygates along GTN.

Slide #58 – "Incremental Transport – NWP" this slide shows expansions such as I-5, Wenatchee Lateral, Spokane Lateral and Eastern OR Mainline

Slide #59 – "Incremental Transport – Bilateral", T-South, Trails West & Pacific Connector.

Question: Do these locations provide price arbitrage?

Answer: Primarily but could be risk mitigation too, if supply gets held up at one location.

Slide #60 – "Incremental Storage – North and East" – These are additional storage locations that are available:

Rickman Creek =	Wyoming, serving Oregon
Magnum =	Serving Oregon
AECO Hub =	Serving system
Clay Basin =	Serving system

Slide #61 – "Incremental Storage – South and West"

Gill Ranch =	Serving Oregon
Mist =	Serving Washington
Wild Goose =	Serving Oregon

Presentation #5 – Devin McGreal
Market Outlook and Long Range Price Forecast

Slide #65 – "Long Range Market Outlook Cont'd" –
- Devin explained that nonhydroelectric renewables are significant and GDP looks good by 2021.
- Devin stated Wood Mackenzie projects gas prices above $3.00 in the 1st half of 2017.

Slide #66 – "Long Range Price Forecast" –
- Devin explained that price forecasting is more of an "art" than a science.
- Ashton has been researching papers on price forecasting so the group can see what methodologies are being used.
- Is futures pricing the best? Devin said we try to prove them wrong!
  - Theoretically, Futures pricing should be good.
  - Factors – optional reporting would be needed.
  - Futures pricing goes through a clearing house.
  - Forward pricing can be diluted.

Slide #67 – "Long Range Price Forecast Cont'd -

- Cascade assigns weight to sources using Henry Hub pricing (HH) for a 20-year planning horizon
- This makes it a bit more scientific

Slide #68 – "Price Forecast Weights" –
- Bruce Folsom gave a "spoiler alert" for Slide #93. The IRP team will be speaking about this an input from stakeholders would be helpful
- Sources used for giving weights are Wood MacKenzie, EIA, NPPC and HH
- Devin mentioned that the EIA's price is generally $2 higher in their forecasts

Slide #69 & 70 – "Example of SMAPE Calculations by Source" & "Example Weights Price Forecast for 2018"

- Devin explained that this shows the "Error %"

- He explained that you take the inverse of that and add up each total and it gives them a "weight" at T + 4, which is not so accurate.
- "Whole Winter Smoothing" data shows the exponent, trending & seasonality.

Mark asked Staff: Would they like to see a sample of the "Holt-Winter Smoothing"?
Answer: Yes!

Slide #72 – "Avoided Cost Overview"
Avoided cost is the estimated cost to serve the next unit of demand – we want to avoid this cost with supply side resources.

Slide #73 & 74 – "Avoided Cost Formula" & "Methodology"

Question: Is this methodology standard?
Answer: Devin explained that, there isn't really a standard beyond commodity. Each LDC does this differently! We all use SENDOUT, but distribution cost is not in our model.

Question: How do you quantify the "Risk Premium"?
Answer: Figure financial derivatives for X volume, then figure the costs of the physical product. You can't hedge smaller physical volumes; those costs are minute and not material.

Presentation #5 – Brian Robertson
SENDOUT Model

Slide #76 – "SENDOUT Model"
- Brian stated that SENDOUT is used for resource optimization….
- it is powerful & complex

Slide #77 - "SENDOUT Model Cont'd"
- This model uses a linear programming approach
- It has perfect information
- It provides good input but not perfect input, it is a "balancing" act
- Cascade has more DELIVERY (DEL) rights than RECEIPT (REC) rights

Question: Why the DEL & REC rights difference, due to a supply spot?
Answer: Mark explained that the pipelines divested themselves (1980) as a way to handle Oregon points. It was decided by NWP to create a flexibility for LDC's by giving more RECEIPT than DELIVERY rights. CNG has 1/3 more DELIVERY rights than RECEIPT rights due to our geographic diversity. Mark explained that there is a section in the IRP that goes through this and he can send it out.

Slide #79 – "Model Challenges"

Question: Why is this a "modeling challenge"?
Answer: Brian explained that some contracts are flexible. If the model had its way it would choose the best choice economically. We must give the model as much "reality" as possible and this is a challenging process! Brian stated that some contracts must be broken into smaller contracts, but you come out with one decision.

Slide #80 – "Supply Resource Optimization Process"

> Step 1 – Uncover resource deficiencies…
> Step 2 – Give model additional resources…
> Step 3 – Run stochastic analysis by running resources through a Monte Carlo (MC) simulation and develop probability distributions.

- Brian said once we have the probability distributions, we go back to the Stochastic model run deterministically to see if that solved the resource deficiencies.

Question: Does this process reveal less "risky" resources?
Answer: We rank alternate resources each run and then cost them.

Slide #81 – "Supply Resource Optimization Process Cont'd"

> Step 4 – Stochastic analysis of all scenarios…
> Step 5 – Selection of preferred portfolio…
> Step 6 – Sensitivity analysis of preferred portfolio then….
> Step 7 – Re-evaluate best portfolio by running sensitivity analysis on it

Question: Do you run Monte Carlo simulations on standard deviations?
Answer: Brian said we put in the forecast and that produces standard deviations for weather. We use the past 30 years data average to get the standard deviations.

- Devin said we try to get granular, but are limited by operational capacity (200 draws).
- We must use 5 machines to run a SENDOUT, which takes a day.
- The price is correlated to weather, hopefully reducing runs.
- Mark said all LDC's do 200 draws!

Slide #82 – "Additional Preferred Portfolio Considerations"

Question: Is there a point where the "rubber hits the road" on distribution?
Answer: We look at reliability, for example, was there a storage facility explosion? We use a qualitative perspective, but how reliable is it??

Slide #83 – "All in Case"

- Brian stated that this shows what the model would select if all current & potential resources available including transportation, storage & supply.

Slide #84 - 91 show additional results from the model

- Mark said they include transport when deciding on incremental storage resources!

Slide #92 – "Sensitivities Analyses"

Includes:
- Price (run Monte Carlos)
- Use a "Carbon adder"
- Per Ton adder (related to carbon tax)

- High gas price environment
- Low gas price environment

Slide #93 – "Additional Input from Stakeholders"

- Mark stated that his group wants feedback. We can do a Skype meeting or come to you!
- We can also send you workbooks.
- Various participants commented that this was great work!
- Mark thanked Eric & Chris for their help with presenting!
- Bruce Folsom commented that Ashton is new to CNG, Devin has been here under a year and Brian 3-4 years and they have done excellent work! Mark added that they have brought so much to the process!

Slide #94 - Mark went over the 2018 IRP Timeline.

- Mark wondered if we can provide food for the next meeting because TAG #3 goes from 9 AM to 3 PM in the "Umatilla Room".
- Mark mentioned the IRP filing is January 25th in Oregon

Bruce said that it was a good meeting and appreciated the background material provided & presentation!