# UM 2030: NW Natural's RNG Evaluation Methodology

NW Natural
December 13, 2019

NW Natural®

# FORWARD LOOKING STATEMENT

This and other presentations made by NW Natural from time to time, may contain forward-looking statements within the meaning of the U.S. Private Securities Litigation Reform Act of 1995. Forward-looking statements can be identified by words such as “anticipates,” “intends,” “plans,” “seeks,” “believes,” “estimates,” “expects” and similar references to future periods. Examples of forward-looking statements include, but are not limited to, statements regarding the following: including regional third-party projects, storage, pipeline and other infrastructure investments, commodity costs, competitive advantage, customer service, customer and business growth, conversion potential, multifamily development, business risk, efficiency of business operations, regulatory recovery, business development and new business initiatives, environmental remediation recoveries, gas storage markets and business opportunities, gas storage development, costs, timing or returns related thereto, financial positions and performance, economic and housing market trends and performance shareholder return and value, capital expenditures, liquidity, strategic goals, carbon savings, gas reserves and investments and regulatory recoveries related thereto, hedge efficacy, cash flows and adequacy thereof, return on equity, capital structure, return on invested capital, revenues and earnings and timing thereof, margins, operations and maintenance expense, dividends, credit ratings and profile, the regulatory environment, effects of regulatory disallowance, timing or effects of future regulatory proceedings or future regulatory approvals, regulatory prudence reviews, effects of regulatory mechanisms, including, but not limited to, SRRM and the Company’s infrastructure investments, effects of legislation, including but not limited to bonus depreciation and PHMSA regulations, and other statements that are other than statements of historical facts.

Forward-looking statements are based on our current expectations and assumptions regarding our business, the economy and other future conditions. Because forward-looking statements relate to the future, they are subject to inherent uncertainties, risks and changes in circumstances that are difficult to predict. Our actual results may differ materially from those contemplated by the forward-looking statements, so we caution you against relying on any of these forward-looking statements. They are neither statements of historical fact nor guarantees or assurances of future performance. Important factors that could cause actual results to differ materially from those in the forward-looking statements are discussed by reference to the factors described in Part I, Item 1A “Risk Factors,” and Part II, Item 7 and Item 7A “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and “Quantitative and Qualitative Disclosure about Market Risk” in the Company’s most recent Annual Report on Form 10-K, and in Part I, Items 2 and 3 “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and “Quantitative and Qualitative Disclosures About Market Risk”, and Part II, Item 1A, “Risk Factors”, in the Company’s quarterly reports filed thereafter.

All forward-looking statements made in this presentation and all subsequent forward-looking statements, whether written or oral and whether made by or on behalf of the Company, are expressly qualified by these cautionary statements. Any forward-looking statement speaks only as of the date on which such statement is made, and we undertake no obligation to publicly update any forward-looking statement, whether as a result of new information, future developments or otherwise, except as may be required by law.

# Agenda

1) Overview
2) Background
3) Analysis
4) Methodology
5) Questions/Next steps
6) Handouts

# NW Natural – 2018 IRP

- NW Natural 2018 IRP filed 8/24/18 – docketed as LC 71
- Requested acknowledgement of Action Plan item 2:

  2) Use the methodology detailed in Appendix H to evaluate renewable natural gas resources against conventional sources based on all-in costs, where all-in costs are defined as:

  *All-in costs = Net Present Value ([cost for delivered gas] + [net GHG emissions intensity*Cost of GHG Emissions Compliance] – [avoided supply capacity costs] – [avoided distribution capacity costs])Renewable Natural Gas*

# NW Natural – 2018 IRP (cont)

- As stated in Appendix H:

  *Enabled by new information and expertise gained since completing the last IRP, NW Natural evaluated low carbon gas resources in a much more detailed and comprehensive manner in the 2018 IRP. This methodology applies the current least cost and least risk planning standard to RNG resources; it is not meant to expand the scope of integrated resource planning or serve as a policy statement regarding RNG. The methodology and process presented in this appendix is meant to be flexible so that as new policies are enacted they can be incorporated into the analysis.*

# Staff Recommendation No. 15

Staff's report presented at the February 26, 2019 Public Meeting, and subsequently adopted by the Commission in Order No. 19-073 contained the following recommendation

(a) As part of an RNG investigation, Staff recommends NWN provide modeling inputs, outputs, and other relevant workpapers to parties in the investigation docket at least 30 days before signing any RNG contract or initiating any RNG project.

(b) Staff recommends acknowledging a revised action item for RNG: "NW Natural will participate in an investigation into the use of the Company's proposed methodology to evaluate renewable natural gas (RNG) cost effectiveness. Until the investigation is complete, NW Natural will procure RNG deemed cost-effective through the methodology in revised Appendix H, up to a 4.5 million therm annual limit on total delivery, for up to ten years (up to 45 million therms in total). The investigation will review the appropriate process for procuring cost-effective RNG resources that do not align with the timeline of acknowledgement in an IRP as well as review the 4.5 million therm annual limit on cost-effective RNG procurement. If NW Natural seeks to procure additional cost-effective RNG before the conclusion of the investigation, it will seek acknowledgment in an IRP update. If the investigation results in the 4.5 million therm annual limit being adjusted or eliminated, or in other changes, the Commission may direct NW Natural to file an update to reflect its findings."

# Docket No. UM 2030

- At the 8/27/2019 Public Meeting Staff presented a memo recommending opening of an investigation into:

  "determining the cost-effectiveness of Renewable Natural Gas (RNG) resources for NW"
- The Commission concurred, opening Docket No. UM 2030
- Today's workshop will focus on the proposed methodology

# Analysis

# IRP Guidelines

IRP Guideline 1(a) states:

*All resources must be evaluated on a consistent and comparable basis.*

*All known resources for meeting the utility's load should be considered, including supply-side options which focus on the generation, purchase and transmission of power – or gas purchases, transportation, and storage – and demand-side options which focus on conservation and demand response.*

IRP Guideline 8(a) states:

*"The utility should construct a base-case scenario to reflect what it considers to be the most likely regulatory compliance future for carbon dioxide (CO2), nitrogen oxides, sulfur oxides, and mercury emissions. The utility also should develop several compliance scenarios ranging from the present CO2 regulatory level to the upper reaches of credible proposals by governing entities."*

# Renewable Natural Gas vs Conventional Natural Gas

- The first inclination in comparing the cost of RNG with the cost of conventional gas is to compare the commodity cost of the two types of natural gas
- This is not a complete comparison, as both energy *and capacity costs* should be considered
- Comparing the “all-in” cost of different natural gas supply resources is more appropriate
- “All-in” cost represents the total cost to deliver a unit of natural gas to customers (i.e. what customers pay for a unit of gas)
- Comparing the “all-in” cost of different gas resources complies with IRP Guidelines

**All-in Cost = Commodity cost of gas + GHG Compliance costs + Supply Infrastructure Costs + Distribution System Capacity Costs**

# Utility Benefits of RNG

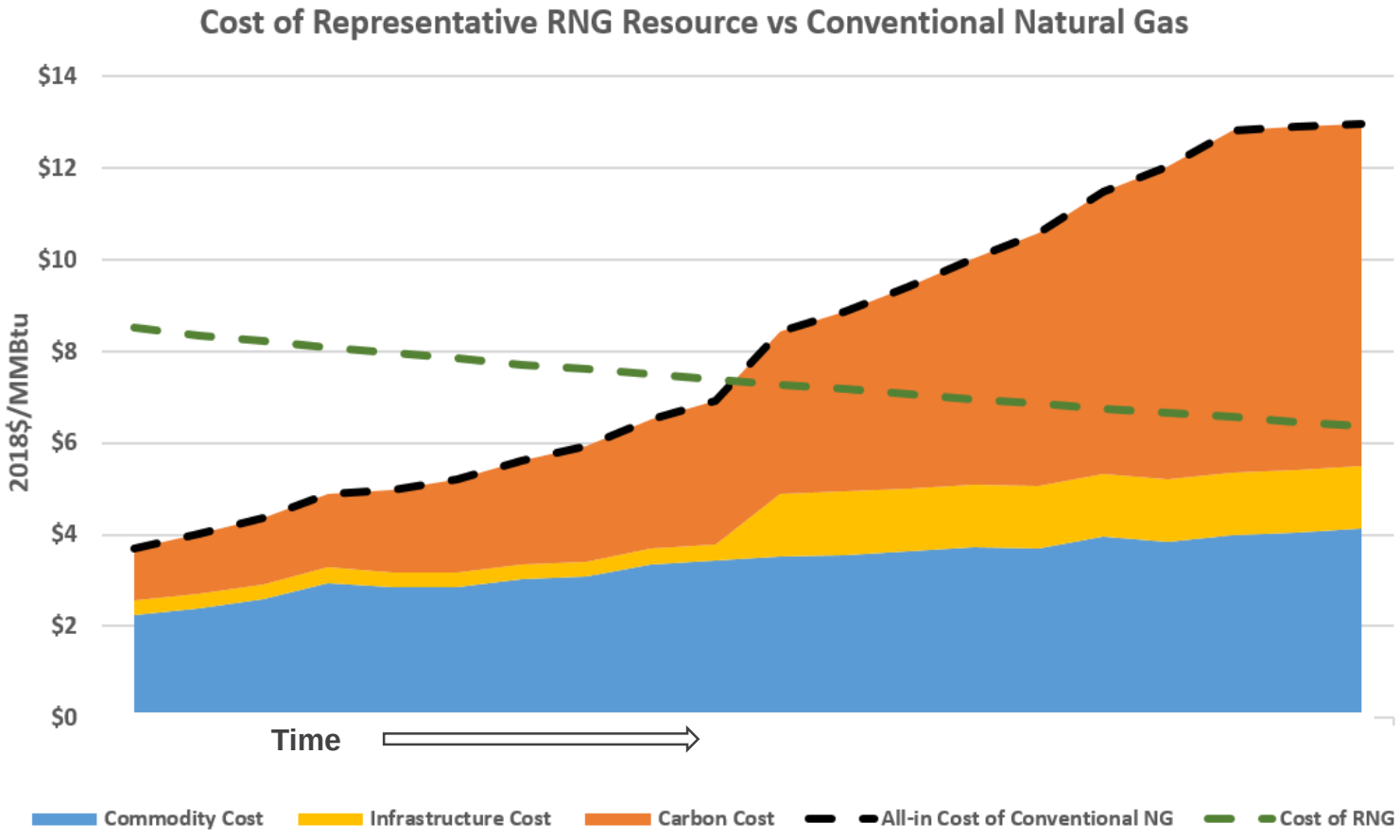
| Benefits of RNG | Description |
|---|---|
| Avoided Commodity & Transport Costs | The marginal costs of daily gas purchases avoided by not having to buy conventional gas and the transportation charges associated with the marginal unit of gas purchased. |
| Avoided GHG Compliance Costs | The compliance benefit of RNG versus carbon intensity of conventional natural gas. |
| Avoided Supply Capacity Costs | The avoided supply capacity cost of not needing additional supply capacity in order to meet peak day requirements. |
| Avoided Distribution System Capacity Costs | The avoided distribution system reinforcement costs by having a supply resource on-system based. This is based on State-wide average. |

# RNG vs Other Energy Resources

| | Direct Use Natural Gas | | Electricity | |
|---|---|---|---|---|
| | Conventional | RNG | Natural Gas Generation | Wind and Solar |
| Renewable | | ✓ | | ✓ |
| Cost per Btu | $ | $$ | $ | $ |
| Storable- Short Duration | $ | $* | $ | $$* |
| Storable- Long Duration | $ | $ | $ | $$$$* |
| Availability | ✓✓✓ | ✓ | ✓✓✓ | ✓✓ |

*RNG can be stored with existing storage infrastructure, where with wind and solar this infrastructure needs to accompany the development of the resource to be storable

# Comparing RNG vs Conventional Gas Costs




NW Natural analysis, not for investment purposes.

# Methodology

# RNG vs. Conventional Gas

- RNG projects need to be compared to the costs of alternative supplies as directed by the IRP Guidelines.
- Mathematically, the RNG project is a least-cost/least-risk resource to acquire if:

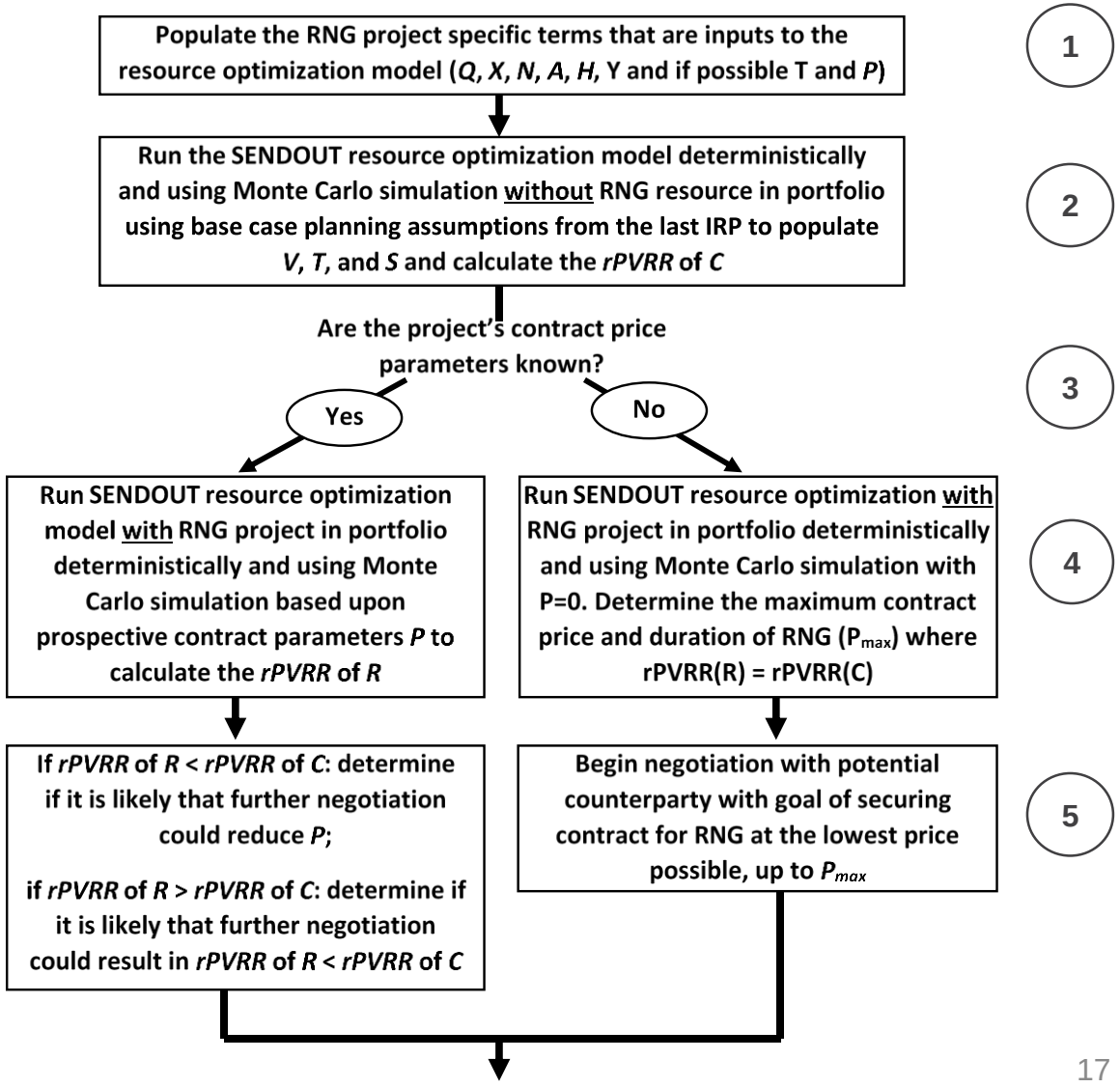
$$\boldsymbol{rPVRR(R) < rPVRR(C)}$$

- In this case the all-in, risk-adjusted cost of the RNG project (R) is less than the comparable cost of a portfolio of resources without the RNG project (C)
- The above analysis examines cost and risk, consistent with the IRP mandate to evaluate all options for least-cost/least-risk portfolio to meet customer needs.

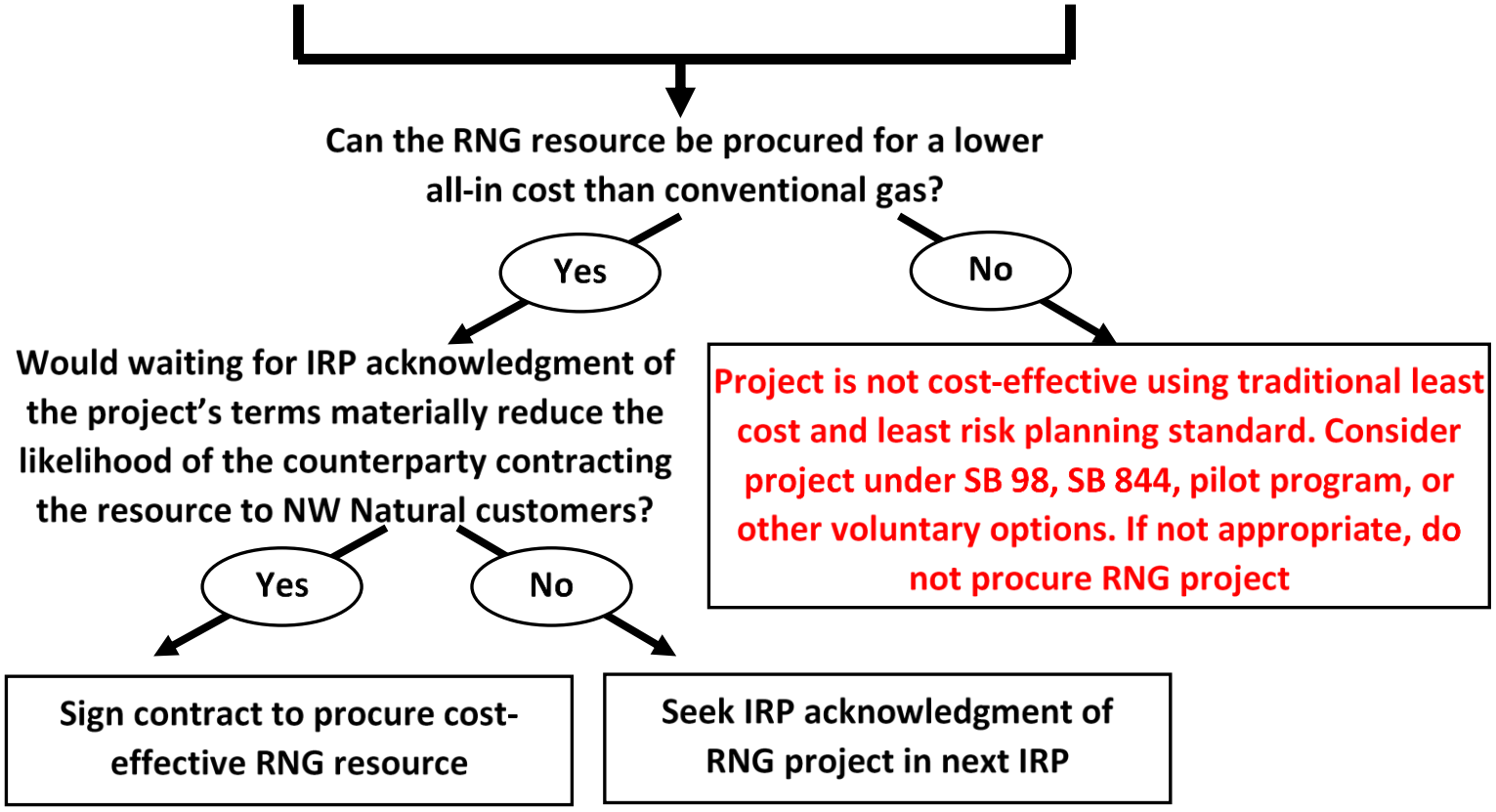
# Possible Contract Structures

| Type of Structure | Ownership of biogas production | Ownership of conditioning and cleanup equipment and/or pipeline interconnection | Cost basis for consideration of cost-effectiveness |
|---|---|---|---|
| 1. RNG commodity-only purchase | 3rd party | 3rd party | Flat $/Dth contract for delivery of gas over a set time period |
| 2. Investment in gas conditioning and/or pipeline interconnection | 3rd party | NW Natural | Capital costs of investment in gas cleanup/ interconnection, minus some payment to 3rd party for raw biogas |
| 3. Investment in full RNG project development | NW Natural | NW Natural | Capital costs of gas production and gas cleanup/interconnection |
| 4. Full acquisition of operational RNG project | NW Natural | NW Natural | Asset purchase price, plus any contractual obligations and operating costs |

# NW Natural RNG Project Evaluation and Procurement Process



# NW Natural RNG Project Evaluation and Procurement Process (cont.)






NW Natural analysis, not for investment purposes.

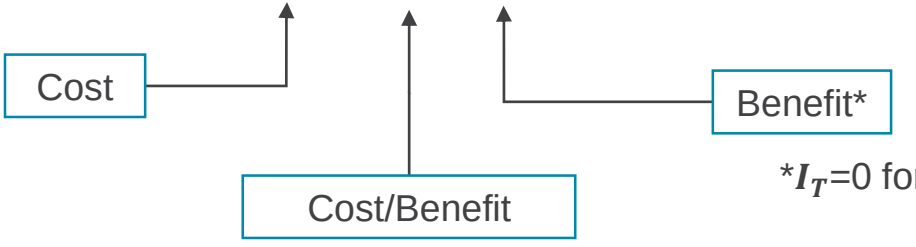
# Cost Calculations

- In general, “all-in costs” of RNG projects calculated with the following equation:

*Annual all-in cost of RNG (R) = Cost of methane (M) + Emissions compliance costs (E) – Avoided infrastructure costs (I)*

- Calculation will examine the entire lifespan of the project with the simplified equation:

$$R_T = M_T + E_T - I_T$$




*$I_T$=0 for Off-system RNG

# Avoided Commodity & Transport Cost

- The commodity cost is the cost of the marginal unit of gas purchased
- The transport cost include fuel and variables cost and depends on where the marginal unit was purchased (roughly 1%-3% of the commodity cost)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# Annual Cost Calculations - Components

- Methane cost:

$$M_T = X_T + \sum_{t=1}^{365} [P_{T,t} + Y_{T,t}^{RNG}] Q_{T,t}$$

Fixed Costs

Variable Costs

- $X_T$ Annual revenue requirements of capital to access RNG resource ($)
  - Pipeline interconnection costs
  - Conditioning equipment
- $P_{T,t}$ RNG commodity contract price at time t ($/Dth)
- $Y_{T,t}^{RNG}$ RNG variable transport costs at time t ($/Dth)
- $Q_{T,t}$ Quantity received at time t (Dth)

# Annual Cost Calculations - Components

- Emissions compliance costs:

$$E_T = \sum_{t=1}^{365} N G_T Q_{T,t}$$

Carbon Intensity

Compliance Cost

Annual Quantity

- $N$ Carbon intensity ($CO_2$ tons/Dth)
- $G_T$ Carbon price ($/$CO_2$ tons)
- $Q_{T,t}$ Quantity received at time t (Dth)

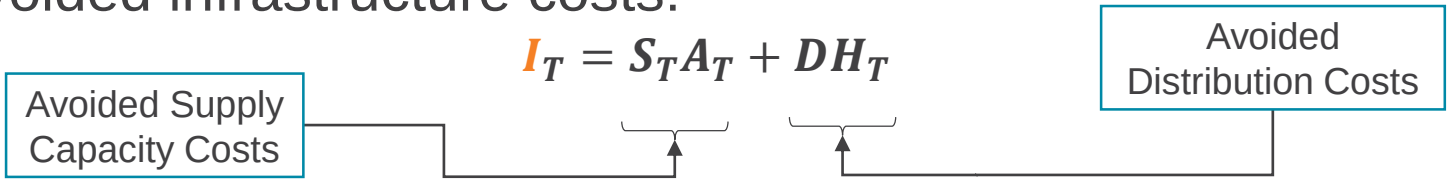
# Infrastructure Avoided Costs Methodology

Two pieces are needed for the calculation for each Supply Capacity and Distribution Capacity Costs:

1. The incremental cost of serving additional peak load
   - This is the same for all resources
2. The amount of energy that would be saved (e.g. EE) or supplied (e.g. RNG) during a peak
   - This is resource specific

# Annual Cost Calculations - Components

- Avoided infrastructure costs:




- $S_T$ System supply capacity cost to serve one additional dekatherm of peak load based on marginal resource ($/Dth)
- $A_T$ Minimum amount of RNG delivered at time t (Dth)
- $D$ Avoided distribution capacity costs ($/Dth)
- $H_T$ Minimum RNG quantity received at peak hour (Dth)
- Avoided distribution costs apply to on-system resources only

# Cost Calculations

- Original equation:

$$R_T = M_T + E_T - I_T$$

- Detailed RNG cost equation is with substitution:

$$R_T = X_T - S_T A_T - DH_T + \sum_{t=1}^{365} \left[ P_{T,t} + Y_{T,t}^{RNG} + N^{RNG} G_T \right] Q_{T,t}$$

All-in Costs

- Compared to the conventional supply:

$$C_T = \sum_{t=1}^{365} \left[ V_{T,t} + Y_{T,t}^{CONV} + N^{CONV} G_T \right] Q_{T,t}$$

All-in Costs

Commodity Costs

# Cost Calculations – Risk Adjustment

- Adjusting for risk in forecast uncertainty, the all in costs are represented by the following:

$$rPVRR(R)=0.75*\text{deterministic } PVRR(R)+0.25*\text{95th Percentile Stochastic } PVRR(R)$$

$$rPVRR(C)=0.75*\text{deterministic } PVRR(C)+0.25*\text{95th Percentile Stochastic } PVRR(C)$$

- These values are compared to determine if the RNG project is the least cost/least-risk alternative as compared to conventional gas supply

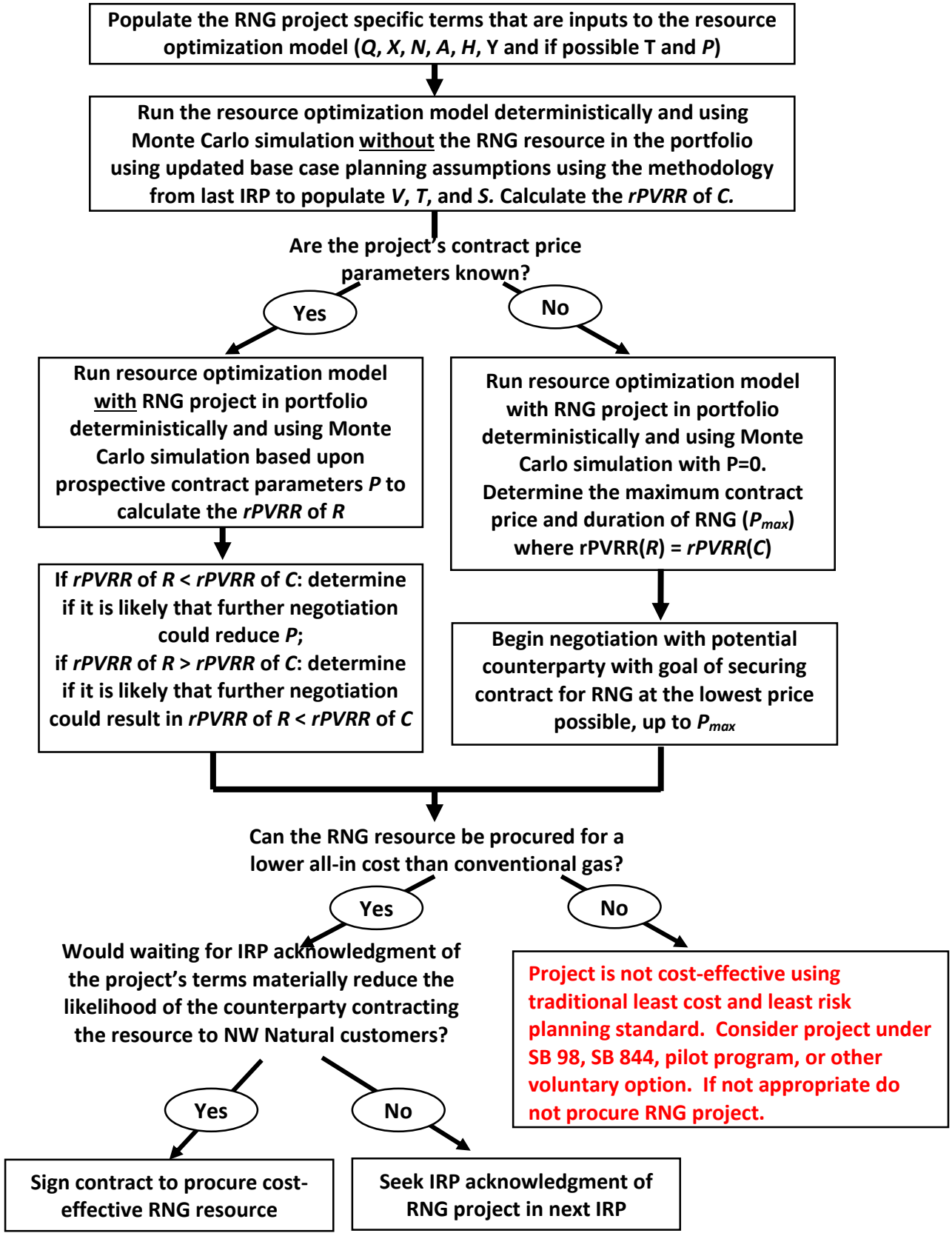
# Variable Update Schedule

| Input/Assumption/Forecasts | Frequency of Update | Additional Explanation |
|---|---|---|
| Resource Under Evaluation | Most Current Estimate | For example, if an RNG project requires any capital costs, the most current estimate of those costs will be run through the cost-of-service model and used for the evaluation. |
| Gas Prices (Deterministic and Stochastic) | Twice a year | Our third party consultant provides long term gas price forecasts twice each year in August and February. |
| Peak Day & Annual Load Forecast | Once a year | These forecasts are updated spring/summer to include data from the most recent heating season. |
| GHG Compliance Cost Expectations (Deterministic and Stochastic) | Once a year | The GHG compliance cost assumptions will be updated each year after the legislation sessions in each state. are updated for each IRP. |
| Design, Normal, and Stochastic Weather | Each IRP | Resources are planned based on design weather, but are evaluated on cost using normal and stochastic weather. |
| Supply Resource Costs (Determinisitic and Stochastic) | Each IRP | For the 2018 IRP base case this included the cost of a pipeline uprate, a local pipeline expansion, and representative |
| Distribution Avoided Costs | Each IRP | NW Natural will calculate and present the avoided distribution avoided costs through the IRP process. |

# Questions/Next Steps

# Handout Material

# NW Natural Renewable Natural Gas Project Evaluation and Procurement Process



**NW Natural Renewable Natural Gas Project Evaluation Criteria and Calculations**

*Annual all-in cost of RNG (R) =*
*Cost of methane (M) + Emissions compliance costs (E) – Avoided infrastructure costs (I)*

Or: $R_T = M_T + E_T - I_T$

Where:

$$M_T = X_T + \sum_{t=1}^{365} [P_{T,t} + Y_{T,t}^{RNG}] Q_{T,t}$$

$$E_T = \sum_{t=1}^{365} N^{RNG} G_T Q_{T,t}$$

$$I_T = S_T A_T + DH_T$$

Substituting leaves the annual all-in cost of RNG as:

$$R_T = X_T - S_T A_T - DH_T + \sum_{t=1}^{365} \left[P_{T,t} + Y_{T,t}^{RNG} + N^{RNG} G_T\right] Q_{T,t}$$

Where the annual all-in cost of the conventional natural gas alternative (C) is:

$$C_T = \sum_{t=1}^{365} \left[V_{T,t} + Y_{T,t}^{CONV} + N^{CONV} G_T\right] Q_{T,t}$$

The present value of revenue requirement of all relevant years is used for evaluation where:

$$PVRR(R) = \sum_{T=k}^{T=k+z} \frac{R_T}{[1+d]^T}$$

$$PVRR(C) = \sum_{T=k}^{T=k+z} \frac{C_T}{[1+d]^T}$$

This is risk-adjusted to account for uncertainty in long-term forecasting where:

$$rPVRR(R) = 0.75 * \text{deterministic } PVRR(R) + 0.25 * 95\text{th Percentile Stochastic } PVRR(R)$$

$$rPVRR(C) = 0.75 * \text{deterministic } PVRR(C) + 0.25 * 95\text{th Percential Stochastic } PVRR(C)$$

The RNG project is a least cost/least risk resource to acquire if:

$$rPVRR(R) \leq rPVRR(C)$$

## Table H.1: NW Natural Renewable Natural Gas Project Evaluation Component Descriptions

| Term | Units | Description | Source | Project Specific? | Input or Output of Optimization? | Treated as Uncertain? |
|---|---|---|---|---|---|---|
| ***R*** | $/Year | Annual all-in cost of prospective renewable natural gas (RNG) project | Output of RNG evaluation process | Yes | Output | Yes |
| ***C*** | $/Year | Annual all-in cost of conventional natural gas alternative | Output of RNG evaluation process | Yes | Output | Yes |
| ***M*** | $/Year | Annual costs of natural gas and the associated facilities and operations to access it | Output of RNG evaluation process | Yes | Output | Yes |
| ***E*** | $/Year | Annual greenhouse gas emissions compliance costs | Output of RNG evaluation process | Yes | Output | Yes |
| ***I*** | $/Year | Annual infrastructure costs avoided with on-system supply | Output of RNG evaluation process | Yes | Output | Yes |
| ***Q*** | Dth | Expected or contracted daily quantity of RNG supplied by project | Project evaluation or RNG supplier counterparty | Yes | Input | If no contractual obligation |
| ***P*** | $/Dth | Contracted or expected volumetric price of RNG | Project evaluation or RNG supplier counterparty; Max cost-effective price determined in SENDOUT if NWN initiating negotiations | Yes | Input if responding to offer, Output if NWN making offer | If no contractual obligation |
| ***T*** | Year | Year relative to current year, where the current year T = 0, next year T = 1, etc. | Project evaluation or RNG supplier counterparty | Yes | Input if responding to offer, Output if NWN making offer | If no contractual obligation |
| ***k*** | Year | When the RNG purhcase starts in # of years in the future; k = RNG start year - current year | Project evaluation or RNG supplier counterparty | Yes | Input if responding to offer, Output if NWN making offer | If no contractual obligation |
| ***z*** | Years | Duration of RNG purchase in years | Project evaluation or RNG supplier counterparty | Yes | Input if responding to offer, Output if NWN making offer | If no contractual obligation |
| ***t*** | Days | Day number in year ***T*** from 1 to 365 | N/A | No | Input | No |
| ***V*** | $/Dth | Price of conventional gas that would be displaced by RNG project | Average price of last ***Q*** quantity of conventional gas dispatched in SENDOUT run without RNG project | Yes | Output | Yes |
| ***Y*** | $/Dth | Variable transport costs to deliver gas to NWN's system | *For off-system RNG* - based upon geographic location of project; *For conventional gas* - determined from last gas dispatched in SENDOUT | Yes | Output | No |
| ***X*** | $/Year | Annual revenue requirement of capital costs to access resource | Engineering project evaluation or RNG supplier counterparty | Yes | Input | If no contractual obligation |
| ***N*** | Tons$CO_2e$/Dth | Greenhouse gas intensity of natural gas being considered | From actual project certification if available, from California Air & Resources Board by biogas type if no certification has been completed | Yes | Input | No |
| ***G*** | $/Ton$CO_2e$ | Volumetric Greenhouse gas emissions compliance costs/price | Expected greenhouse gas compliance costs from the most recently acknowledged IRP | No | Input | Yes |
| ***S*** | $/Dth | System supply capacity cost to serve one Dth of peak DAY load | Calculated within SENDOUT based upon marginal supply capacity resource that is being deferred using Base Case resource availability from the last IRP | No | Output | Yes |
| ***A*** | Dth | Minimum natural gas supplied on a peak DAY by project | Project evaluation or contractual obligation from RNG supplier counterparty | Yes | Input | If no contractual obligation |
| ***D*** | $/Dth | Distribution system capacity cost to serve one DTH of peak HOUR load | Distribution system cost to serve peak hour load from avoided costs in most recently acknowledged IRP | No | Input | No |
| ***H*** | Dth | Minimum natural gas supplied on a peak HOUR by project | Project evaluation or contractual obligation from RNG supplier counterparty | Yes | Input | If no contractual obligation |
| ***d*** | % rate | Discount Rate | Discount rate from most recently acknowledged IRP | No | Input | No |

## Table H.2:

### NW Natural Renewable Natural Gas Project-Specific Component Definition Fill-In Sheet

| Term | # | Question | Project Parameter | |
|---|---|---|---|---|
| ***Q:*** RNG Output | 1 | How much RNG is the project expected to sell to NW Natural annually? | | Dth |
| | 2 | Is this volume expected to vary by season, day of the week, or any other factor? If so, provide the expected variation on a separate spreadsheet | | |
| | 3 | Is there a minimum daily, monthly, or annual quantity included/expected to be included in the prospective contract? If so, what is the minimum daily volume? | | Dth per |
| ***T***: Timing of RNG Purchase | 4 | Is the duration and timing of the RNG purchase known? | | |
| | 5 | If Yes, when does the RNG purchase begin? | Date | |
| | 6 | If Yes, when does the RNG purchase end? | Date | |
| | 7 | If No, when does the RNG purchase begin? | Date | |
| ***P:*** Price of RNG | 8 | Is the volumetric pricing arrangement for the RNG known? | | |
| | 9 | If Yes, and it is it a fixed price arrangement, what is the proposed price NW Natural will pay for the RNG? If fixed, but varying through time attach separate spreadsheet and enter average for duration of contract to the right: | $ | per Dth |
| | 10 | If Yes and it is not a fixed price arrangment, please provide the formula for pricing on a separate spreadsheet and enter average expected price for the duration of the contract to the right: | $ | per Dth |
| ***X***: Required Capital Investment | 11 | What (if any) is the total annual revenue requirement of any equipment and facilities in which NW Natural needs to invest to access the RNG from the project? | $ | per Year |
| | 12 | If there is a fixed non-volumetric payment to the RNG supplier as part of the contract, what is the annual payment? | $ | per Year |
| ***N***: GHG Emissions Intensity | 13 | If the project has already been assessed a greenhouse gas intensity from the EPA or ODEQ, what is the carbon intensity of the RNG? | | Metric Tons CO2e/Dth |
| | 14 | If the project has not already been assessed a carbon intensity, what is the average GHG intensity for the projects biogas type from the Low Carbon Fuel Standards work done by the California Air & Resources Board | | Metric Tons CO2e/Dth |
| **On-System?** | 15 | Will the project inject the RNG onto NW Natural's distribution system? | | |
| | 16 | Where will NW Natural take custody of the RNG? | | |
| If the answer to *Question 15* is **YES** fill-in **Zero** on *Question 17* | | | | |
| ***Y***: Variable Transport | 17 | What are the total variable volumetric transport charges that would be required to bring the off-system RNG to NW Natural's system? | $ | per Dth |
| If the answer to *Question 15* is **NO** fill in **Zero** for the remaining questions | | | | |
| ***A***: Peak Day Supply | 18 | What is the mininum daily amount of methane the project would inject into NW Natural during a cold weather event? | | Dth per Day |
| | 19 | Is this amount a contractual obligation? | | |
| ***H***: Peak Hour Supply | 20 | What is the minimum amount of methane the project would inject into NW Natural's system during the 7am hour of a cold weather event? | | Dth per Hour |
| | 21 | Is this amount a contractual obligation | | |