NW Natural's 2025 IRP- Technical Working Group

TWG #8
Distribution System Planning
April 8, 2025

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Forward Looking Statement

This press release, 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," "assumes," “continues,” “could,” "intends," "plans," "seeks," "believes," "estimates," "expects," "will" and similar references to future periods. Examples of forward-looking statements include, but are not limited to, statements regarding the following: plans, objectives, assumptions, estimates, expectations, timing, goals, strategies, commitments, future events, gas supplies and infrastructure, pipeline transportation, storage and capacity, adequacy of gas supplies, customer rates, effects of weather, commodity costs, gas storage availability, adequacy and pricing, state carbon compliance programs and our ability to meet their compliance requirements, costs of and tools available for carbon compliance, renewable natural gas, carbon capture, alternative fuels, hydrogen, synthetic methane, tax credits, electrolysis, sequestration, plasma pyrolysis, carbon air capture, biomass, gasification, resource modeling, regional third-party projects, storage, pipeline and other infrastructure investments, competitive advantage, customer service, customer and business growth, business risk, efficiency of business operations, regulatory recovery, gas storage development, costs, timing or returns related thereto, financial positions and performance, economic and housing market trends, capital expenditures, strategic goals, greenhouse gas emissions, carbon savings, hedge efficacy, 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, effects of federal and state legislation, effects of local regulation, and other statements that are other than statements of historical facts.

Forward-looking statements are based on current expectations and assumptions regarding our business, the economy, geopolitical factors, 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. Actual results may differ materially from those contemplated by the forward-looking statements. You are therefore cautioned against relying on any of these forward-looking statements. They are neither statements of historical fact nor guarantees or assurances of future operational, economic or financial 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 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 quarterly reports filed thereafter, which, among others, outline legal, regulatory and legislative risks, public health risks, financial, macroeconomic and geopolitical risks, growth and strategic risks, operational risks, business continuity and technology risks, environmental risks and risks related to our natural gas business.

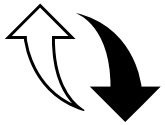
All forward-looking statements made in this report and all subsequent forward-looking statements, whether written or oral and whether made by or on behalf of NW Natural, are expressly qualified by these cautionary statements. Any forward-looking statement speaks only as of the date on which such statement is made, and NW Natural 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. New factors emerge from time to time and it is not possible to predict all such factors, nor can it assess the impact of each such factor or the extent to which any factor, or combination of factors, may cause results to differ materially from those contained in any forward-looking statements.

Today's Agenda

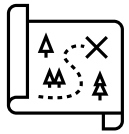
- Logistics
- Recap of previous TWG
- Objectives
- Distribution System Planning
- Pipeline Options and Non-Pipeline Alternatives (NPAs)
- Forward Looking Plan
- Targeted Demand Side Management

Facilitator Requests

Engage constructively and courteously towards all participants



Take space and make space



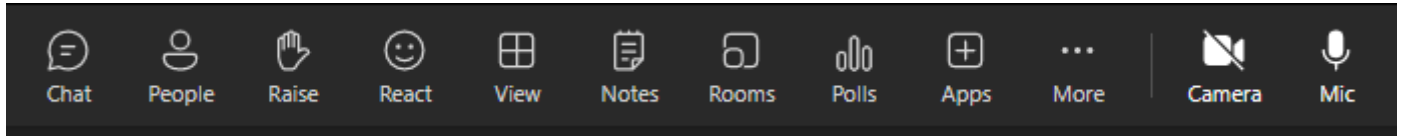
Respect the role of the facilitator to guide the group process

Avoid use of acronyms and help each other understand

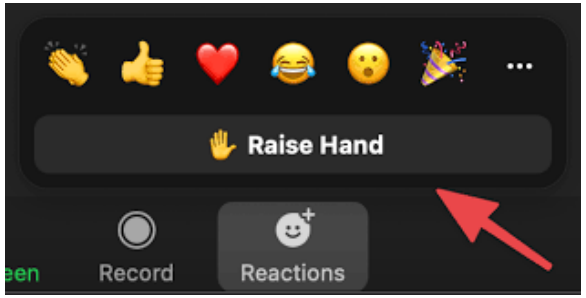
Aim to focus on the meeting topic

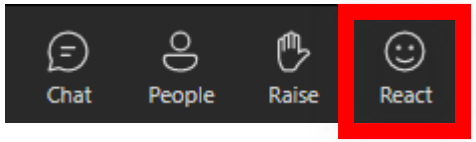
How to Interact in a Teams Meeting

- Participant Controls are at the top or bottom of your screen

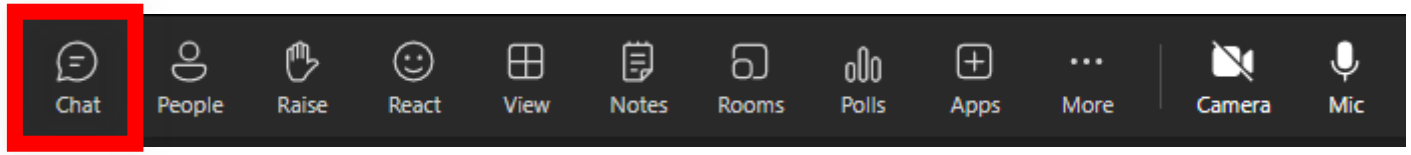


- Ask a question or comment at any time using the “raised hand”





- You may also use the chat box



A member of the IRP team will monitor the chat, and participant list for raised hands during the meeting.

Meeting Best Practices – virtual spaces

To maintain an engaged and productive space, please:

Mute your mic unless asking a question and/or providing comment

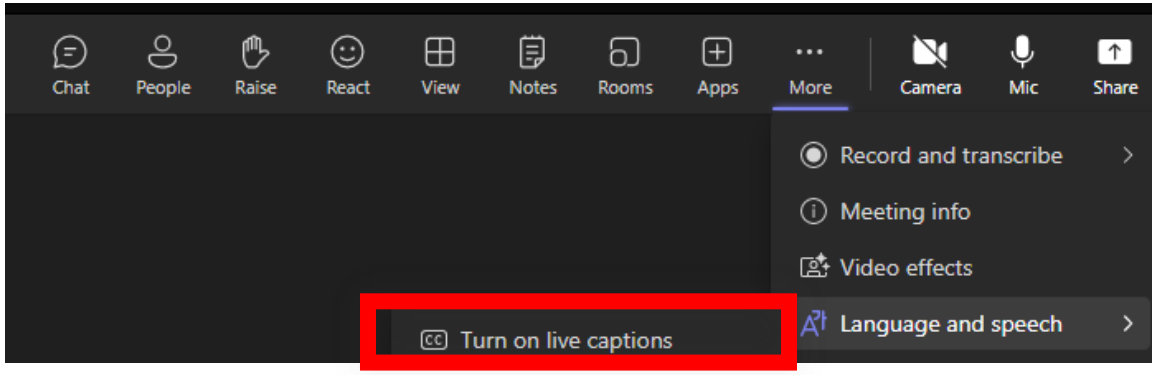
Turn your camera on when speaking (if you are comfortable and your bandwidth allows)

Limit side conversations in the chat

Make efforts to adhere to the meeting schedule

Teams Meeting – Accessibility Functions

- Live Captions - real-time auto-generated text of what is said in a meeting. They appear a few lines at a time for a user who has turned them on, and aren't saved



- Reducing Distractions and Customizing Views:
  - Microsoft Teams has a variety of features to support different learning styles, please find reference material for:
    - Turn on live captions during meetings
    - Customize your meeting view
    - Change background effects in Teams meetings
    - Reduce background noise in Teams meetings
    - 5 tips for using Teams when you're deaf or hard of hearing
- Meeting Recordings:
  - NW Natural will record IRP virtual meetings and will post them to the NW Natural website on the resource planning webpage

Take 2 Minutes for Safety: April is Spring Safety Awareness Month

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As the weather warms for spring, keep safety top of mind!

- Weather can be unpredictable – this can cause an increase in roadway incidents due to unexpected conditions
- People and animals are out and about – be mindful of extra foot and vehicle traffic
- Yard work can pose safety risks – call before you dig; use equipment properly and wear protective gear when appropriate; keep children and animals clear from where you are working
- Seasonal plants and insects – allergies can be trigged in people and pets

Recap Jan. 28 TWG

- Shared information about NW Natural's current resource portfolio
- Gained a shared understanding about potential resources NW Natural will consider for supply side and compliance requirements
- Addressed clarifying questions about:
  - Peak interruption capacity and the impact of climate change on forecasts
  - Availability and contracting of nonconventional fuels like renewable natural gas and hydrogen, the potential for hydrogen storage, and cost assumptions
  - The benefits of biogenic CO2 for alternative fuels, the integration of gas decarbonization with other sectors, and the potential of biomass resources

▷ ▶ Today's objectives

- Gain a shared understanding of our:
  - distribution planning process
  - distribution planning tools
  - alternative analysis process
  - cold weather planning process
- Review areas that were identified as potentially needing some system reinforcements in the future

Current Technical Working Group Schedule

TWG No.	Date	Type & Purpose of Engagement
TWG#1	Oct 22, 2024	Planning Environment
TWG#2	Nov 1, 2024	Scenarios
TWG#3	Nov 21, 2024	Scenarios Cont. and Climate
TWG#4	Dec 17, 2024	Load Forecast
TWG#5	Jan 21, 2025	Avoided Costs & Demand-Side Resource
TWG#6	Jan 28, 2025	Supply-Side & Compliance Resources
TWG#7	Repurposed	Repurposed for Office Hours
Office Hours	April 1, 2025	Electrification Study – follow up from TWGs
TWG#8	Apr 8, 2025	Distribution System Planning
TWG#9	TBD	Resource Optimization Planning Model
TWG#10	TBD	Portfolio Results and Action Plan
File Draft	Jun 13, 2025	Comments due by July 7th
File 2025 IRP	**Aug 1, 2025**	**Beginning of formal process**

- We will be moving the Resource Optimization TWG to May 6th and cancelling the April 29th TWG
- We will be rescheduling the Portfolio Results TWG for later in May
- All TWGs will be facilitated and virtual
- Dates and topics are tentative and subject to change
- Please refer to website for most up to date information: IRP Website

Other Public Engagement Opportunities

Public Engagement Opportunity & Topic	Date	Type & Purpose of Engagement
Energy Resource (IRP) Fair #1:	November 16, 2024	**In-Person Only. Opportunity to learn and engage on IRPs and Energy Services & Programs. Event to be held in collaboration with community partners.** ***Parkrose High School from 11:00am to 2:00pm***
Public Engagement Webinar #1:	March 5, 2025	**Opportunity to learn and engage on an IRP and key topics previously presented and related to resource planning and utility energy services.**
Energy Planning-Events Engagement:	Refer to webpage for details	**In-Person Only. Opportunity to learn about Energy Planning, Services & Programs. Events to be held in collaboration with community partners.**
Public Engagement Webinar #2:	TBD	**Opportunity to learn and engage on an IRP and key topics previously presented and related to resource planning and utility energy services.**

- Please check our dedicated IRP website for the most current information:

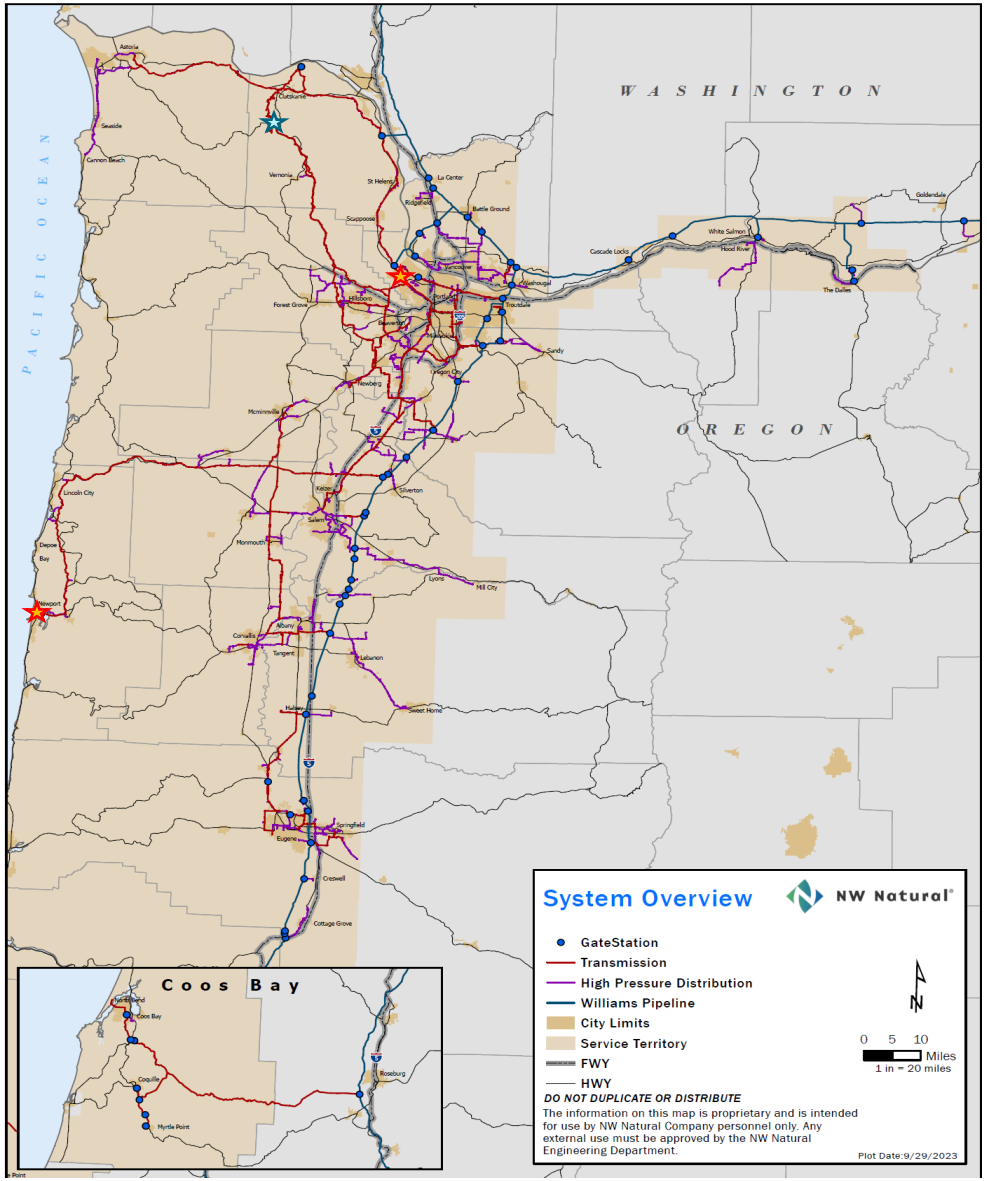
  IRP Website
- Feedback form direct link: Feedback Form
- Email us at IRP@nwnatural.com

Distribution System Planning

NW Natural's System

- 14,420 miles of transmission and distribution main
  - 86% Oregon
  - 14% Washington
- 54 Gate Stations
- Approximately 1,050 Regulator/Regional Stations
- 2 Liquified Natural Gas (LNG) Storage Plants
- Mist Underground Storage Facility

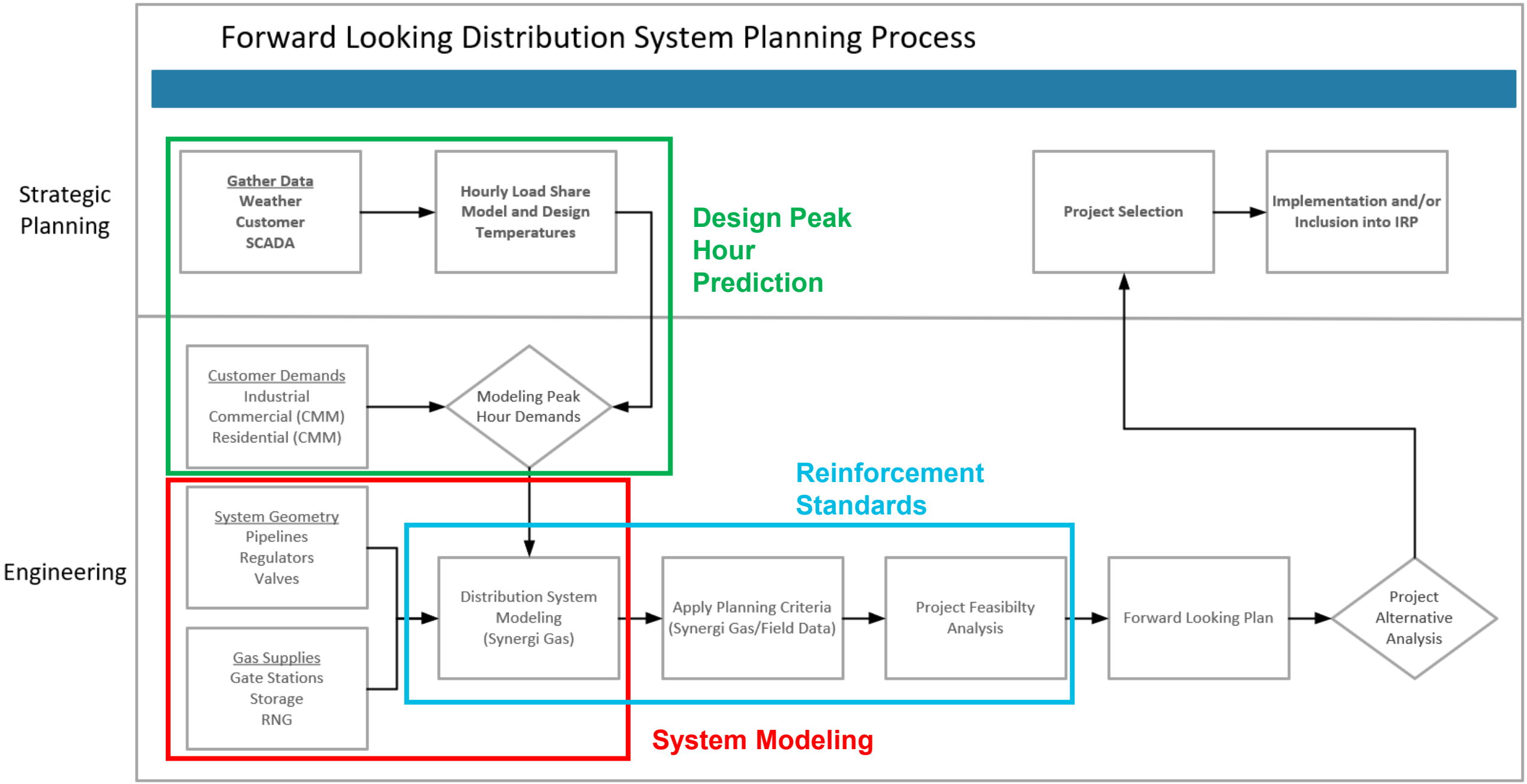
NW Natural has replaced all known Aldyl-A, cast iron, and bare steel mains with modern polyethylene and coated steel.



Objectives of Distribution System Planning

- ✓ Ensure the distribution system meets firm service customers' peak hour demand
- ✓ Address distribution system needs related to localized customer demand or growth
- ✓ Minimize system reinforcement costs by selecting the most cost-effective alternative and implementing a solution at the best time

Forward Looking Distribution System Planning Process



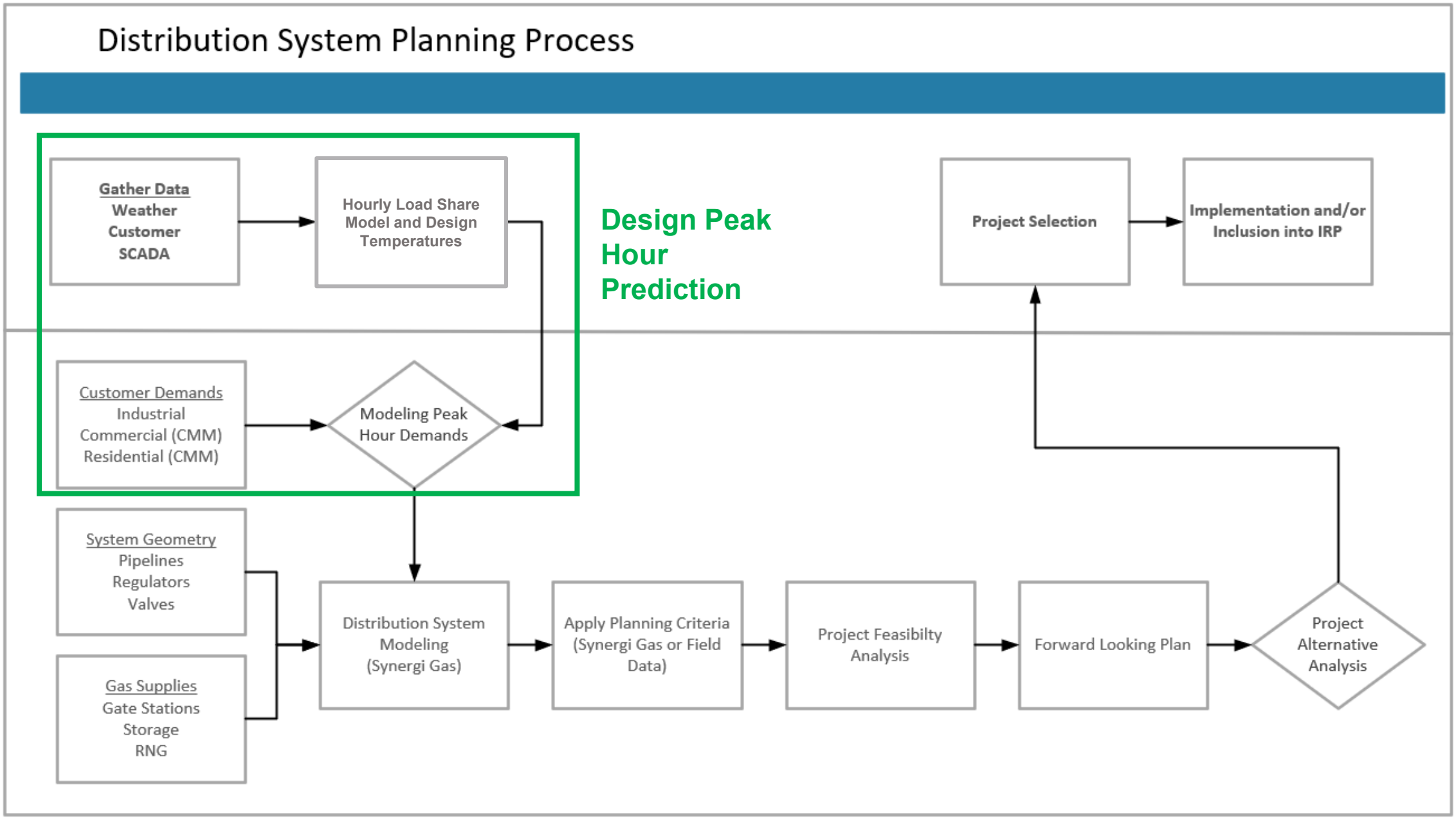
Distribution System Planning Tools

They all work together …

- Design Peak Hour Load Prediction – Enables system planners to develop models to serve firm peak hour customer demand
- System Modeling – Helps system planners determine the health of the system and resolve potential issues
- System Reinforcement Standards – Provides a consistent framework for system planners to apply criteria to identify conditions that require attention

Peak Hour Prediction

Distribution System Planning Process

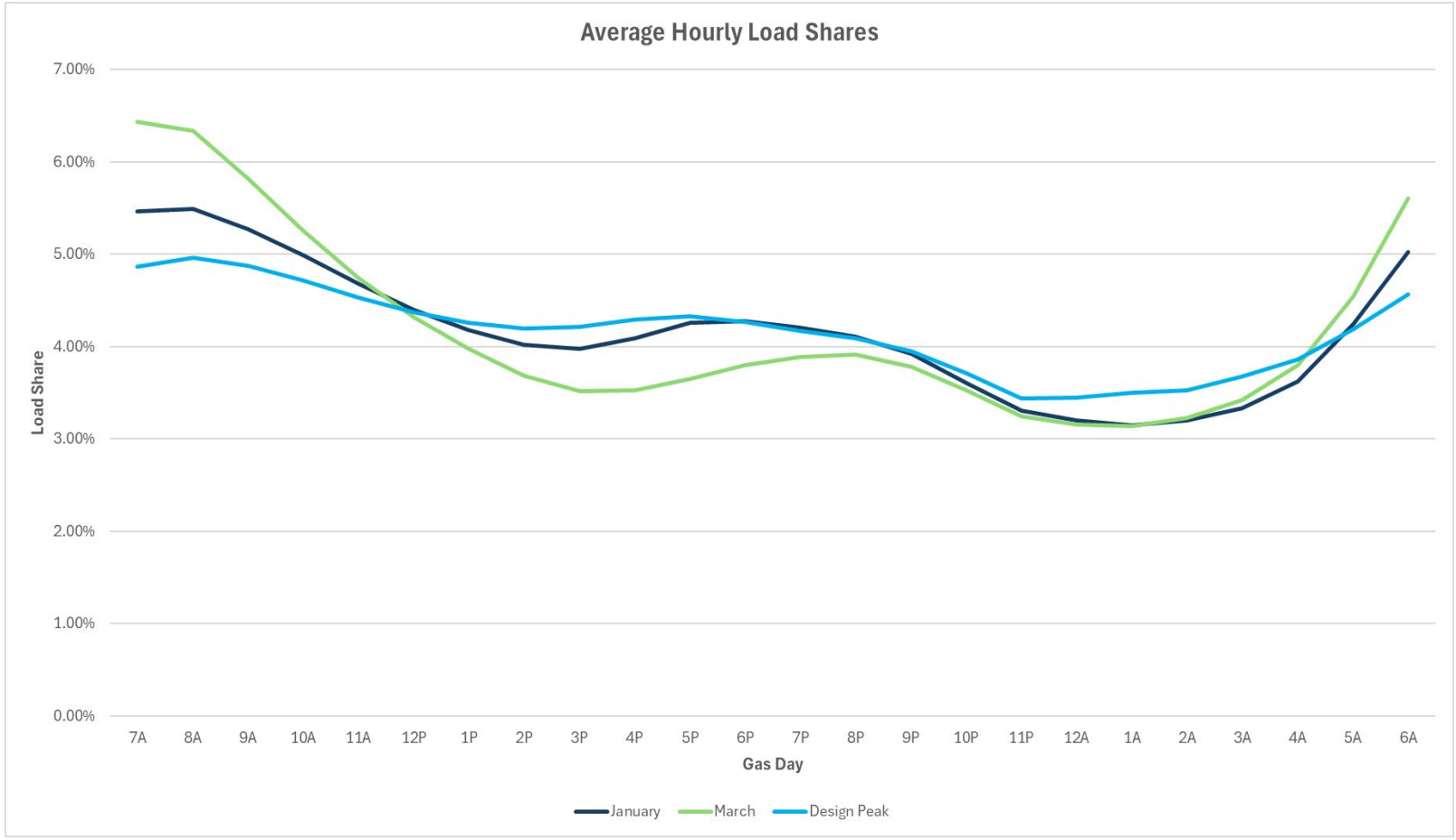


Design Peak Temperatures by Weather Zone

Weather Zone	Historical Minimum Daily Temperature	1st Percentile Daily Temperature
Columbia River Gorge	-9.5°F	-1.8°F
Clark County	6.5°F	7.6°F
Portland	7.0°F	8.0°F
Eugene	0.5°F	8.8°F
Salem	3.0°F	10.2°F
Albany	6.0°F	10.5°F
Astoria	13.5°F	15.6°F
Lincoln City	17.7°F	19.3°F
Coos County	18.0°F	23.1°F

- Historical data for the coldest day in each winter is used to simulate the coldest day temperatures
- The 1st percentile of temperatures is used as the non-coincident planning standard for each weather zone
- Historical minimum daily temperature are shown for context
- The 1st percentile temperatures are converted to HDDs as the input to the Synergi Customer Management Module (CMM)
- The CMM calculates daily loads for customers in the area based on these design day temperatures for a given weather zone
- Hourly demands are calculated based on the system hourly load shares model for peak temperatures

System Hourly Load Share Model



- Hourly load shares are modeled using historical Firm (sales + transport) load and temperature data
- The design peak hour load shares are applied to the design peak day throughput to get the peak hour usage
- The intra-day profile flattens as temperatures get colder
- Peak hour share is about 5% of the daily load and peaks around 8-9 AM

Distribution System Load Forecast

Customer **M**anagement **M**odule (CMM)

Primary Tasks

Generate Loads

Calculates individual customer demands from historical weather data and consumption

Customer Assignments

Assigns customers to pipes and/or nodes on the Synergi Gas model

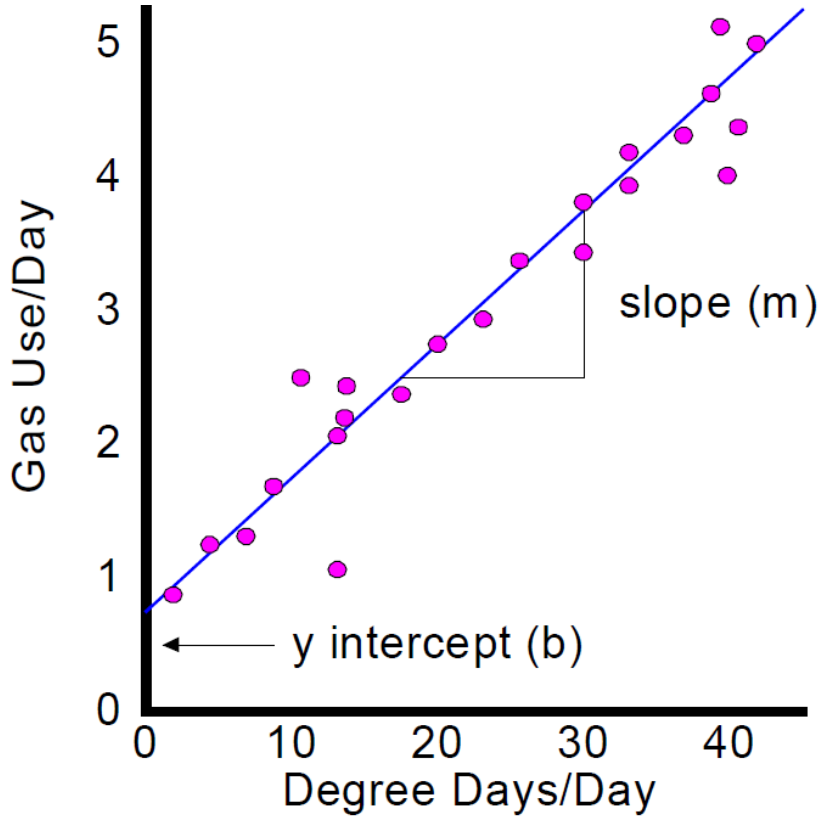
Demand File Creation

Exports files containing customer demands which are imported into Synergi Gas models

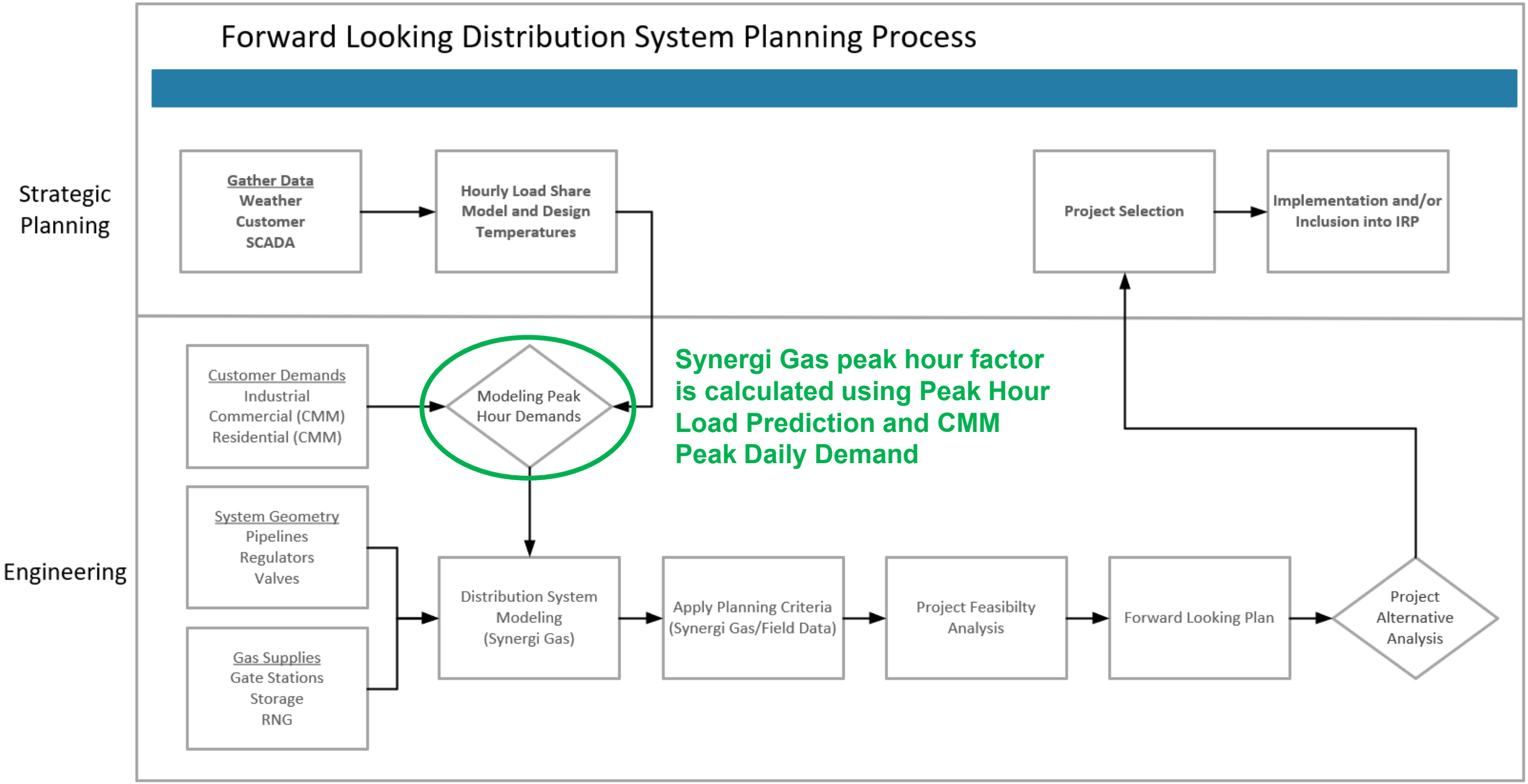
Distribution System Load Forecast

Generating Loads from Customer Information System (CIS) Data

- The Customer Management Module (CMM) estimates individual customer demands based on their unique historical usage patterns
  - Based on historical weather and monthly billing records
    - Linear regressions completed using past 2 years of monthly meter data
    - Previous method relied on load center averages (Usage Per Customer) for residential and commercial loads



Forward Looking Distribution System Planning Process



Distribution System Load Forecast

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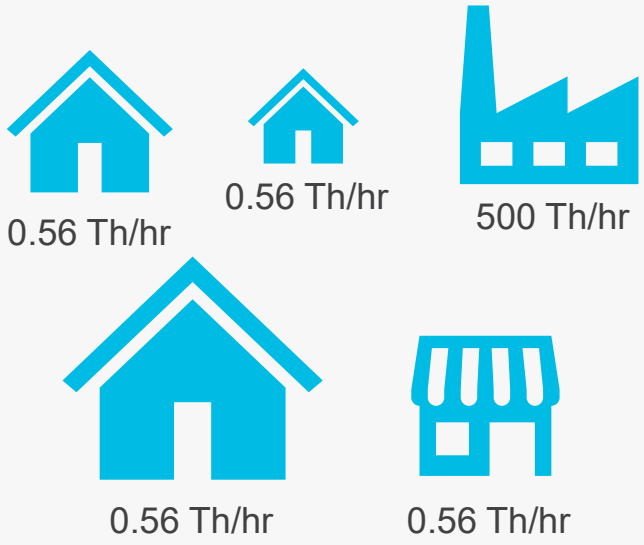
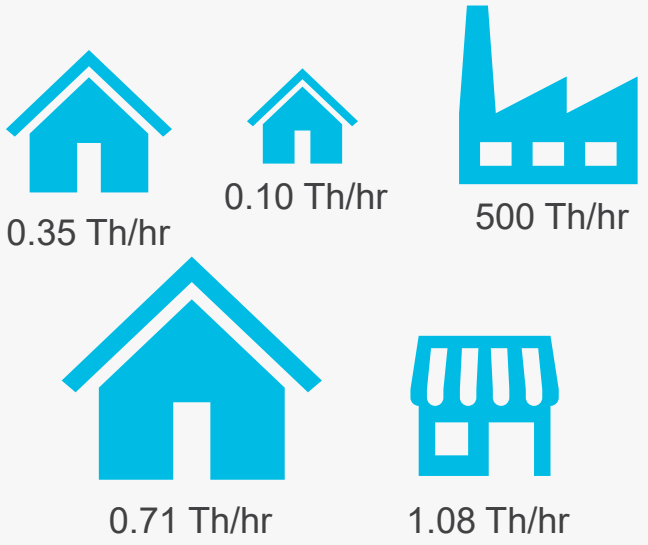
Old Forecasting Method



CMM Method



Demands updated based on rolling 2-year period

Distribution System Load Forecast

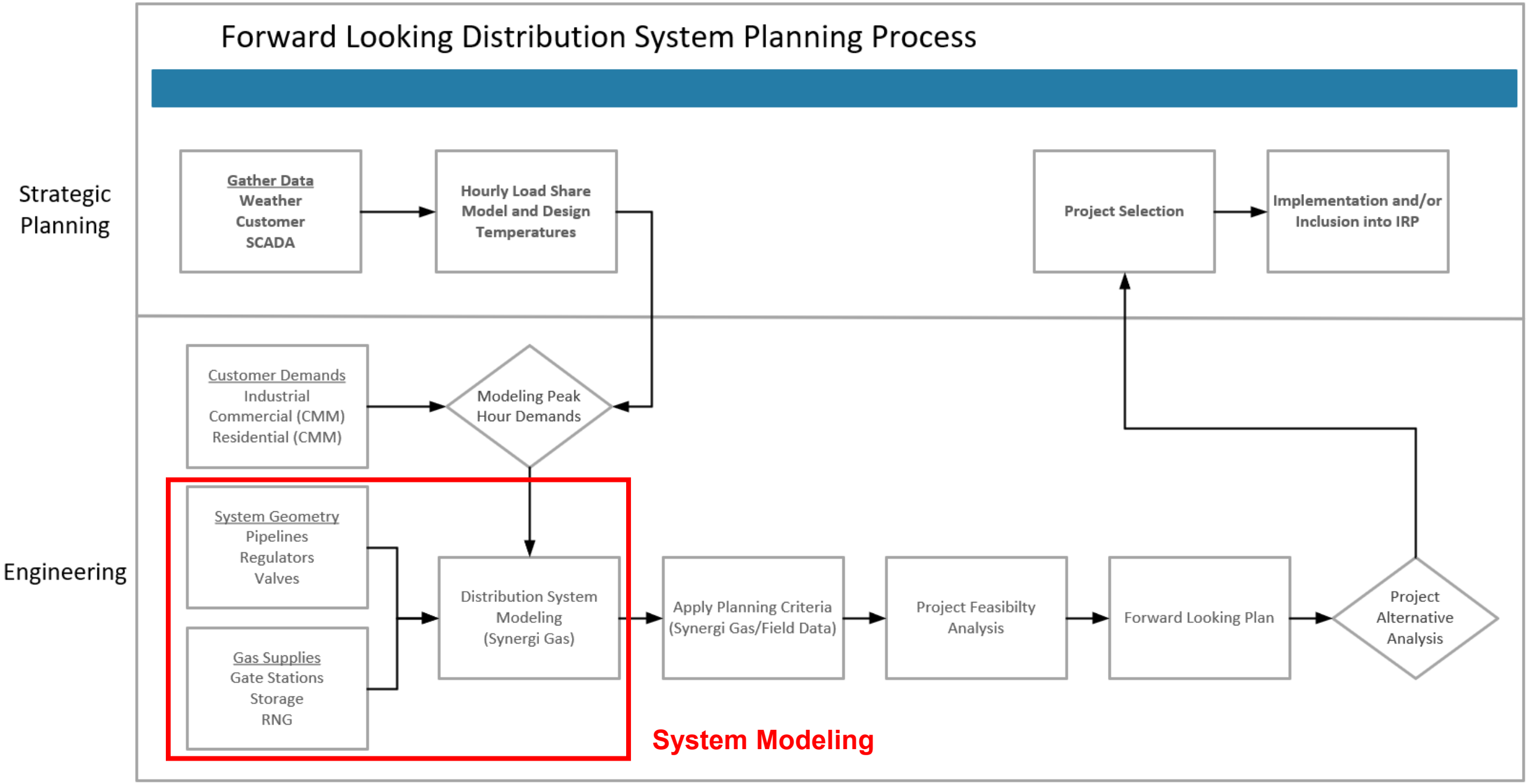
CMM – Connecting CIS, GIS and Synergi Gas

- Customer information updates from **CIS**
  - Demand changes – Gas end use equipment is added or removed
  - Customer additions or disconnects – Growth or decline in the total number of customers
  - Rate schedule changes
    - Firm to interruptible service
    - Interruptible to firm service
- Automated demand assignments based on **GIS** coordinates
  - CMM assigns customers to Synergi Gas pipes or nodes
  - Previously, updates were performed manually
- CMM Demand File
  - CSV files created by CMM are loaded into **Synergi Gas** which include both nodal and pipe demands

All NW Natural Synergi Gas models have been updated with CMM Demands

System Modeling

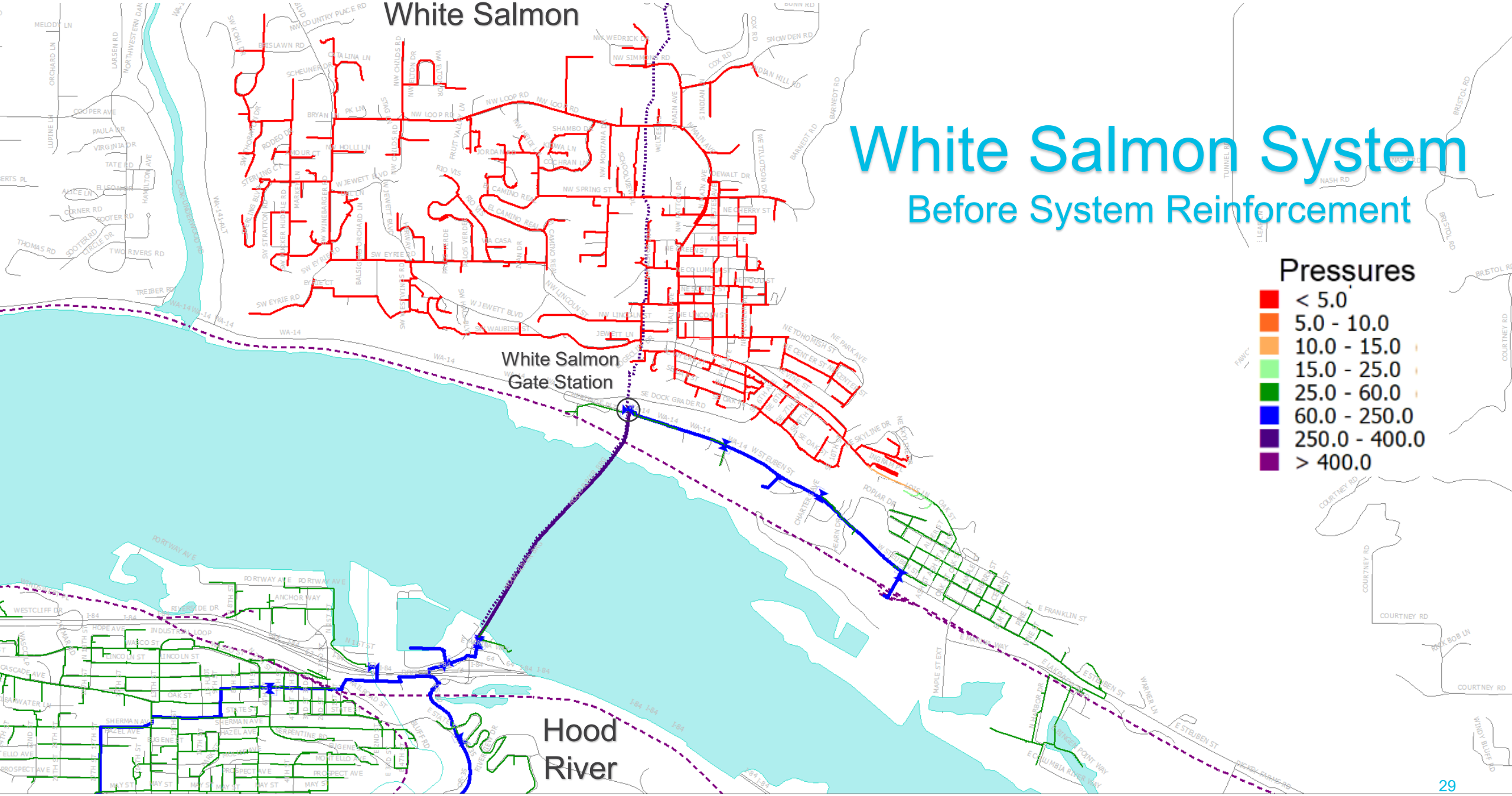
Forward Looking Distribution System Planning Process



System Modeling

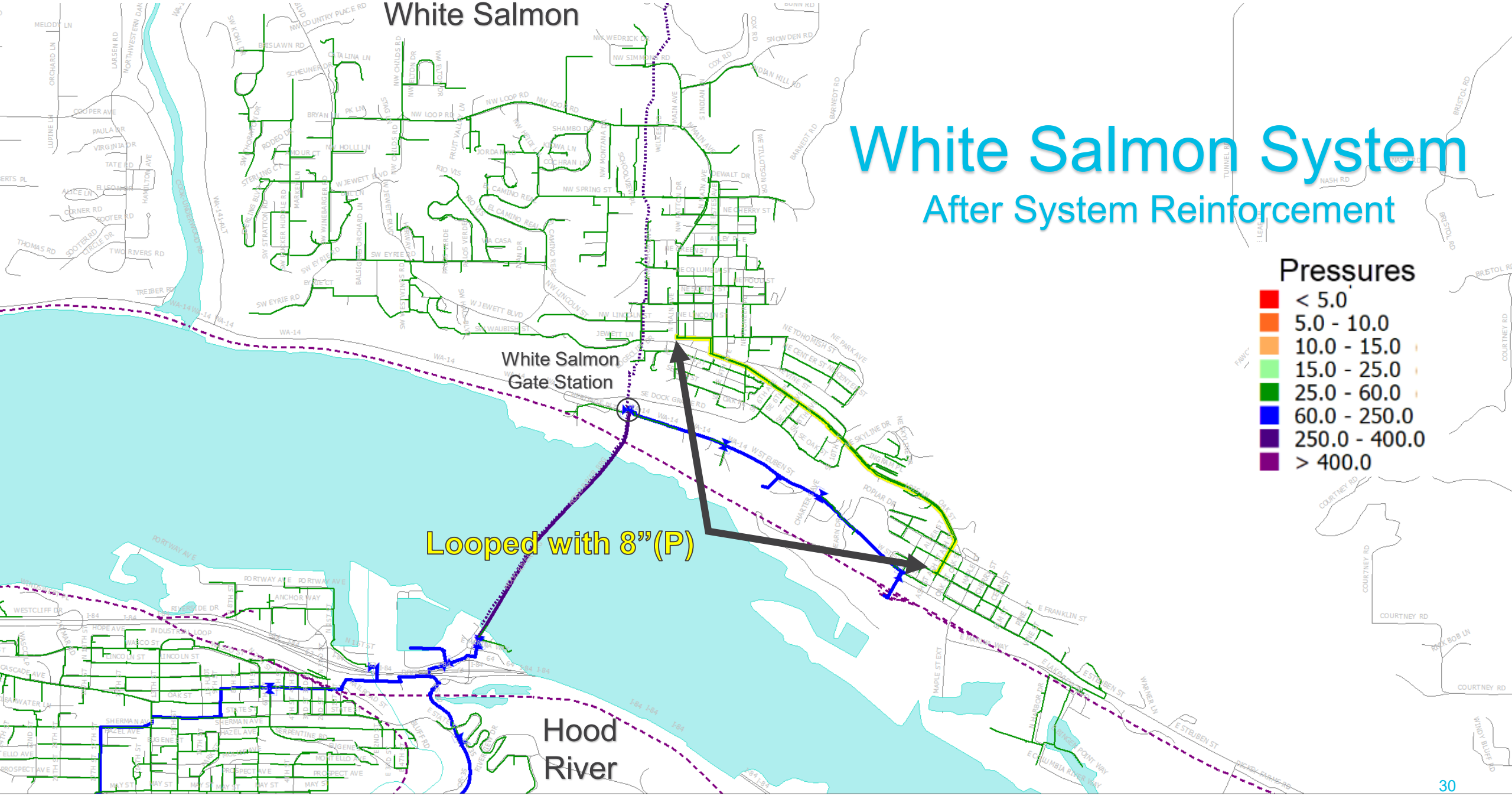
Synergi Gas applications

- Perform cold weather planning
- Evaluation of new large demands
- Modeling of various gases including conventional natural gas, hydrogen and RNG
- Determine how to best support maintenance and construction operations
- Determine impacts of unexpected events
- Identify solutions to address low pressure areas
- BTU modeling for accurate customer billing
- Identify demand response temperatures for interruptible customers

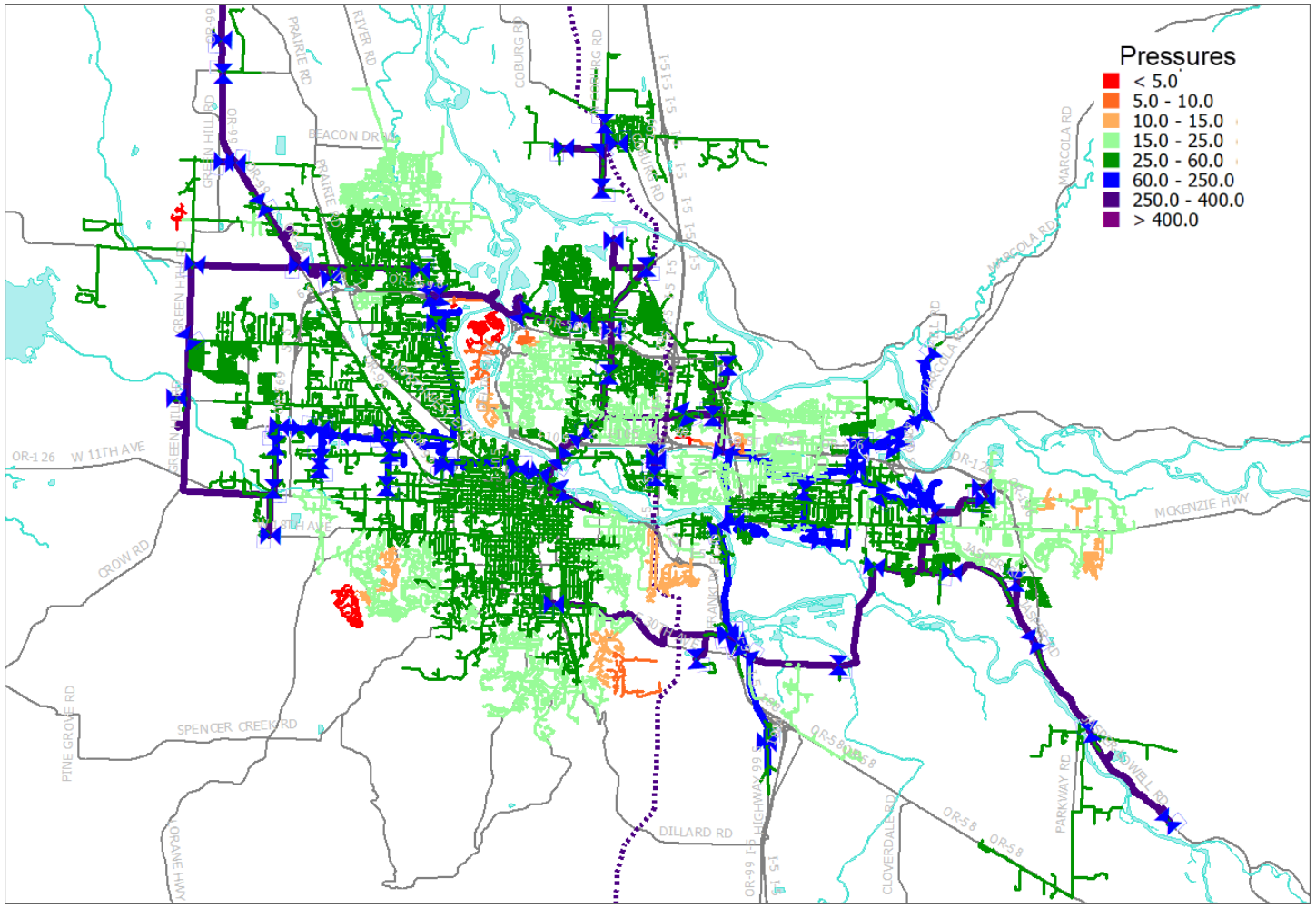


White Salmon System

Before System Reinforcement



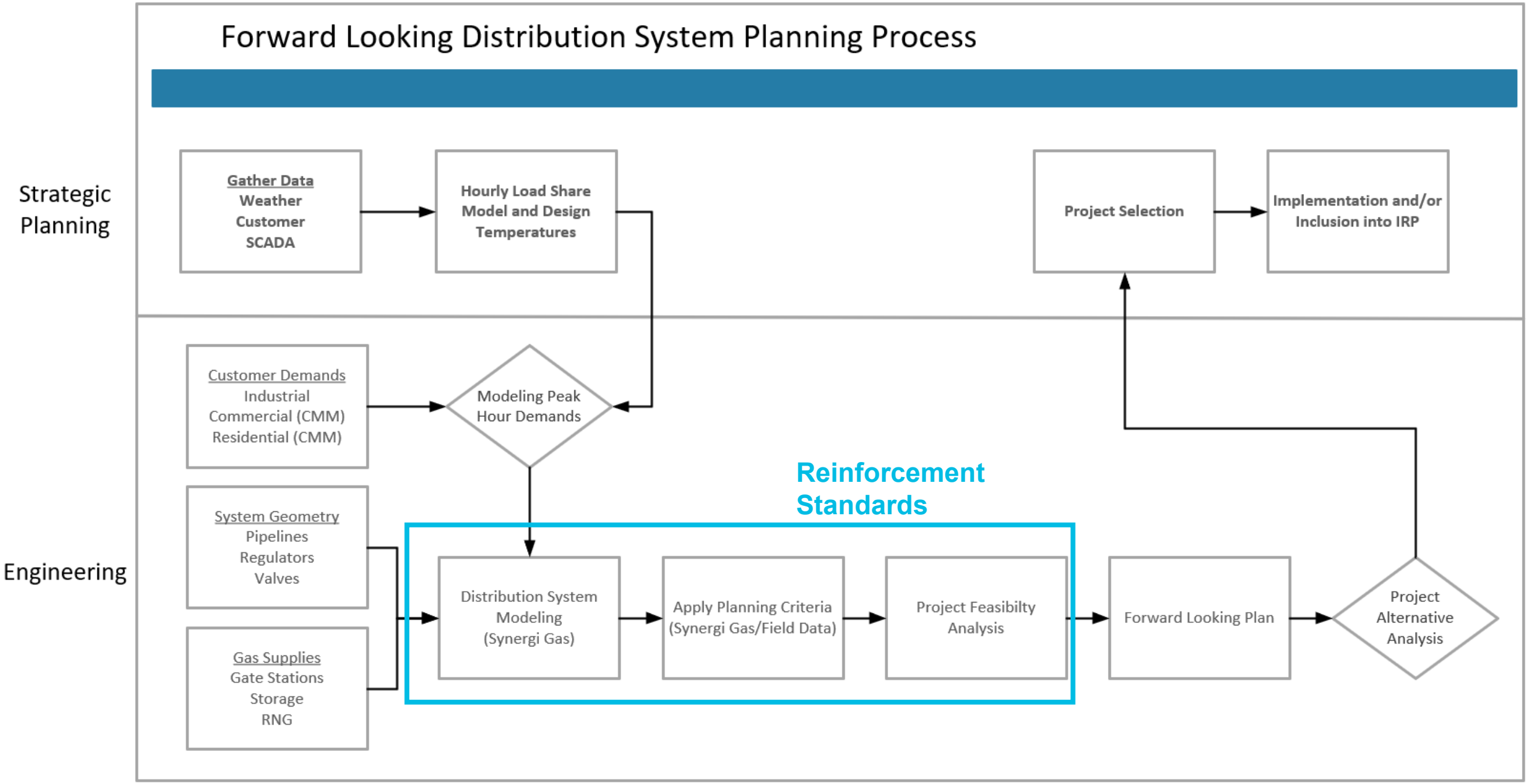
System Modeling



- Gas Networks are very complex, and computer tools are required to properly understand and model them

System Reinforcement Standards

Forward Looking Distribution System Planning Process



System Reinforcement Standards

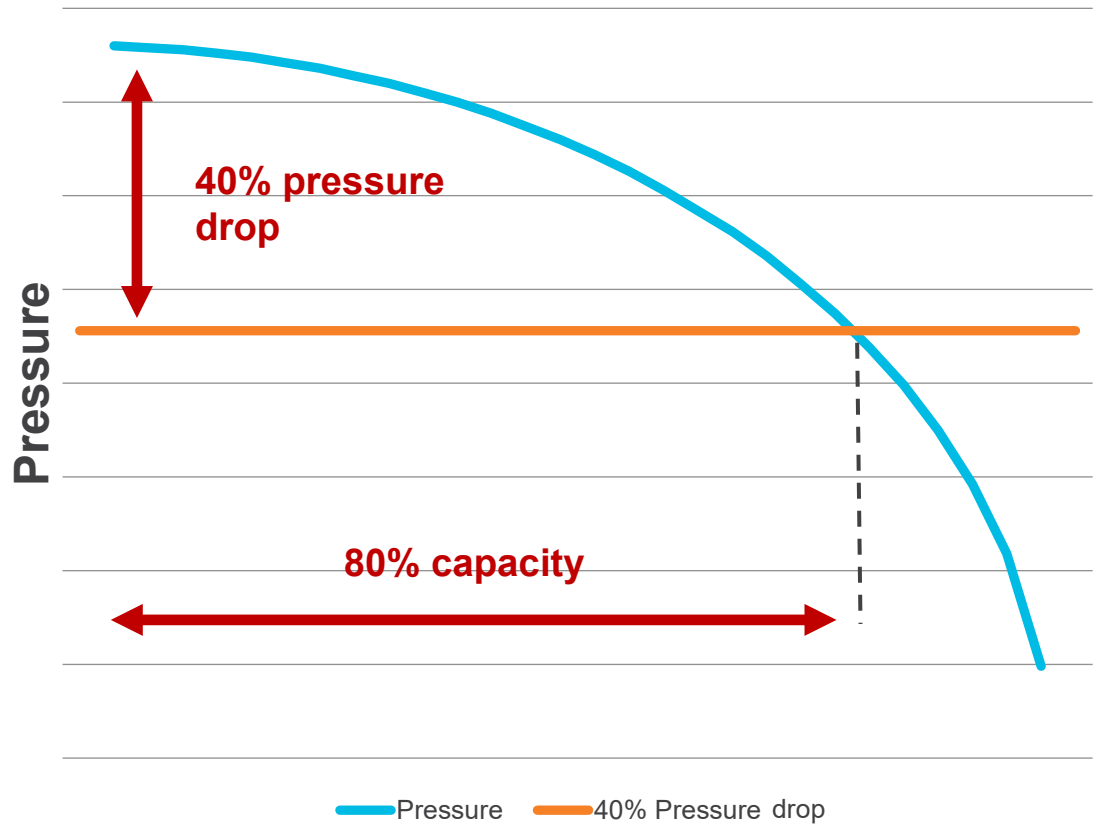
Transmission and high pressure distribution systems criteria with design parameters set to peak hour load requirements

System operating pressure is greater than 60 psig

- Experience at least a 30% pressure drop over the facility length indicates an **investigation** will be initiated
- Experience or model a 40% pressure drop indicates reinforcing the facility is **critical**
  - 40% Pressure Drop = 80% pipeline capacity utilization[1]
- For pipelines that feed other high pressure systems, consider minimum inlet pressure requirements for proper regulator functionality
- Firm service customer delivery requirements (flow or pressure)
- Associated with supply requirements identified in the IRP

[1]*Gas Engineering and Operating Practices (GEOP), Volume 3, Distribution, Book D-1, System Design Revised*

System Reinforcement Standards



When a gas pipeline is experiencing a 40% pressure drop it is flowing at 80% of maximum capacity

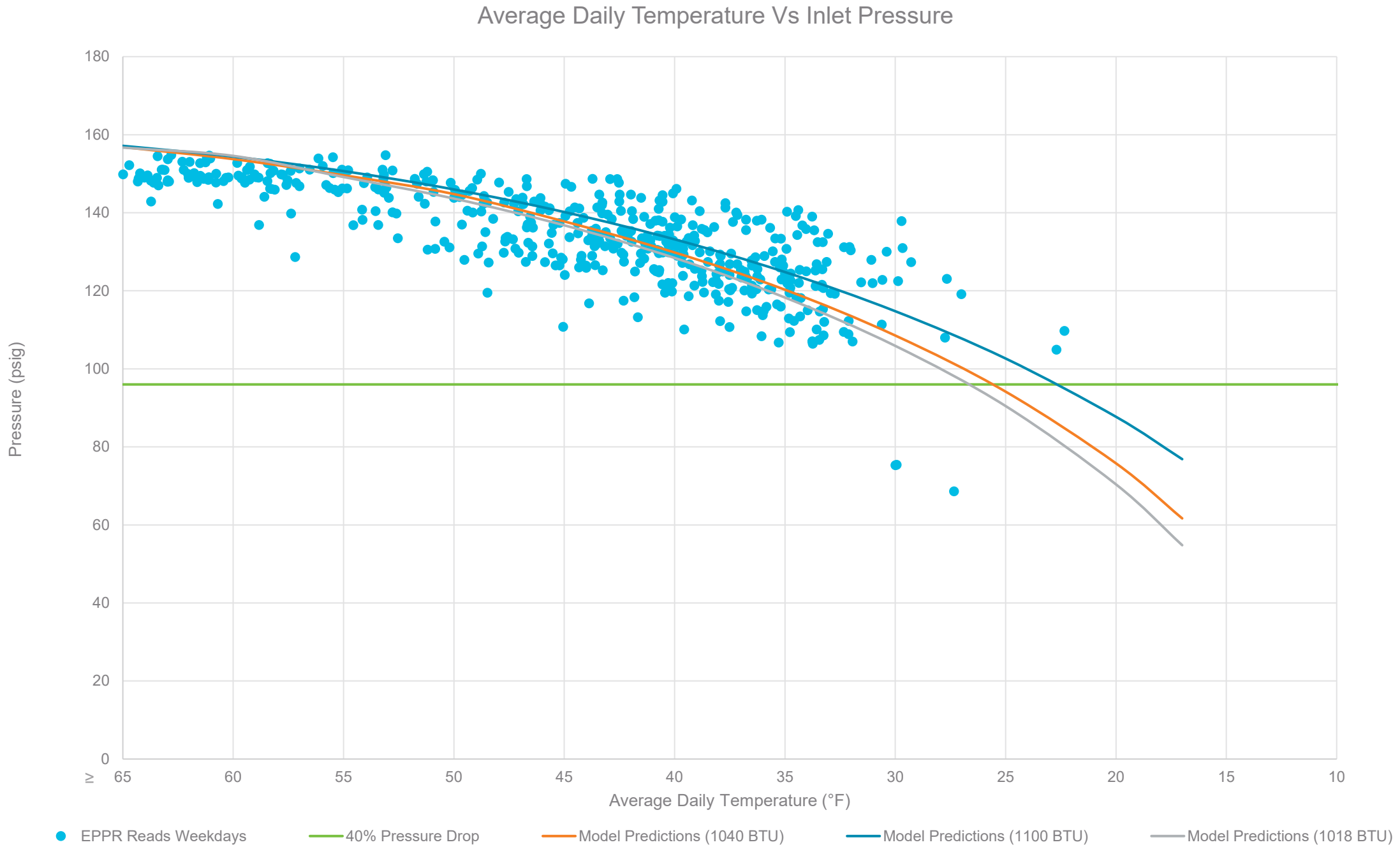
The relationship between pressure and available capacity is non-linear

In other words, small increases in demand from weather or growth can cause outages when pipelines operate above 80% capacity and pipeline pressure falls rapidly

System Reinforcement Standards

Justification for the 40% pressure drop threshold

- Loss of service during cold weather is a safety risk to our customers
- Restoration of service to gas customers typically takes longer than electric outages when caused by limited system capacity
  - Several hours to several weeks
- Provides buffer for demand and system performance variability for cold weather event
- Gas energy content can vary
  - Modeling is completed at 1040 Btu/scf
  - Oregon Tariff limits are 985 to 1155 Btu/scf
- Customers may add equipment without going through the proper channels
- Interruptible customers may continue to consume gas after a demand response event is issued
- Project to address low pressures may take multiple years to implement



Prepared for IRP TWG - Not to be used for investment purposes.

System Reinforcement Standards

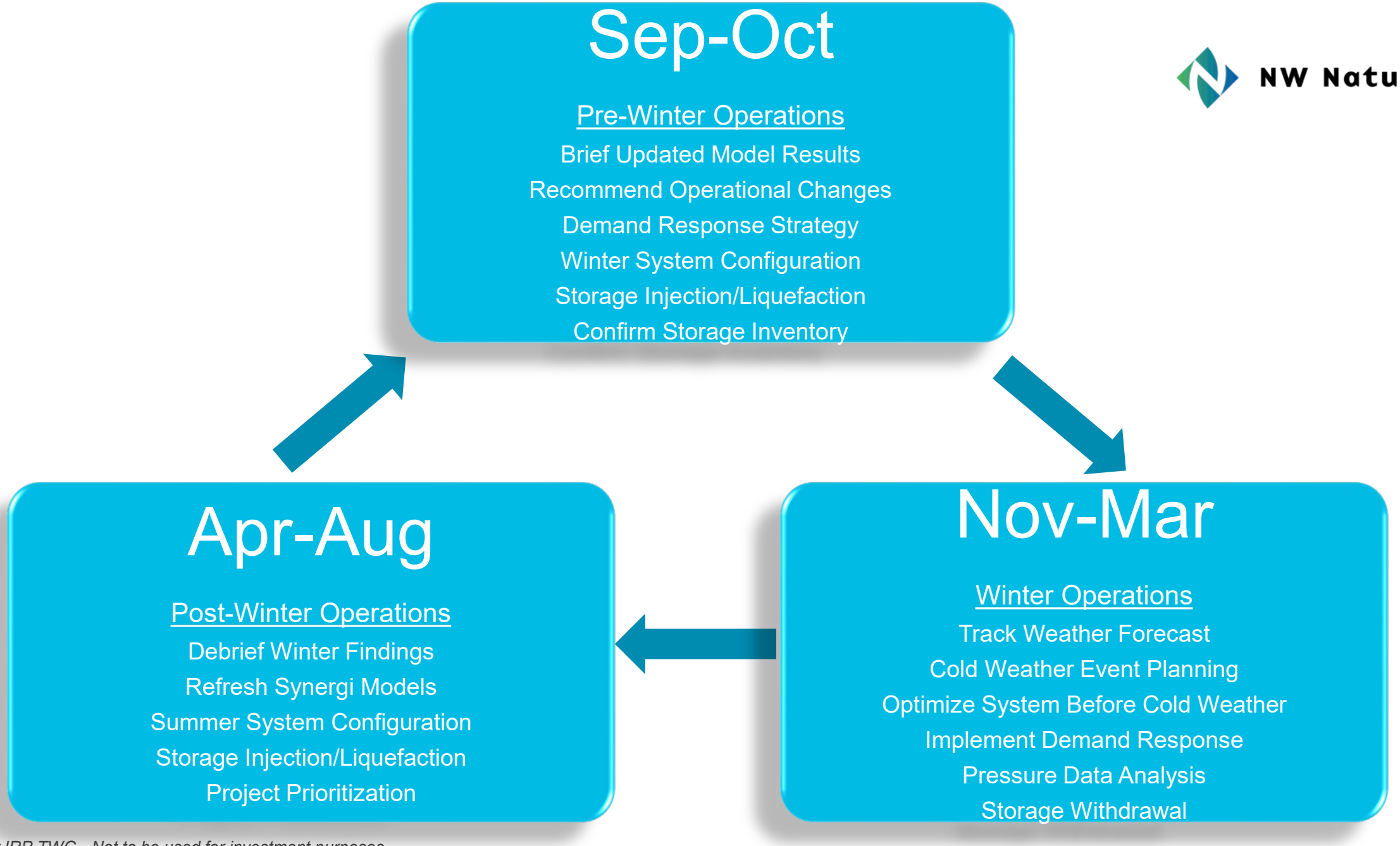
Standard pressure distribution systems criteria with design parameters set to peak hour load requirements

System operating pressure is 60 psig or less

- Experience a minimum distribution pressure of 15 pounds per square inch gauge (psig) indicates an **investigation** will be initiated
- Experience or model a minimum distribution pressure of 10 psig indicates that reinforcement is **critical**
  - Excess Flow Valves (EFV) require 10 psig for proper operation[2]
- Firm service customer delivery requirements (flow)

[2]*Based on the minimum inlet pressure required for an Excess Flow Valve (EFV) to properly function, per 49 CFR §192.381*

Cold Day Contingency Plan


Sep-Oct
Pre-Winter Operations
Brief Updated Model Results
Recommend Operational Changes
Demand Response Strategy
Winter System Configuration
Storage Injection/Liquefaction
Confirm Storage Inventory
Nov-Mar
Winter Operations
Track Weather Forecast
Cold Weather Event Planning
Optimize System Before Cold Weather
Implement Demand Response
Pressure Data Analysis
Storage Withdrawal
Apr-Aug
Post-Winter Operations
Debrief Winter Findings
Refresh Synergi Models
Summer System Configuration
Storage Injection/Liquefaction
Project Prioritization

Cold Weather Event Planning Meetings

- Topics Covered at Cold Weather Event Planning
  - 7-Day NOAA Weather Forecast for upcoming cold weather event
  - Potential for icy road conditions that could inhibit travel
  - Off-system: Gas Supply Market Conditions and Interstate Pipeline conditions
  - On-system: Storage Plant and distribution system status
  - Planned Demand Response activities
  - Targeted Customer Load Curtailment
  - System pressure data collection sites functioning correctly? (SCADA, EPPR)
  - Pressure Regulator Station bypassing or pressure set point changes to increase flow through a regulator
  - Any Planned Manual Cold Weather Data Collection?
  - Field employee resource management
  - Roundtable / Misc topics

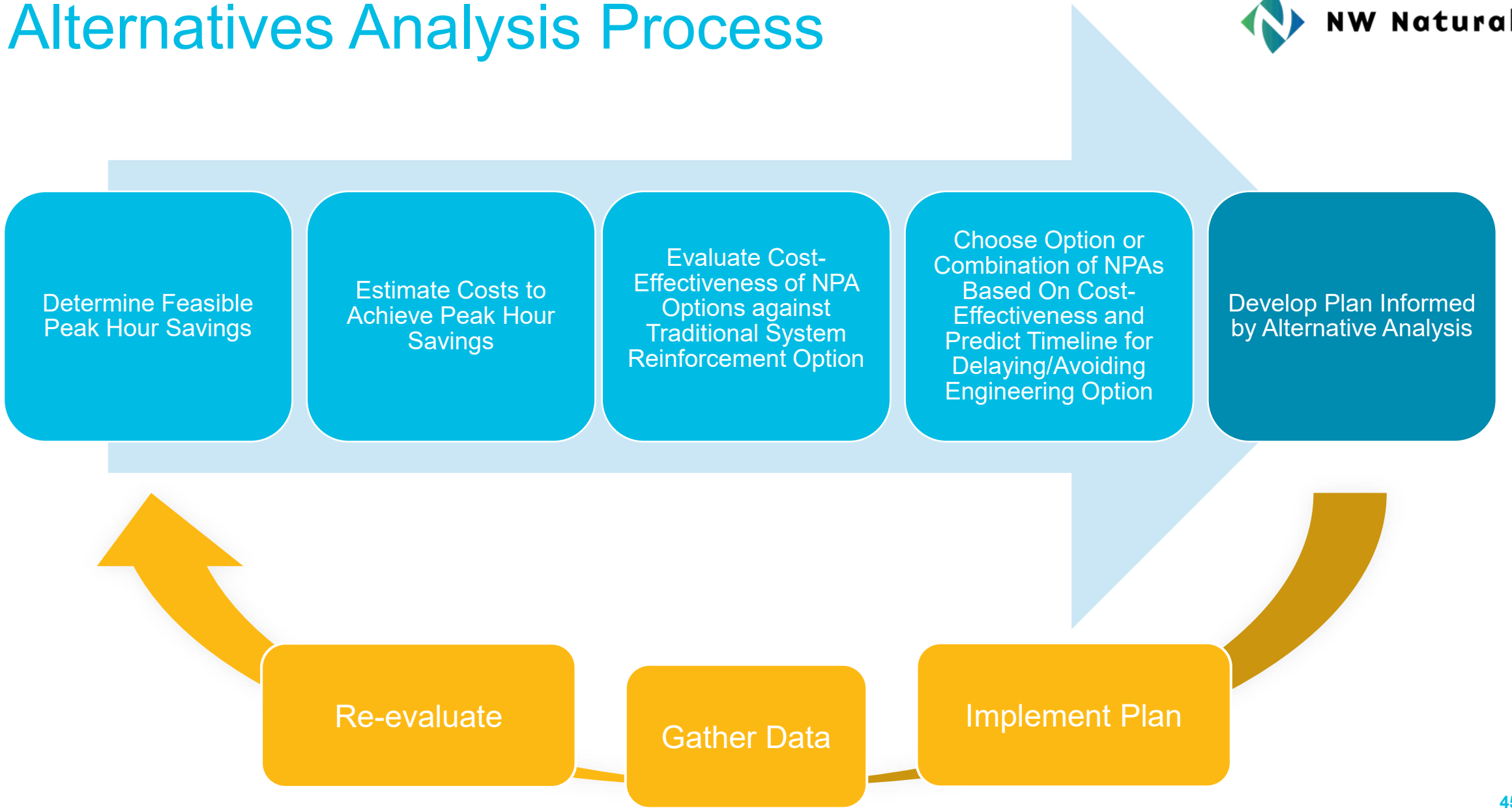
Cold Weather Event Planning Meetings

- Examples of Off-system Management
  - Entitlements from Interstate Pipeline Company
  - Interstate system equipment problems / failures that restrict delivery of gas to the Company's distribution system
- Examples of On-System Management
  - Demand side management
  - System wide curtailment for transportation and interruptible customers in response to Force Majeure
  - Targeted Customer Load Curtailment
    - Reduce Interruptible Customer Demand
    - Reduces demand in targeted areas of the distribution system

Distribution System Planning Tools

Distribution System Planning Alternatives (not all options are possible or applicable in all situations)				Option Currently Considered for Cost-Effectiveness Evaluation
Supply-Side Alternatives	Pipeline Related Capacity Options		Loop existing pipeline	✓
			Replace existing pipeline	✓
			Install pipeline from different source location into area	✓
			Uprate existing pipeline infrastructure	✓
			Add or upgrade regulator to serve area of weakness	✓
			Add or upgrade gate station	✓
			Add compression to increase capacity of existing pipelines	✓
	Non-Pipeline Solutions	Distributed Energy Resources (DER)	Mobile/fixed geographic targeted CNG storage	✓
			Mobile/fixed geographic targeted LNG storage	✓
			On-system gas supply (e.g. RNG, H2)	✓
			Geographically targeted underground storage	✓
Demand-Side Alternatives		Demand Response	Interruptible schedules (DR by rate design)	✓
			Geographically targeted interruptible agreements	✓
			Geographically targeted Res & Com demand response (GeoDR)	✓
		Energy Efficiency	Peak hour savings from normal statewide EE programs	✓
			Geographically targeted peak-focused energy efficiency (GeoTEE)	✓

Alternatives Analysis Process



Distribution System Alternatives
Pipeline Related Options

Pipeline Related Capacity Options

- Loop existing pipeline
- Replace existing pipeline
- Install pipeline from different source location into area
- Uprate existing pipeline infrastructure
- Add or upgrade regulator to serve area of weakness
- Add or upgrade Gate station
- Add compression to increase capacity of existing pipelines

Distribution System Non-Pipe Alternatives (NPAs)

Distributed Energy Resources

CNG/LNG Trucking Study

CNG and LNG Trucking Study

- Statement of Work:
  - Assist NW Natural with determination
    - CNG and LNG trucking facility site requirements
    - Gas supply costs delivered via trucking
    - Gas supply contracting and logistics
- Expected Outcomes:
  - Cost estimate for initial CNG or LNG site development
  - Procurement of CNG and LNG price quotes from multiple vendors
  - Guidance from CNG and LNG vendor as to which fuel is the most cost effective to transport
  - Net present value of CNG or LNG trucking alternative consisting of:
    - fuel supply delivery costs
    - initial site capital development costs
    - site O&M costs
- Status of CNG / LNG Trucking Study
  - Scope of trucking site facility has been finalized
  - Consultant just received LNG trucking fuel supply quotes

CNG/LNG Trucking Risks and Benefits

Risks

- NW Natural reliant upon third party vendor for LNG supply
- CNG and LNG trucking vendor market is limited
- Pricing unknown beyond year 1
- Pricing for CNG & LNG trucking subject to market conditions for LNG availability, fuel source location and diesel fuel prices
- LNG not locally sourced
- Requires advanced vendor coordination and planning
  - Payment to vendor required to secure vendor's commitment to service
- Cold weather demand could potentially exceed the volume of LNG fuel supply
- Weather conditions could make delivery conditions challenging
- NW Natural field staff required to coordinate connection to our system

Benefits

- Provides temporary fuel supply when areas of low pressure require reinforcement
- LNG trucking is a viable resource for serving isolated communities that cannot be economically reached by pipeline (Tillamook, for example.)

Distribution System Non-Pipe Alternatives (NPAs)

Other Distributed Energy Resources

Other Distributed Energy Resources

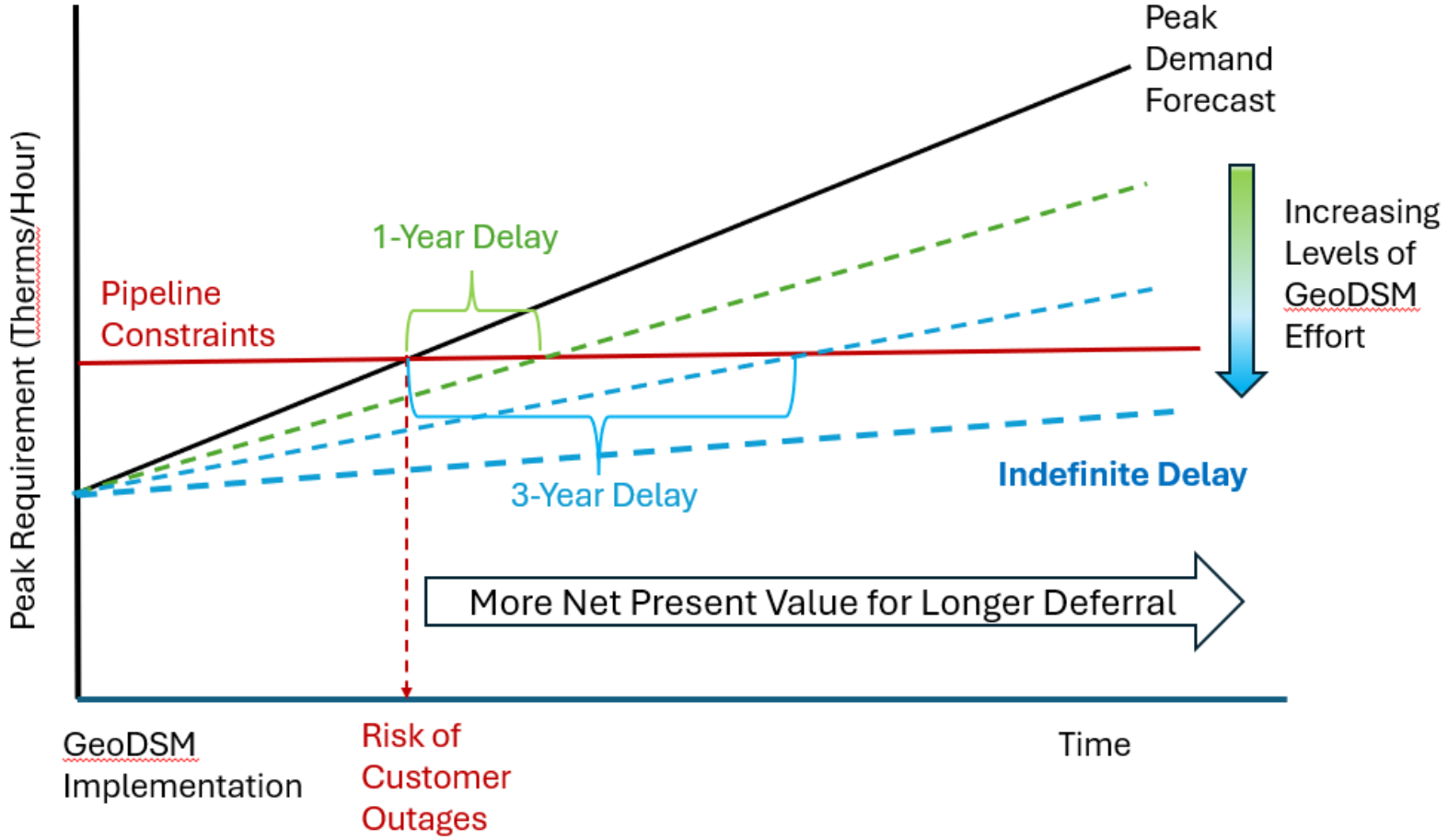
- Satellite LNG/CNG Storage
  - This faces many of the same benefits/challenges as CNG/LNG Trucking
  - Additionally siting and permitting benefits/challenges
- On-system gas supply
  - Local RNG
- On-system underground storage

Distribution System Non-Pipe Alternatives (NPAs)

Demand Side Alternatives

Geographically Targeted Demand-Side Management (GeoDSM) for Distribution System Planning

- GeoDSM (i.e., GeoTEE and GeoDR) is often evaluated NPAs
- A GeoDSM effort can be cost-effective even if it just delays a pipeline investment
- Must have a forward-looking Distribution System Plan to implement this NPA in advance of need



List of Non-Pipeline Alternatives (NPAs)

- Geographically targeted energy efficiency (GeoTEE)
  - Area-specific EE offerings and incentives
  - Residential, commercial, and industrial
- Geographically targeted smart tstat demand response (Smart Tstat GeoDR)
  - Area-specific incentives for smart tstats
  - Residential and small commercial
- Geographically targeted behavioral demand response (Behavioral GeoDR)
  - Area-specific perform-based incentives
  - Large commercial and industrial
- Geographically targeted interruptible rate schedule
  - Area-specific interruptible rate schedule offerings
  - Industrial and transport

Break

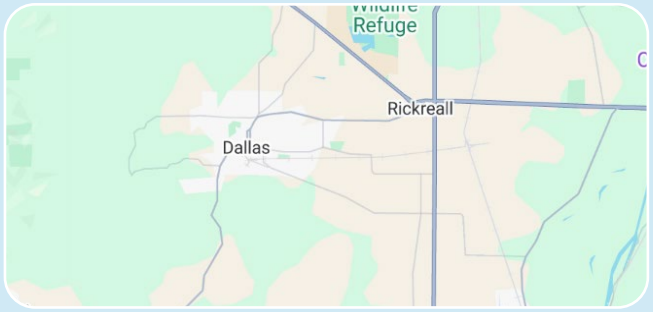
Forward Looking Distribution System Plan

Forward Looking Distribution System Plan

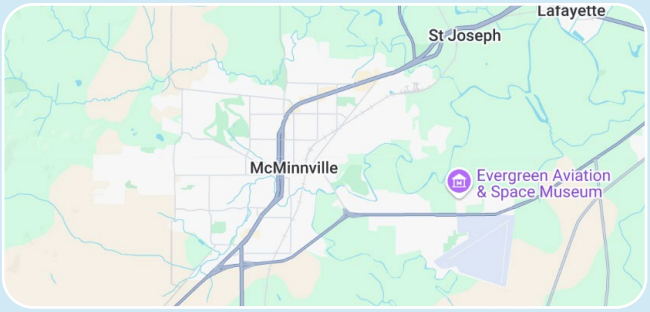
- Transition from “just-in-time” approach to forward-looking planning process
- Identifies areas for investigation and monitoring on NW Natural’s system that may require a future large system reinforcement or non-pipeline alternative effort to provide reliable service
  - For these areas reinforcing the system is not critical per NW Natural’s system reinforcement criteria, but is nearing these criteria
  - These areas of the gas distribution system that may exceed design capacity in the future because of increased demand
- Allows NW Natural to evaluate more non-pipeline demand-side solutions (GeoDSM) as viable options as these GeoDSM projects take longer to implement to produce reliable peak load reductions

Forward Looking Distribution System Plan
Three Areas Identified

Creswell, Oregon

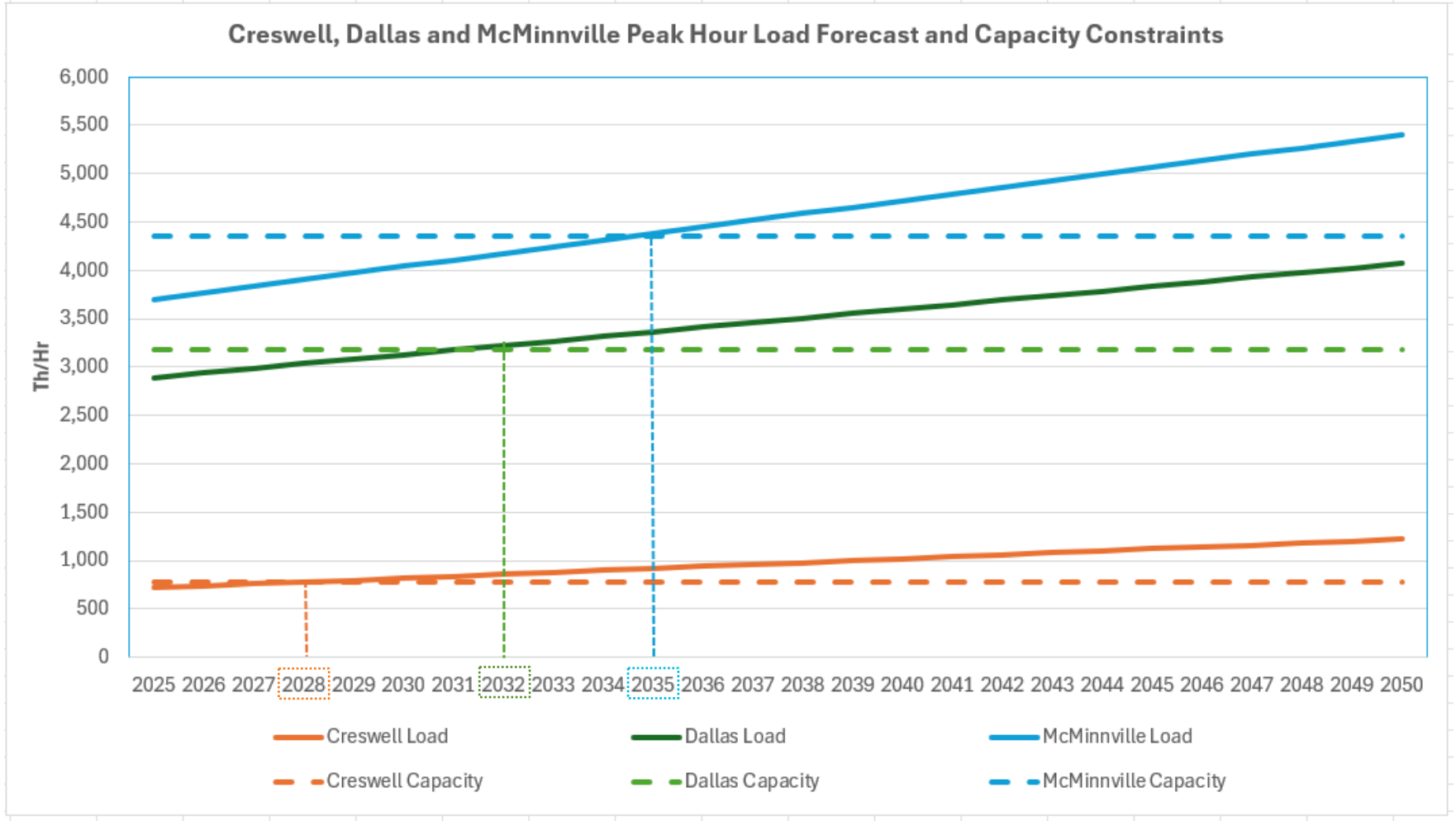


Dallas, Oregon



McMinnville, Oregon

Peak Hour Load Forecast for Distribution Capacity Constrained Areas (No GeoDSM)



- NW Natural is closely watching these areas, tracking customer count and load changes, and updating the analysis.
- Lebanon was also assessed but the results suggest that its capacity won't be exceeded within the IRP planning horizon, however; will still be monitored going forward.

Forward Looking Distribution System Plan – Creswell

Forward Looking Distribution System Plan

NW Natural®

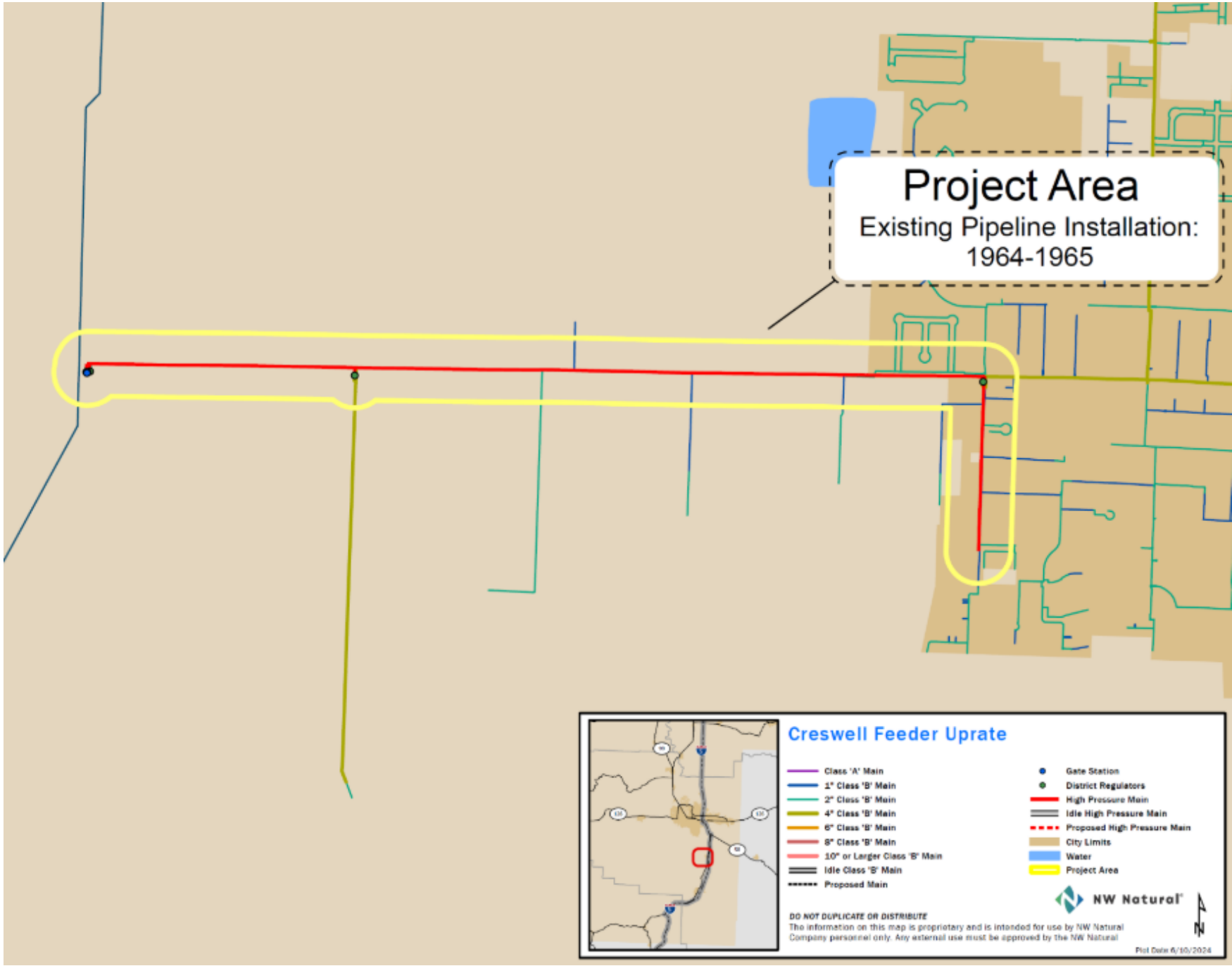
Creswell Feeder

- 1.9 miles of 150 MAOP 3.5” wrapped steel
- Estimated available capacity
  - 80 Th/hr
- Lowest Modeling Pressure
  - 88.6 psig at 56.2 HDD
- Lowest Recorded Pressure
  - 107 psig at 33 HDD
- Estimated to exceed capacity in 2028 without NPA intervention
- Estimated to exceed capacity in 2030 with NPA intervention

Creswell Feeder

Pipeline Solution

- Uprate approximately 1.9 miles of 3.5” wrapped steel from Creswell Gate Station to the end of High Pressure main
- Increases capacity from approximately 80 Th/hr to approximately 900 Th/hr



Forward Looking Distribution System Plan – Dallas

Forward Looking Distribution System Plan

NW Natural®

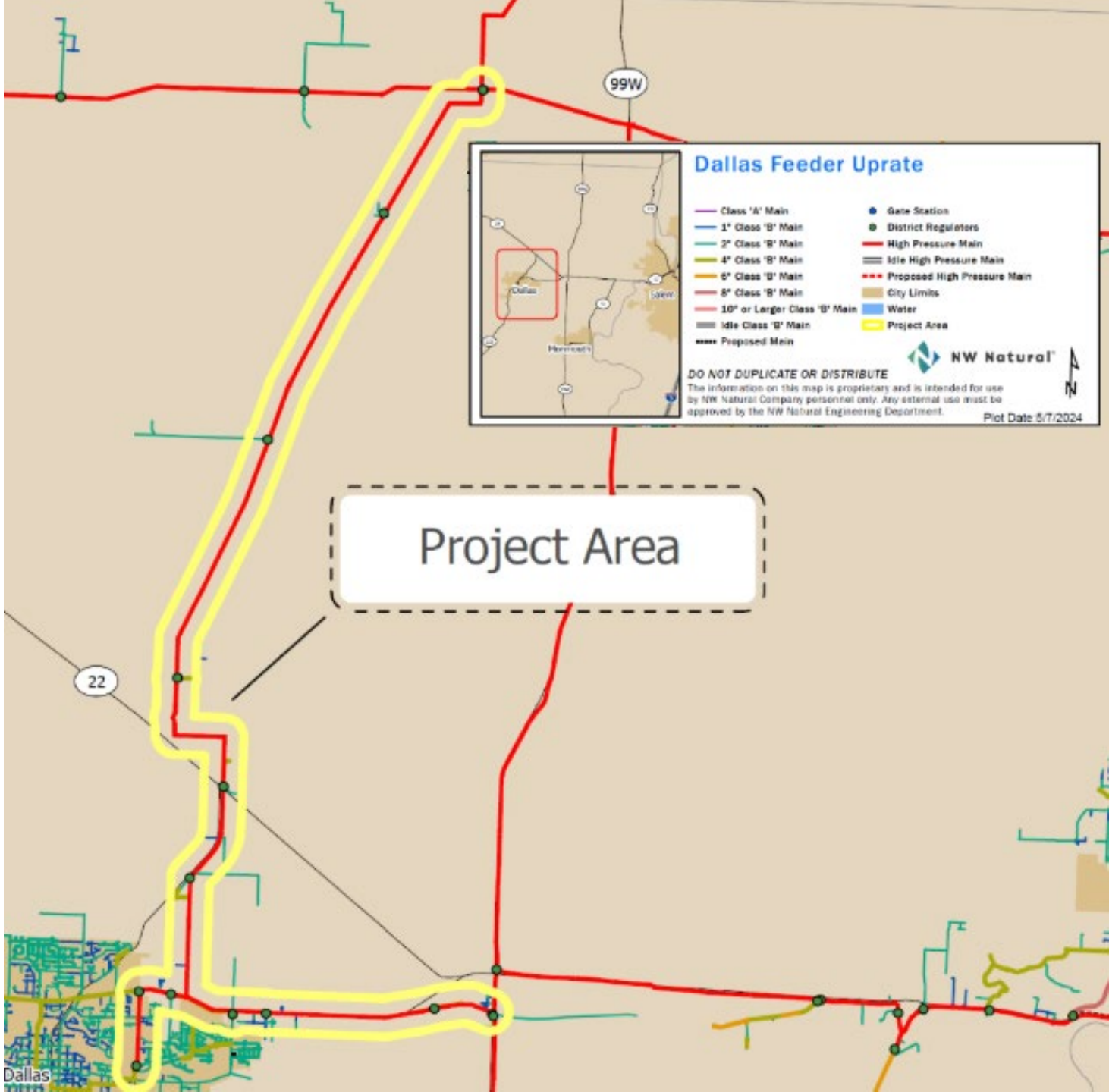
Dallas Feeder

- 15 miles of 175 MAOP 6”(W) and 4”(W) wrapped steel
- Estimated available capacity
  - 340 Th/hr
- Lowest Modeling Pressure
  - 115.6 psig at 54.8 HDD
- Lowest Recorded Pressure
  - 133.8 psig at 31 HDD
- Estimated to exceed capacity in 2032 without NPA intervention
- Estimated to exceed capacity in 2036 with NPA intervention

Dallas Feeder

Pipeline Solution

- Replace approximately 1,100’ of high pressure 4” wrapped steel with 6” wrapped steel
- Uprate 15 miles of 6" wrapped steel from an MAOP of 175 to an MAOP of 300 psig
- Increases available capacity from approximately 340 Th/hr to approximately 2350 Th/hr



Forward Looking Distribution System Plan – McMinnville

Forward Looking Distribution System Plan

NW Natural®

McMinnville Feeder

- 17 miles of 400 MAOP 6”(W) and 4”(W) wrapped steel
- Estimated available capacity
  - 650 Th/hr
- Estimated to exceed capacity in 2035
- Lowest Modeling Pressure
  - 240.7 psig at 54.8 HDD
- Lowest Recorded Pressure
  - 267.39 psig at 31 HDD
    - Data includes interruptible customer load
- Estimated to exceed capacity in 2035 without NPA intervention
- Estimated to exceed capacity in 2049 with NPA intervention

McMinnville Feeder

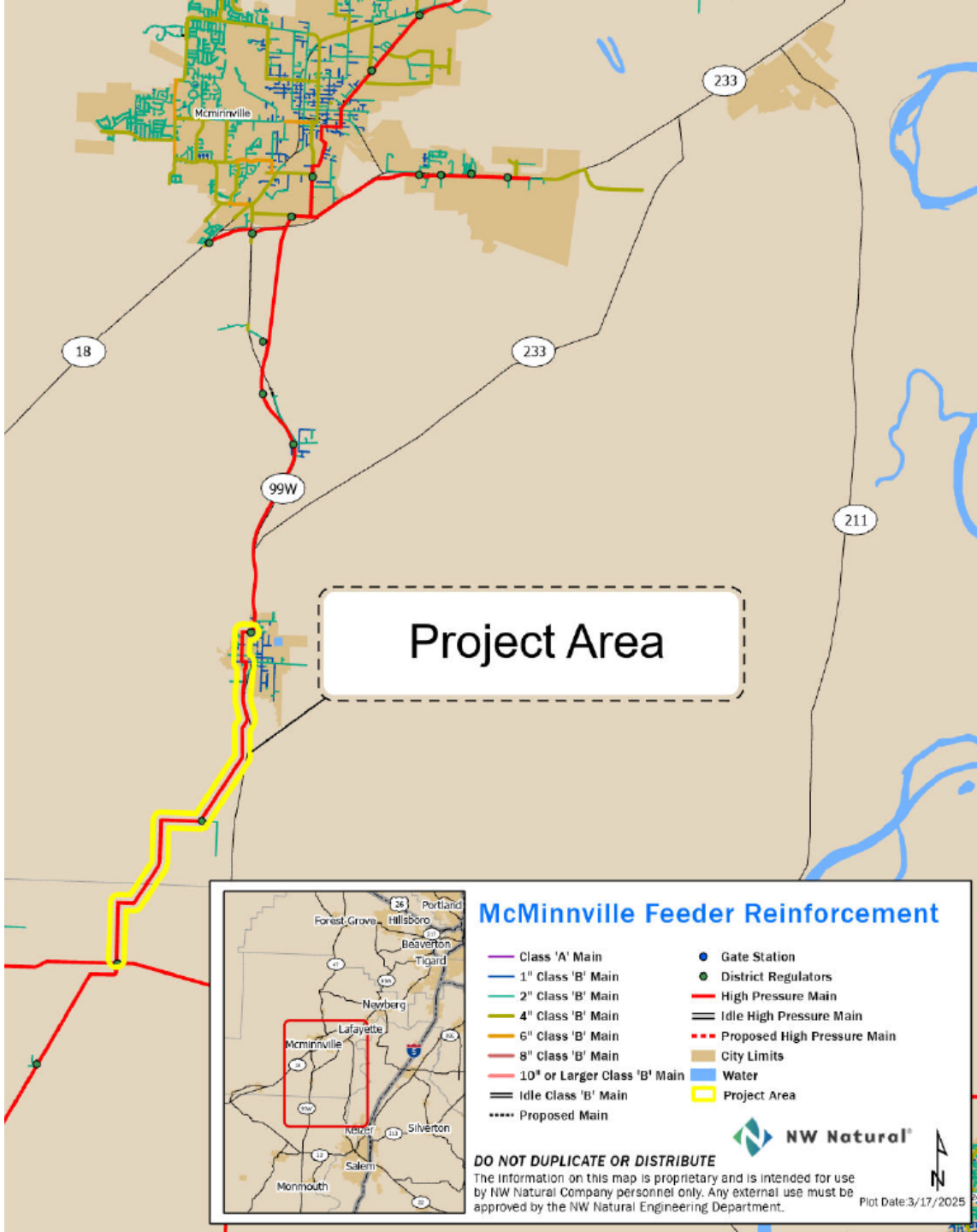
Pipeline Solution

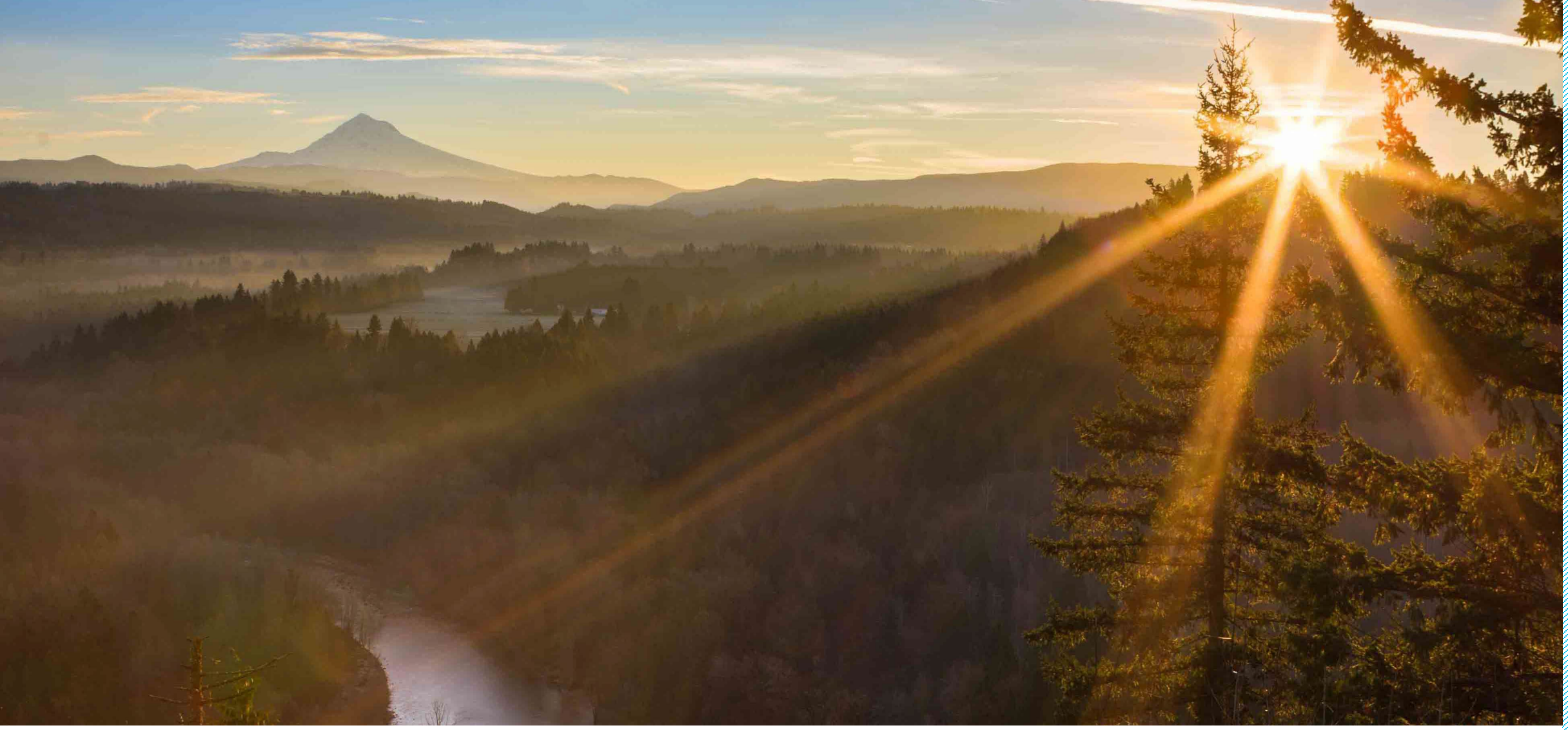
Option A

- Add approximately 500 horsepower of compression along the existing line
- Increases available capacity from approximately 650 Th/hr to approximately 1740 Th/hr

Option B

- Loop Existing Pipeline with 5.2 miles of 8"(W)
- Increases available capacity from approximately 650 Th/hr to approximately 1740 Th/hr





NW Natural Targeted Load Management/GeoTEE
Preliminary Scoping of 3 Sites
11/14/2024

Energy Trust of Oregon

Agenda

- Background of the Request
- Overview of 3 Sites
  - Creswell
  - Dallas
  - McMinnville
- Areas for further analysis

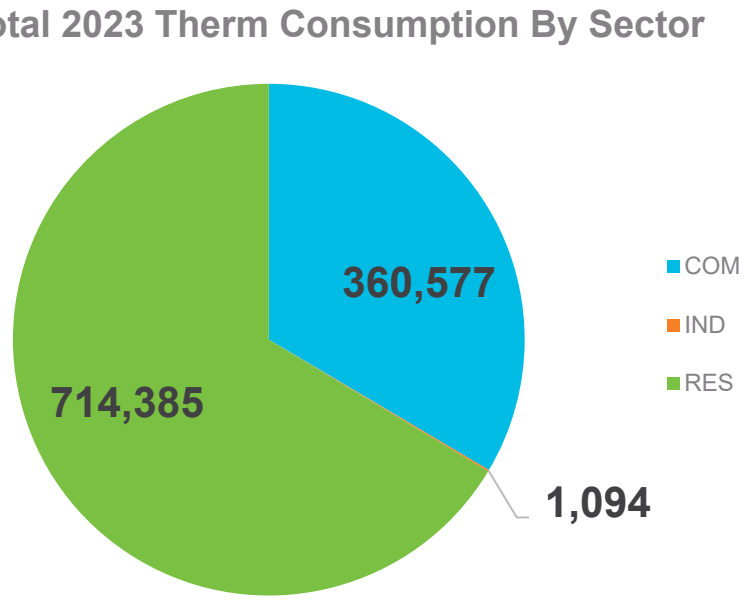
Note about Savings and Cost Estimates in this Presentation

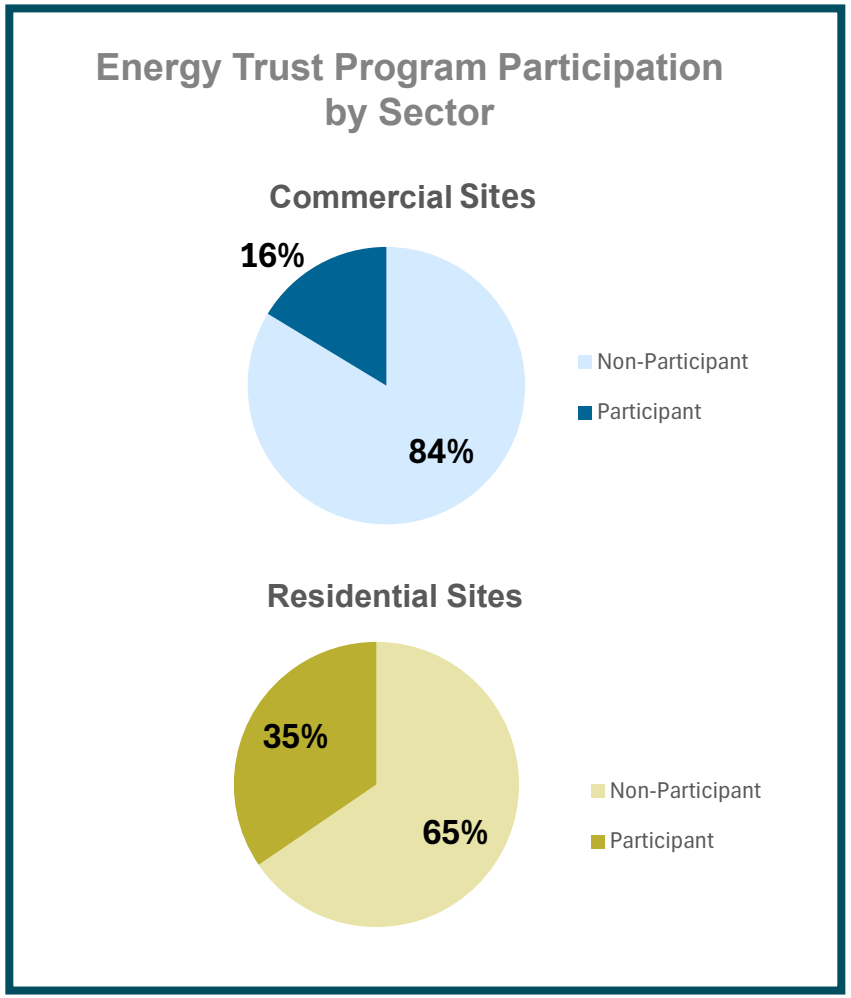
- *Potential savings and cost estimates presented in this slide deck are rough estimates based on historical trends and generalized assumptions, they are not future savings and costs commitments made by Energy Trust of Oregon*
- *These estimates may change based on further analysis refinement and additional sources of information and data*

Creswell Area

Creswell Area: Consumption & Participation

Sector	Site Count
Commercial	124
Industrial	3
Residential	1,273
Grand Total	**1,400**

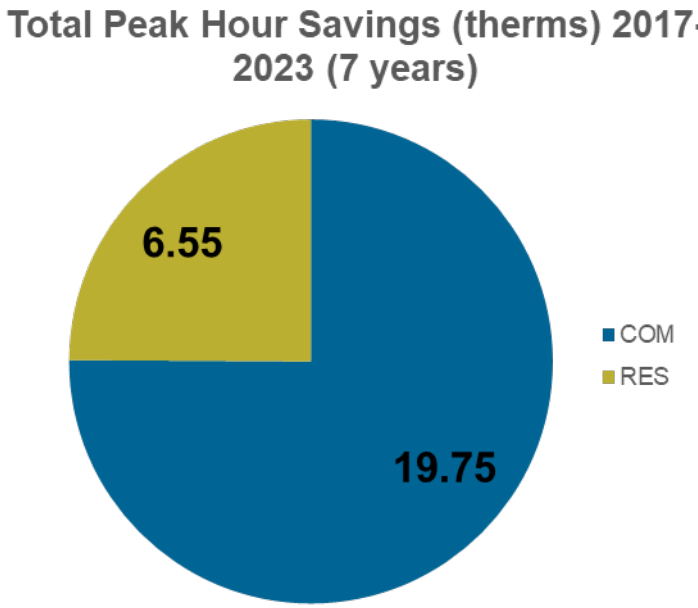




Creswell Area: Project Count & Peak Savings

Sector	Measure Type	Count of EE Projects Since 2017	Average Peak Hour therm savings per therm saved
Com	Process Heating	0	0.00123
	Refrigeration	1	0.00123
	Motors	0	0.00123
	Weatherization (Windows and Insulation)	2	0.00124
	HVAC	0	0.00123
	O & M	0	0.00123
	Appliance	0	0.00045
	Water Heating (Aerators and Showerheads removed)	0	0.00022
	Other	0	0.00124
	Food Service	0	0.00012
	HVAC Controls	0	0.00102
Ind	Process Heating	0	0.00124
	Other	0	0.00123
	Food Service	0	0.00011
Res	New Construction	0	0.00117
	HVAC	47	0.00114
	Weatherization (Windows and Insulation)	22	0.00115
	HVAC Controls	28	0.00114
	Water Heating (Aerators and Showerheads removed)	1	0.00027
	Other	0	0.00011
	Appliance	4	0.00010
Total		**105**	**0.00097**

Green highlighted rows are higher peak hour savings impact measure types



**Single large 2022 commercial insulation project accounts for 19.1 peak hour therm savings (97%)*

Creswell Area: Considerations and Potential Savings & Costs

- One large commercial project in 2022 created majority of historic commercial savings
  - With that project removed, comparatively few commercial projects have been completed in this area, specifically in high peak hour impact measure types
- Small industrial load in the area, minimal industrial savings potential
- No residential new construction projects have been completed in this area
- High percentage of non-participants, especially in commercial sector
- Smallest load of all 3 sites
- Area Median Income: $76K (highest of the 3 sites)

Potential Annual Peak Hour Therm Savings through a targeted Approach

Highly Likely Achievable	Possibly Achievable
1.95	3.89
2x Historical Activity	*4x Historical Activity*

**Single large commercial 2022 peak hour therm value removed*

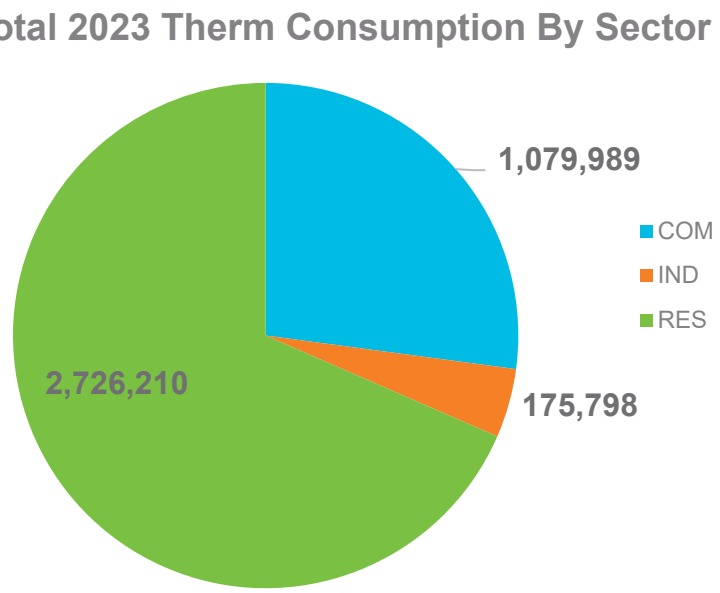
Potential Annual Delivery & Incentive Costs

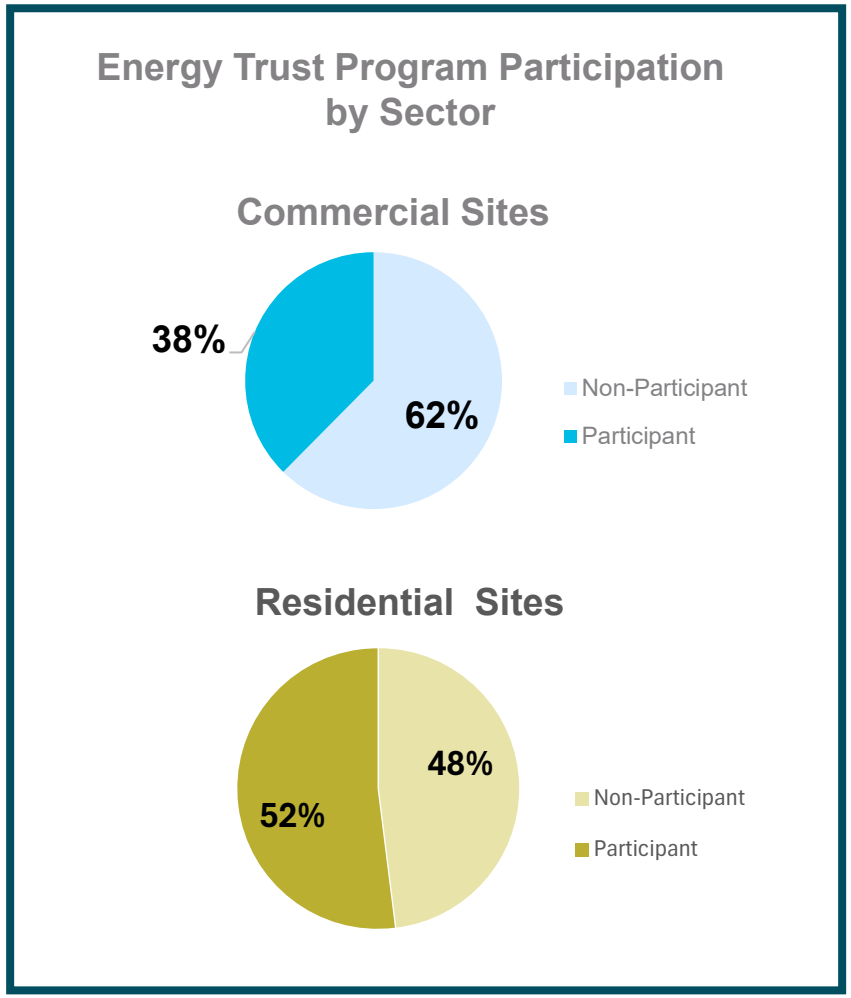
$47K — $175K

Dallas Area

Dallas Area: Consumption & Participation

Sector	Site Count
Commercial	415
Industrial	18
Residential	4,714
Grand Total	**5,147**

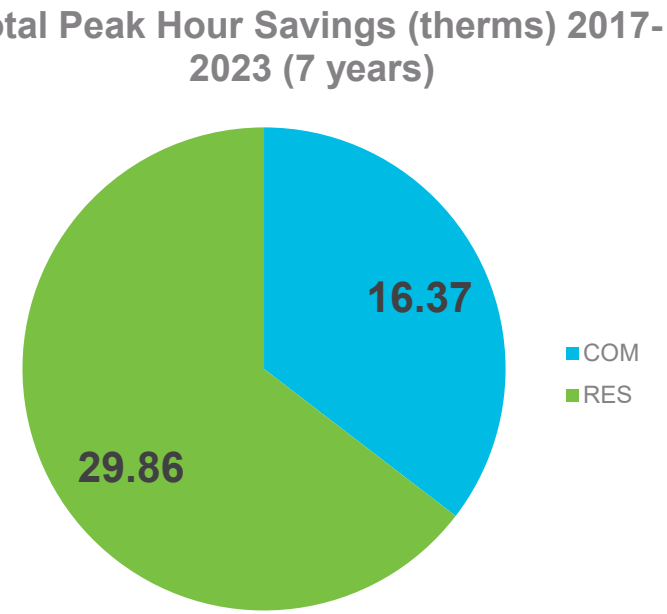




Dallas Area: Project Count & Peak Savings

Sector	Measure Type	Count of EE Projects Since 2017	Average Peak Hour therm savings per therm saved
Com	Process Heating	1	0.00123
	Refrigeration	0	0.00123
	Motors	0	0.00123
	Weatherization (Windows and Insulation)	9	0.00124
	HVAC	11	0.00123
	O & M	9	0.00123
	Appliance	6	0.00045
	Water Heating (Aerators and Showerheads removed)	1	0.00022
	Other	0	0.00124
	Food Service	13	0.00012
	HVAC Controls	4	0.00102
Ind	Process Heating	0	0.00124
	Other	0	0.00123
	Food Service	0	0.00011
Res	New Construction	67	0.00117
	HVAC	103	0.00114
	Weatherization (Windows and Insulation)	95	0.00115
	HVAC Controls	249	0.00114
	Water Heating (Aerators and Showerheads removed)	0	0.00027
	Other	2	0.00011
	Appliance	36	0.00010
Total		**606**	**0.00097**

Green highlighted rows are higher peak hour savings impact measure types



Dallas Area: Considerations and Potential Savings & Costs

- Significant industrial consumption, however, no industrial therm savings in the area which may point to untapped potential
  - McMinnville has similar sized industrial therm consumption, and we project 1.08 – 2.17 of Annual peak hour therm saving potential in that area
- Highest number of historical commercial projects, however 2nd smallest number of commercial sites (415)
- Largest proportion (not total) of residential consumption of the 3 sites
- Area Median Income: $74K (2nd highest of the 3 sites)

Potential Annual Peak Hour Therm Savings through a Targeted Approach

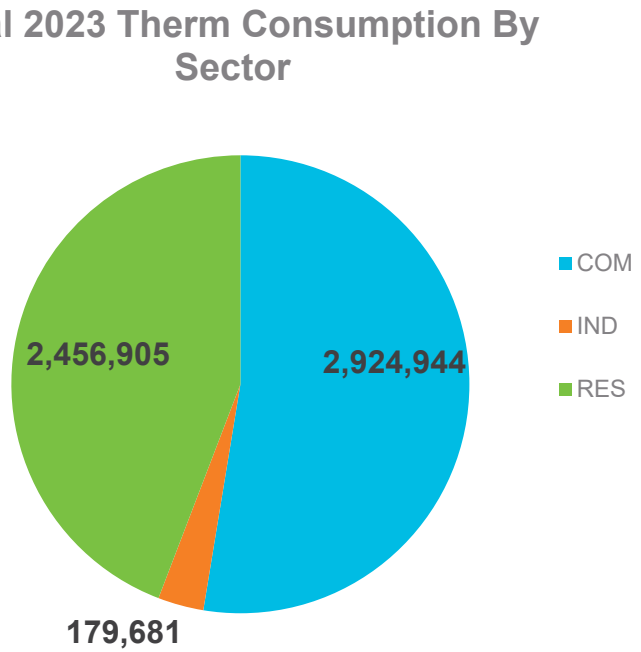
Potential Annual Delivery & Incentive Costs

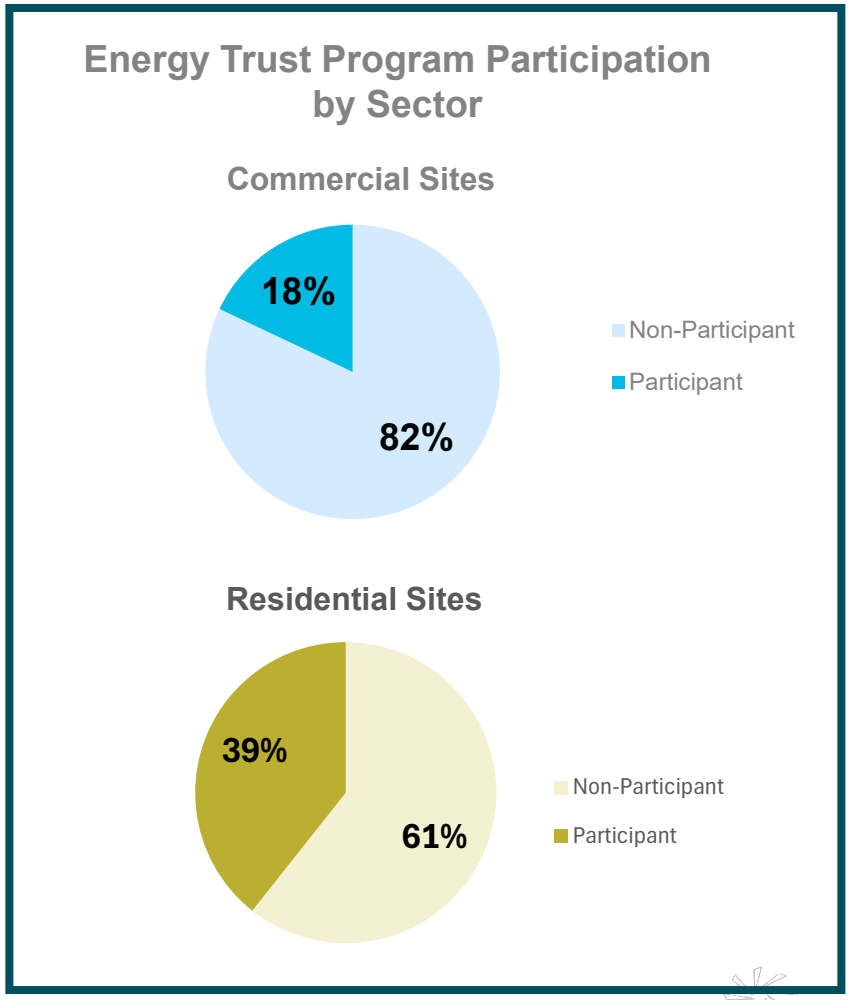
McMinnville Area

(*Includes parts of McMinnville, Amity, Carlton, Dayton, and Lafayette*)

McMinnville Area: Consumption & Participation

Sector	Site Count
Commercial	864
Industrial	34
Residential	4,666
Grand Total	**5,564**



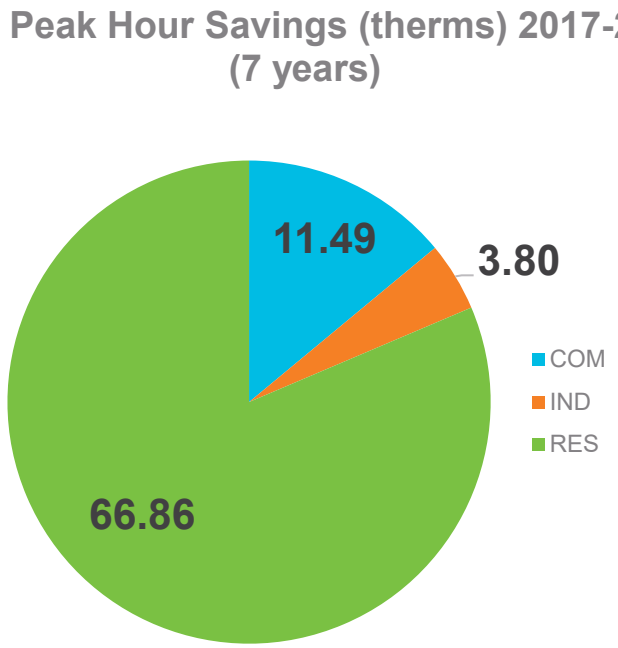


McMinnville Area: Project Count & Peak Savings

Sector	Measure Type	Count of EE Projects Since 2017	Average Peak Hour therm savings per therm saved
Com	Process Heating	0	0.00123
	Refrigeration	0	0.00123
	Motors	0	0.00123
	Weatherization (Windows and Insulation)	2	0.00124
	HVAC	1	0.00123
	O & M	5	0.00123
	Appliance	1	0.00045
	Water Heating (Aerators and Showerheads removed)	8	0.00022
	Other	0	0.00124
	Food Service	25	0.00012
	HVAC Controls	1	0.00102
Ind	Process Heating	1	0.00124
	Other	0	0.00123
	Food Service	1	0.00011
Res	***New Construction**	**365**	0.00117
	HVAC	47	0.00114
	Weatherization (Windows and Insulation)	34	0.00115
	HVAC Controls	159	0.00114
	Water Heating (Aerators and Showerheads removed)	2	0.00027
	Other	0	0.00011
	Appliance	31	0.00010
Total		**683**	**0.00097**

Green highlighted rows are higher peak hour savings impact measure types

**A lot of residential new construction projects, specifically in 2022 & 2023, that make up majority of residential savings*



McMinnville Area: Considerations and Potential Savings & Costs

- Historic peak hour savings driven by residential new construction (2022 & 2023)
- Comparatively few residential HVAC and weatherization measures completed
- Largest commercial consumption of all sites
  - However comparatively few high peak hour impact commercial project types completed
- High percentage of non-participants, especially for commercial sector
- Area Median Income: $68K (2nd lowest of the 3 sites)

Potential Annual Peak Hour Therm Savings through a Targeted Approach

Potential Annual Delivery & Incentive Costs

Areas for Further Analysis

The following concepts were not considered (for the most part) in this analysis and would need to be in order to further assess the effectiveness of targeting these areas for increased energy efficiency acquisition efforts

- Housing stock (Age, condition, type)
- Forecasted new construction
- Incentive level adjustments and no-cost offer potential
- Socio-economic factors
  - Especially from the lens of ETO and OPUC Equity goals
- Contactor/Trade Ally presence and infrastructure

Geographic Targeted Demand Response (GeoDR)

GeoDR Efforts as NPAs in the Targeted Areas

- Continue to enroll industrial customers in the interruptible rate schedule to curtail peak day demand as needed
- Leverage the DR platform created for the system-wide smart tstat DR program and work with ETO to intensify smart tstat marketing efforts with site-specific higher enrollment and participation incentives
- Work with AWEC to explore opportunities for the large commercial and industrial customers to enroll in behavioral GeoDR programs with performance-based incentives
- Conduct cost effectiveness of the GeoDR NPAs including benefits from engineering project deferring
- Aggregate peak hour load reductions from all cost effective GeoTEE and GeoDR programs to derive an NPA impacted peak hour load forecast

Summary of GeoDSM

Customer Composition in the GeoDSM Targeted Areas

Customer Segment	Creswell	Dallas	McMinnville
Residential	1,267	4,672	4,753
Commercial	118	316	640
Industrial - Firm	0	3	12
Industrial - Interruptible	1	0	0
Transport - Firm	0	0	1
Transport - Interruptible	0	0	1
Total	1,386	4,991	5,407

GeoDSM Benefit/Cost Calculation

GeoDSM Program	Total Costs, 2024$	Eng Project Delaying Benefits, 2024$	Other Benefits, 2024$	B/C Ratio
	A	B	C	$\frac{B + NPV(C)}{NPV(A)}$
EE	Total annual costs of implementation of GeoDSM program	NPV of delaying the engineering solution costs associated with a GeoDSM program This benefit is allocated across GeoDSM programs based on their forecasted peak hour therms savings in the total	Total annual benefits from NW Natural avoided costs associated with GeoDSM program	A benefit cost ratio > 1 indicates that the GeoDSM program is cost effective and should be pursued Analysis for each area will need annual update to re-evaluate the decisions to continue targeted efforts and the risk of customer outages
Smart Tstat DR				
Behavioral DR				

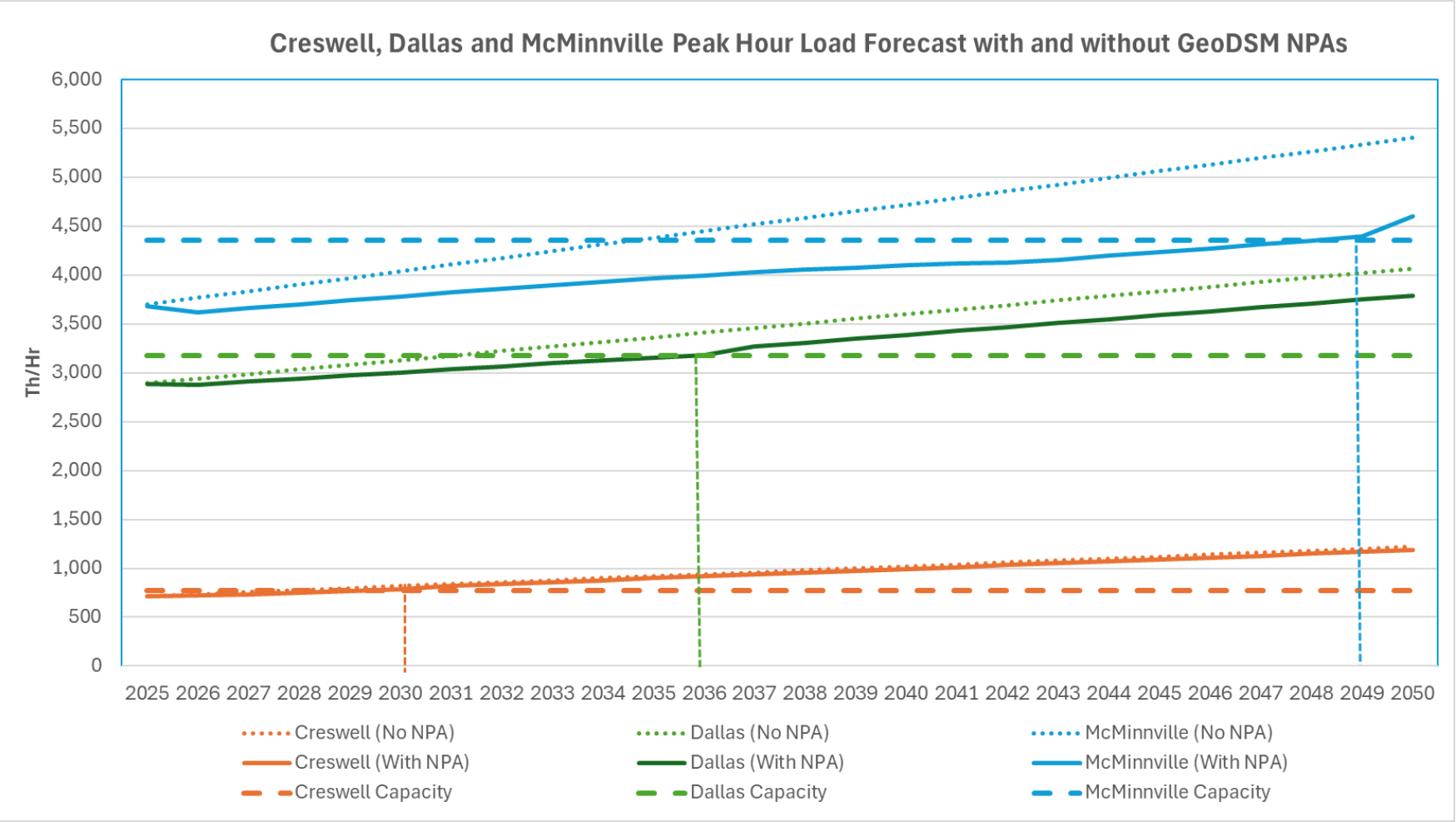
GeoDSM NPA Load and Energy Savings

NW Natural®

Area	GeoDSM	Peak Hour Load Savings, Th/Hr		Annual Energy Savings, Th/Yr		B/C Ratio*
		Start	End	Start	End	
Creswell (GeoDSM 2026 - 2030)	EE	3	11	3,452	10,355	1.62
	Smart Tstat DR	2	4	78	161	2.03
	Behavioral DR	12	15	119	148	5.62
Dallas (GeoDSM 2026 - 2036)	EE	20	152	20,429	156,620	3.95
	Smart Tstat DR	5	33	190	1,177	2.35
	Behavioral DR	38	43	380	427	2.98
McMinnville (GeoDSM 2026 - 2049)	EE	35	575	38,916	635,628	4.19
	Smart Tstat DR	11	230	380	8,265	2.44
	Behavioral DR	102	137	1,017	1,373	1.10

*indicative numbers showing to be cost effective, final numbers to be produced in IRP

Peak Hour Load Forecast with GeoDSM NPAs



Years of Pipeline Solutions Delayed	
Creswell	2
Dallas	4
McMinnville	14

* Vertically dotted lines indicate the years when capacities will be exceeded with NPA efforts

** Such analysis will be updated annually

Feedback Form

Feedback preferred by April 22, 2025

https://www.surveymonkey.com/r/NWNaturalIRP

Thank you!

We value your feedback.

IRP@nwnatural.com

IRP Website

IRP Feedback Form