Natural Gas Delivery Plan

4th Quarter 2023 – 2033

Revision 3

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Acronyms

AGA – American Gas Association

AMI – Advanced Metering Infrastructure

AMR – Automated Meter Reading

API – American Petroleum Institute

ARMA – Association of Records Managers and Administrators

Bcf – Billion Cubic Feet

BYOD – Bring Your Own Device

C&I – Commercial and Industrial

CAGR – Compounded Annual Growth Rate

CARE Program - Consumers Affordable Resource for Energy

CE – Consumer's Energy

CG – City Gate

CIP – Critical Infrastructure Protection

CO2e – The number of metric tons of CO2 emissions with the same global warming potential as one metric ton of another greenhouse gas

CoE – Center of Excellence

DIMP – Distribution Integrity Management Program

DR – Demand Response

ECAP – Enterprise Corrective Action Program

ECO – Enterprise Contractor Oversight

EIRP – Enhanced Infrastructure Replacement Program

ETR – Estimated Time of Restoration

FT – Firm Transport

GCM – Gas Communication Module

GCR – Gas Cost Recovery

GIS – Geographic Information System

GRN – Gamma-ray Neutron

GSMS – Gas Safety Management System

GTIE – Gas Technical Information Excellence

HCA – High-Consequence Area

HP – High Pressure

hp – Horsepower

IaaS – Infrastructure as a Service

IT – Information Technology

LAUF – Lost and Unaccounted for (gas)

LDCs – Local Distribution Companies

LFERW – Low Frequency Electric Resistance Welded

MCA – Moderate Consequence Area

MMbtu – Million British Thermal Units

MMCFD – Million Cubic Feet per Day

MP – Medium Pressure

MPSC – Michigan Public Service Commission

NERC – North American Electric Reliability Corporation

O&M – Operations and Maintenance

OTSRA – Operational Technology Security Reference Architecture

PAAS – Platform as a Service

PHMSA – Pipeline & Hazardous Materials Safety Administration

PIPES – Pipeline Inspection, Protection, Enforcement, and Safety Act

Plan – Natural Gas Delivery Plan

psi – Pounds Per Square Inch

psig – Pounds Per Square Inch Gauge

PSMS – Pipeline Safety Management System

RCV – Remote-Control Valve

RM – Regulated Diaphragm Meter

RORs – Random Outage Rates

RNG – Renewable Natural Gas

RP – Recommended Practice

RTU – Remote Terminal Units

SaaS – Software as a Service

SEA – Statewide Energy Assessment, an MPSC report dated September 11, 2019 (Case No. U-20464)

SCADA – Supervisory Control and Data Acquisition

SCC – Stress Corrosion Cracking

SMB – Small Business, as described in the Company's gas demand response pilot

SP – Standard Pressure, also referred to as utilization pressure

TC – Top Connect Meter

TCF – Trillion Cubic Feet

TED-I – Transmission Enhancements for Deliverability and Integrity

TOD – Transmission Operated by Distribution

TP – Transmission Pressure

USM – Ultrasonic meters

VSR – Vintage Service Replacement

WC – Inches of Water Column

Revision History

Revision	Approval Date	Revision Description
0	12/16/2019	Initial Document
1	12/11/2020	First Revision
2	12/01/2021	Second Revision
3	12/01/2022	Third Revision

I. Executive Summary

A. Introduction

Consumers Energy Company's ("Consumers Energy" or the "Company") natural gas system has served the people of Michigan safely, reliably, and affordably for decades, providing energy for residential and business space heating, water heating, grain drying, industrial processes, and electricity generation.

The natural gas system is critical because it provides the Company's customers with affordable and reliable fuel for heating and replacing it with electricity in the near-term is neither technically feasible nor affordable. The natural gas system is vast, and the age of the system requires spending beyond standard maintenance. The Company is balancing costs by leveling various programs spend dramatically which focuses on safety and reliability with the balancing of affordability, as customers need Consumers Energy to continue to invest in the gas system.

Natural gas remains a relatively clean, low-cost fuel to heat Michigan's homes and power the state's industries for the future—and the Company is continuing to modernize the gas storage and delivery system to ensure the sustainable delivery of safe, reliable, clean, and affordable energy to customers.

Technological changes and environmental concerns continue to create a time of unprecedented change in the energy industry. Consumers Energy continues to embrace the opportunities and meet the challenges of the coming decades by carefully planning for the future.

The Company's Commission-approved *Clean Energy Plan,* along with the Electric Distribution Plan, will chart the path for its electric business. This annually updated Natural Gas Delivery Plan ("NGDP" or the "Plan") maps the Company's vision to continue safely serving customers with natural gas for the next 10 years, from the fourth quarter of 2023 to 2033.

The Plan reflects input provided by the Michigan Public Service Commission's ("MPSC" or the "Commission") previous Orders in which Consumers Energy received insights on the natural gas system through the Statewide Energy Assessment ("SEA"), and also from the outcome of the Company's latest gas rate case, Case No. U-21148. To continue updating this Plan, Consumers Energy also weighed input from peer gas utilities, industry experts, MPSC staff, and other key external stakeholders.

The Plan was founded on the Company's commitment to providing a safe, affordable, reliable, and increasingly clean natural gas system for Michigan.

The Plan clearly outlines the next decade of investments in natural gas infrastructure, planning for natural gas supply and demand, and operational changes in accordance with the industry best practice of a Pipeline Safety Management System ("PSMS") protocol from the American Petroleum Institute ("API") Recommended Practice ("RP") 1173, or as Consumers Energy identifies it, as an expanded Gas Safety Management System ("GSMS").

Four key external drivers continue to prove critical to the natural gas business over the next decade:

External Drivers	Key Factors
Safety	Employees, customers, and the public must safely co-exist with natural gas assets. That means Consumers Energy must continue to anticipate risks and mitigate them proactively.
Increasing Regulation	Safety incidents across the nation's gas infrastructure and changing policies regarding carbon and methane emissions will continue to result in new rules and increased regulatory oversight at the state and federal levels.

Changing Supply and Demand Patterns	The plan anticipates consistent domestic natural gas supply growth adequate to meet increases in long-term demand, enabled by mid-stream investment. This will limit commodity price increases over the longer term as the North American natural gas market expands, led by demand growth in exports and the industrial sector. Gas-fired electrical generation demand growth is limited by maturing renewable generation and electric storage technologies.
Environmental Focus	The impact of natural gas usage on climate change through carbon emissions and methane emissions is becoming more of a focal point of environmentally conscious customers and regulators as coal-based emissions from electric generation continue a downward trend.

The Plan documents the Company's analysis and stakeholder input on these drivers and is built on four objectives that provide flexibility to adapt and continue to perform as an energy provider customers, regulators, and the people of Michigan can count on.

Objectives	Natural Gas Delivery Plan Outcomes
Safe	Expanded remote control and monitoring capabilities and maintaining pace of retiring vintage materials throughout the gas system to reduce the probability of incidents that would adversely affect the public, customers, and employees or contractors.
Reliable	Improved reliability, resilience, and system flexibility in preparation for more variable climate patterns, variable supply sourcing options, regulatory and maintenance activities, with improved equipment reliability.
Affordable	Stable, predictable, and reasonable total bills, including gas asset investment costs, the commodity costs of natural gas, and costs to support additional regulatory requirements.
Clean	Reduction of the Company's and its customers' contribution to climate change through gas system decarbonization. Gas system decarbonization will include options for addressing greenhouse gas emissions of natural gas use, e.g., reduction of carbon dioxide and methane emissions across the delivery system.

Through development of the Plan, the gathering of stakeholder input, and the SEA report, the Company considered the long-term future of the natural gas business along with the potential outcomes of the current trends. The result is a plan that enables shorter-term activities and regulatory filings to be informed by and aligned with a long-term, predictable path to the future.

The Plan will guide the Company's actions today, and provide an evolving framework to monitor initial assumptions, gather new stakeholder input, adjust to potential new expectations for the future, and remain on a transparent pathway to a safe, reliable, affordable, and clean natural gas system for Michigan.

B. Consumers Energy's Natural Gas System

The Company's natural gas system contains 2,380 miles of transmission pipelines, more than 28,170 miles of distribution mains, and approximately 1.6 million services (see Reference 1 for citation source) utilizing single meter stands where one service feeds one meter (e.g. single family home) or multi-meter stands where one service feeds multiple meters (e.g. apartment building) providing natural gas to 1.8 million customers.

The Company operates seven compressor stations on the transmission system, one compressor station on the distribution system, and 15 underground storage fields with a total of 859 wells.

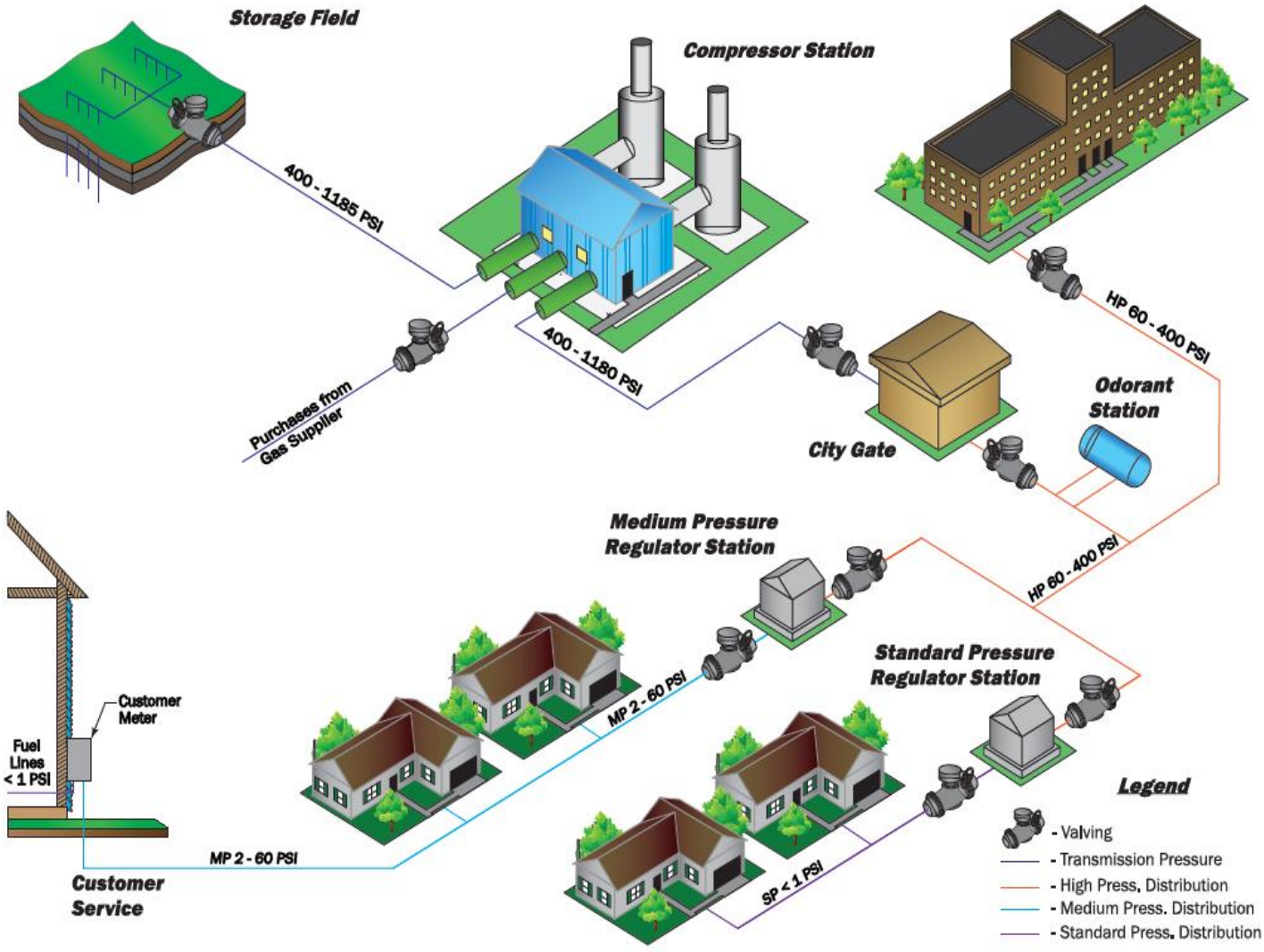
Consumers Energy receives gas supply into its transmission pipelines that operate between 400–1,185 pounds per square inch ("psi"), which are considered transmission pressure ("TP") lines.

Within the natural gas system:

- Compressor stations are used to increase the pressure of natural gas for transportation in the system and for withdrawal from or injection into storage fields.
- City gate stations move gas from the transmission pipeline system to feed distribution mains that operate as high-pressure ("HP") lines between 60–400 psi and medium pressure ("MP") lines between 2-60psi.
- The gas is then routed throughout the distribution system and delivered to residential and business customers that operate on MP lines, and standard-pressure ("SP") lines at less than 1 psi.

Consumers Energy safely operates its system and provides continuous service to approximately 1.8 million natural gas customers. An illustration of a typical natural gas system layout is shown in Figure 1.

Figure 1: Typical Natural Gas System Layout



The Company's distribution system, including Transmission Operated as Distribution ("TOD") pipe, is summarized in the figures provided below.

Figure 2A: Distribution Mileage by Material

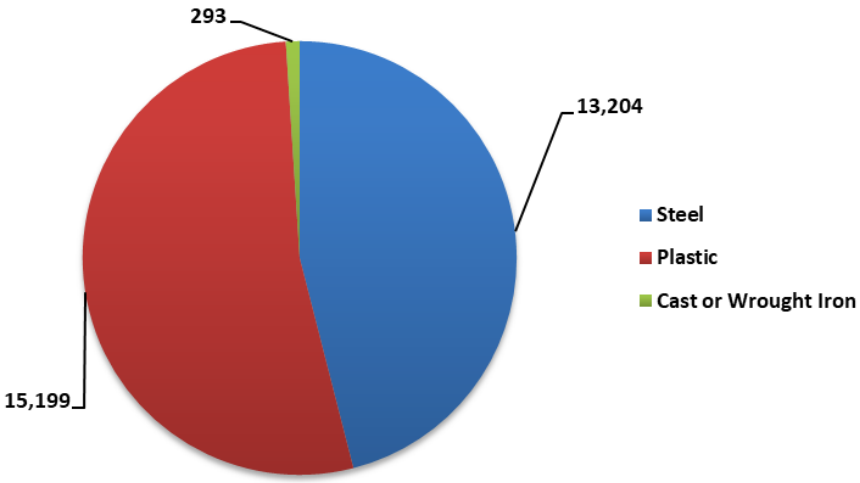


Figure 2B: Distribution Mileage by Pressure

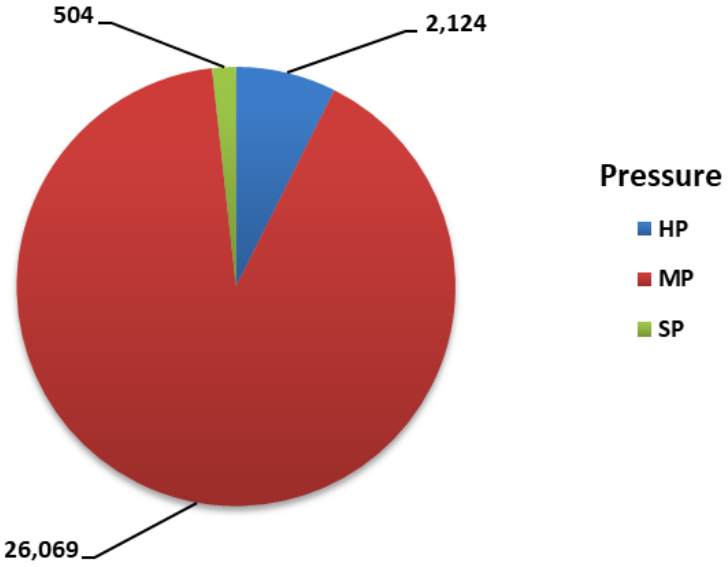
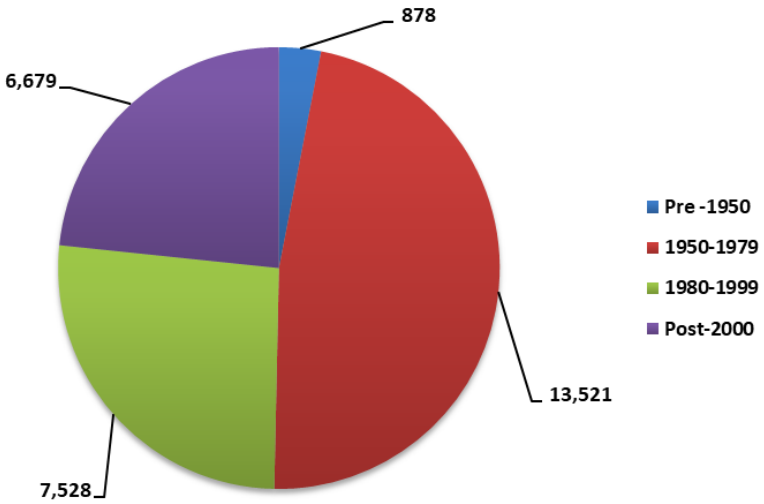


Figure 2C: Distribution Mileage by Installation Year



C. Pipeline Supply

Consumers Energy's system accesses seven interstate pipelines and one major intrastate pipeline. This interconnectivity provides diverse access to supply from Appalachia, the Rockies, Canada, the Gulf Coast, and Mid-Continent production basins.

Pipeline deliveries must conform to fixed pipeline scheduling procedures, and are not instantaneous, barring expensive tariff options mimicking the on-demand availability of owned storage assets.

Pipeline supply encompasses both supply purchased directly at the Company's system interconnects, i.e., city gate supply, and gas purchased at receipt points upstream of the system.

Firm Transport ("FT") contracts reserving capacity on a pipeline can be both short- or long-term agreements representing an additional fixed cost to the user and are used to access specific sources of natural gas supply, including third-party storage.

Interstate pipeline supply into Consumers Energy's system generally ranges from 600 million cubic feet per day ("MMCFD") to 1,400 MMCFD. Overall, pipeline supply is required to fill storage in the summer season while meeting customer demand. Generally, a mix of pipeline supply and storage supply withdrawals are used during the winter season.

D. Asset Classes

1. STORAGE

The gas storage system today includes 15 storage fields made up of 859 wells, totaling more than 149 billion cubic feet ("Bcf") of gas storage capacity.

Storage assets continue playing an important role in customer affordability and system resiliency. The American Gas Foundation defines resilience as, "a system's ability to prevent, withstand, adapt to, and quickly recover from a high-impact, low-likelihood event such as a major disruption in a transmission pipeline." The stored gas is within the state, readily available under the Company's span of control, and provides price stability in times of high demand. Pipeline Supply capability alone is not sufficient to meet customer demand during times of high demand, therefore necessitating storage supply.

On average, gas storage assets have supplied approximately 50% of customer gas deliveries during winter (November through March) and can provide up to approximately 80% on peak days if needed.

In developing the Plan, an analysis was completed for the gas storage assets to compare the role each storage field plays in the Company's annual operating plan. The Plan calls for continuing execution of well inspection, well rehabilitation, increased remote well monitoring, and strategic new well drilling to optimize storage fields. This work will increase efficiency and resiliency while lowering risk and cost. Storage Fields and/or selected wells with high-cost, high-risk, and low deliverability will be evaluated for potential retirement and decommissioning.

2. COMPRESSION

Consumers Energy's fleet of compression assets are grouped into eight stations: five storage—with two of those stations also acting as transmission stations, two strictly transmission, and one distribution compressor station.

- In aggregate, these stations contain 43 compressor units capable of producing more than 150,000 horsepower ("hp").
- Gas compression assets are used to inject gas into and withdraw gas from storage fields, inject gas onto the Company's system from interstate pipelines, and boost transmission and distribution gas pressures seasonally.

Beginning in 2010, the Company made significant progress transforming the compression fleet from 1950s technology to modern, efficient, and clean running equipment. To operate our compression fleet in a manner that delivers natural gas to the right place at the right time to serve and benefit our customers, Consumers Energy is planning to do the following:

- Improve reliability, operating flexibility, and resiliency of the compression fleet.
- Improve monitoring of operating parameters to better understand equipment health and to optimize maintenance work management.
- Implement lessons learned from the 2019 Ray Compressor Station ("Ray") fire incident to improve resilience of the Ray station as well as overall system resilience.
- Optimize the compression fleet, which may include addition of certain equipment for reliability or resiliency, and retirement of antiquated compression assets that do not positively affect the Company's plan to provide safe, reliable, affordable, and clean energy.

3. TRANSMISSION

Gas transmission pipelines are the 'expressways' of the gas system, transmitting large quantities of gas at high pressures in large diameter pipes ranging from 12 inches to 36 inches.

Consumers Energy operates approximately 2,380 miles of gas transmission pipelines that are not part of distribution systems in its integrated system. This includes transmission pipelines, transmission lines within the storage fields and TOD lines.

The Company's goal is to meet the capacity needs of Michigan and have a top quartile transmission system in terms of age, materials, and technology to ensure public safety.

- The Plan details compliance with Pipeline & Hazardous Materials Safety Administration ("PHMSA") requirements for inspection, increased inspections based on the age of the current transmission system, and actions to mitigate risk.

- The Plan also continues investment in upgrading and replacing the Company's major pipelines and modernizing the system with remote-control valves ("RCVs") to quickly isolate the system when system integrity is compromised.

4. DISTRIBUTION

Consumers Energy's distribution system moves gas from city gates through pressure regulation stations into neighborhoods and commercial and industrial ("C&I") districts to customer homes and businesses. Gas enters the distribution system at 60–400 psi and residential meter service pressures are less than 1 psi.

The distribution system includes some of the Company's oldest facilities and is situated closest to customers. Therefore, replacing infrastructure to reduce risk and expanding remote monitoring in this area is a critical focus.

- The Company has approximately 28,170 miles of distribution pipeline, excluding TOD, with approximately 1,860 miles of vintage materials. The Company's system also contains 1.6 million services with 127,370 services with vintage materials.
- Vintage materials include cast iron, bare steel, and copper, which were installed from the 1890s through the 1970s. These are the highest-risk assets in this system and are the primary risk drivers.

While leaks in this asset class are at a lower pressure compared to the transmission system, they are also located much closer to the public. To support expanded monitoring, the Company plans to implement advanced leak detection and upgrade its Supervisory Control and Data Acquisition ("SCADA") system, which is further explained in the *Operational Capabilities* section.

In 2012, Consumers Energy launched the Enhanced Infrastructure Replacement Program ("EIRP"), targeting replacement of pipeline vintage materials over multiple decades. Further, in 2017, the Company added the Vintage Service Replacement ("VSR") Program to eliminate identified vintage materials on services on a programmatic and accelerated basis.

Removing vintage materials from the distribution system will improve customer safety and reliability by eliminating the higher-risk materials from the system, reduce/eliminate the standard pressure system improving system efficiency due to higher operating pressure, and reduce methane emissions into the atmosphere from older leaking pipes and services.

E. Operational Capabilities

As Consumers Energy moves forward with the Plan, the Company will require essential operational capabilities in the areas of people, process, and technology for each of the asset areas to ensure the Company achieves the 10-year goals and outcomes.

People

Consumers Energy is focused on how to safely deliver to customers by ensuring the Company has the right people, with the right skills, at the right place and time.

To make sure these commitments are met, the Company is placing a strong focus on creating the right employee experience to ensure Consumers Energy is attracting and retaining the most qualified and talented candidates to ensure a diverse, equitable, and inclusive workforce, and providing the essential training needed to meet the demands of the system.

Process

To ensure the Company continues to best position itself for the future uncertainties, it will also assess operating models (e.g., governance, roles, responsibilities, structure, ways of working) and will adjust as required. The following are some examples of future process improvements:

- Consumers Energy will continue to ensure risk prioritization drives work management processes as the Company transitions its current relative (i.e., indexed) risk models to a complete probabilistic system risk model over time.
- The Company has implemented and is progressing to increase maturity of the RP API 1173, *Pipeline Safety Management System*, an industry-leading practice that Consumers Energy is calling GSMS as discussed in Section V.B.3 – *Gas Safety Management Systems*, in order to be more holistic and cover the entire gas system.
- GSMS will keep key performance indicators visible to leadership, and will increase focus on processes, procedures, and outcomes in the same manner leading companies in other industries have implemented ISO 9000 to assist with transparency, communication, and timely decision-making.

Technology

To fully enable the goals and outcomes of the Plan, the Company must invest in both new digital capabilities as well as the operations of its existing technology assets to keep them safe, secure, operating, and maintained.

This Plan shows the need to invest in both information and operational technologies (IT/OT), to provide digital capabilities essential for:

- Modernizing and expanding system monitoring to support 24/7 system control
- Improving data analytics to support asset reliability and optimization
- Optimizing compression and storage assets
- Modernizing the distribution and transmission system
- Incorporating predictive and condition-based maintenance
- Transforming work and asset management
- Ensuring physical and cyber security of Company assets
- Reducing methane emissions

Overall, these operational capabilities will enhance Company workforce resources, processes, and technologies to successfully execute the Plan.

In addition, these capabilities will further enable the Company to routinely assess the gas system and update the integrated Plan annually and/or as needed.

F. Initiatives

Consumers Energy is committed to innovatively moving forward with various types of new efforts categorized in the Plan as ‘initiatives.’ This work has a specific focus, with a series of deliberate actions to achieve future outcomes for the Company and Customers in areas such as:

- **Gas System Decarbonization**

  The Company has committed to reducing fugitive methane and carbon emissions from the delivery system, while also better understanding the emissions from the natural gas upstream suppliers and end-use customers.

To minimize the Company's future contribution to climate change, a long-term plan is under development to decarbonize the Consumers Energy natural gas system. Key components of the plan include:

- The Company's methane net-zero emissions goal.
- Long-term pathway to reduce carbon while maintaining affordable, resilient, and reliable energy supplies to heat homes and provide energy to large business customers like energy waste reduction, renewable natural gas ("RNG"), and potentially other decarbonization technologies in the future (e.g., hydrogen, carbon capture sequestration, etc.).
- This initiative will also include a customer voluntary carbon offset program, anticipated to launch in 2022 as a mechanism for customers to reduce their individual climate impact through natural gas use.

- **Gas Demand Response ("DR")**

  As recommended in the MPSC's 2019 Statewide Energy Assessment (or SEA), Consumers Energy has completed two winter seasons of gas DR pilots to evaluate the costs and benefits associated with incentivizing residential and business customers to reduce their gas consumption during times of peak system demand or abnormal system conditions. Pilots were conducted during the 2020/2021 and 2021/2022 winter seasons. The results obtained from the Company's pilot indicate that a full-scale customer program for gas DR would not provide enough benefits to be cost effective. The Company will not proceed with plans to further study gas DR over the next two winter seasons.

- **Energy Waste Reduction ("EWR")**

  Since 2009, Consumers Energy has been implementing a diverse and balanced portfolio of EWR programs that have achieved significant energy savings for all major sectors and customer classes, including small businesses and low-income customers. The Company will continue offering a portfolio of proven programs that have demonstrated market interest and acceptance, as well as exploring new programs.

See the Section(s) in the Plan for further detailed discussion on each initiative.

G. References

1. Source: U.S. Department of Transportation, Gas Distribution System Annual Report for Calendar Year 2020, submitted 03/11/2021.

II. Consumers Energy Natural Gas Delivery Plan

A. Vision Statement

The Company's original vision through early 2021 stated: Provide a **safe**, **reliable, affordable, and clean** gas supply to customers.

However, as the Company continues to clarify its objectives and incorporate stakeholder input, the vision statement has now evolved into the following: ***Deliver safe, reliable, and affordable natural gas to our customers while transforming the system to deliver cleaner fuels for a decarbonized future.***

This evolution was necessary due to the increasing focus by the Company and many external stakeholders, which includes Michigan's recently established climate goals for decarbonization. This is discussed more in the *Gas System Decarbonization* section.

B. Objectives

The Plan has four objectives to guide future investment decisions across the full system of storage, compression, transmission, and distribution, including all regulator stations and city gates. Consumers Energy plans to use these objectives to help prioritize investment decisions based on factors such as risk, cost, and various impacts to the customer to ensure successful outcomes for the Plan.

The Plan's four objectives are:

- **Safe:** Zero incidents. The **safety** of employees, customers, and system is the Company's top priority.
- **Reliable:** The **reliability** and resiliency of the system is essential to operating as a trusted energy partner for Michigan.
- **Affordable:** Competitive, predictable prices. To have a safe and reliable system, investments must be made along with preventative maintenance. Therefore, the Company must balance system needs and the timing of investments with the ability to maintain **affordability** of the customer bill.
- **Clean:** Decrease the environmental footprint and determine the potential to evolve the system over time. Investing in a safe, reliable, and affordable system will help provide a **clean** gas system for the future. In addition, learning and assessing new decarbonization technologies that will allow customers to lower their emissions and use cleaner burning fuel in the future.

C. Objectives and Goals

The Company implements modeling results and input from industry experts and other external gas utilities to identify goals for each objective:

1. SAFE

Safety remains the Company's top priority. That means:

- Continuously reducing system risk.
- Focusing on process enhancements to improve gas system safety.
- Enhancing reliability and expanding 24/7 monitoring of the system.
- Modernizing the entire natural gas system, including the remediation of distribution and transmission assets, and replacing higher-risk vintage distribution mains and services.

The Company is also placing an emphasis on implementing best practices in GSMS (API RP 1173), and records management. Consumers Energy will continue to use operational metrics to measure factors spanning the safety of personnel, assets, processes, as well as physical and cybersecurity.

The Company is moving to system-wide risk management to reduce overall system risk and better justify the necessary spending priorities.

2. RELIABLE

Consumers Energy continues to create and maintain a **reliable** system through dependable assets, measured through metrics such as gas flow deliverability, system optimization (utilization rate), and total system resilience to avoid unplanned outages.

The Company issues a resilient storage and market supply plan for peak demand days, and proactively balances peak customer demand primarily with storage and use of EWR. The Company continuously uses the lessons learned from events such as the Ray incident and the recent Line 400 incident.

Considering the Ray incident, the SEA, and the need to ensure ***energy delivery resiliency and system reliability***, the Company's efforts will be to assess the current system's ability to adapt to single failures, and balance customer energy delivery resilience risk with safety and affordability while using gas assets to provide the agility needed to respond to the potential for changes in the natural gas market environment and connected systems.

The American Gas Foundation[1] provides definitions for both resilience and reliability as follows:

- Resilience is defined as the set of energy system abilities that allow it to prevent, withstand, adapt to, and quickly recover from system damage or operational disruption.
- Reliability is defined as the ability of the energy system to deliver services in the quantity and with the quality demanded by end-users.

The Company agrees with those definitions and considers both reliability and resilience critical to the Company and its customers, and this shows the value of Consumers Energy having an underground transportation network that is highly reliable and resilient in delivering energy without interruption.

In addition, the Company also assesses the gas system resiliency needed due to potential climate change risk, as part of our publicly available *Climate Change Risk, Vulnerability and Resiliency Report*.

3. AFFORDABLE

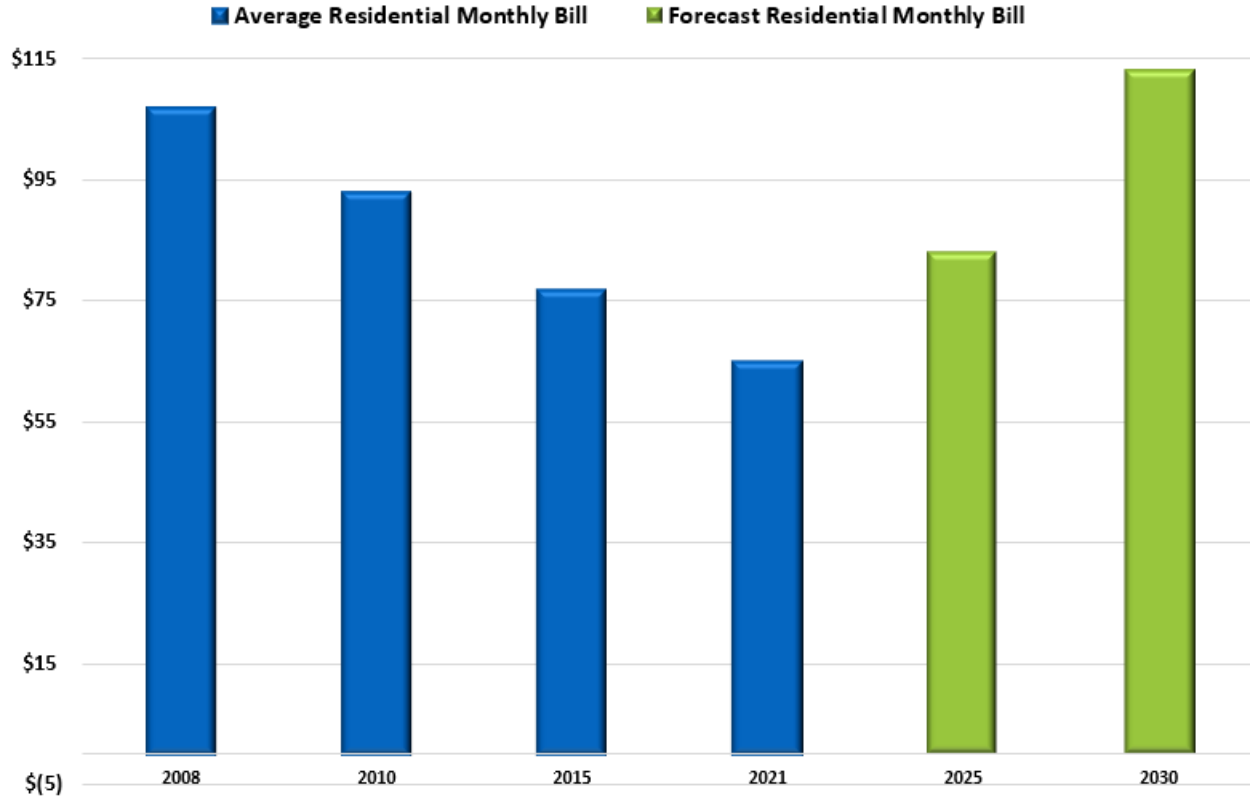
There is a continued and consistent focus on delivering **affordable** gas to customers with competitive and predictable prices. Consumers Energy continues to analyze average customer bills (total cost and cost per Mcf) to manage total costs to the customer. The Company recognizes customer's bills will increase significantly over the course of the next few years due to inflation and market forces. The bill increases in 2022 stem from a combination of a gas delivery rate adjustment approved earlier this year and the recovery of natural gas commodity and power supply costs that have spiked over the past year, primarily due to the rising price of natural gas. The Company has a responsibility to keep bills as low as possible for all customers and will continue to work with to mitigate these rising costs in the examples as follows:

- The Company is committed to helping customers to use less of product (natural gas) by providing energy-efficient products and resources. This includes winterization kits for homes and businesses and promoting customer assistance available.
- Offering EWR choices for all classes of natural gas customers.
- Offering tariff options to customers will create the additional benefit of enabling decreased transportation costs for C&I customers during peak times.

- Continue our commitment to low-income customers through the Consumers Affordable Resource for Energy ("CARE") Program, to support energy efficiency programs at 1% or more of sales, and measure customer satisfaction.

Figure 3 shows the history in blue and the forecast in green for the average monthly residential bill per year that was in the previous version of this Plan.

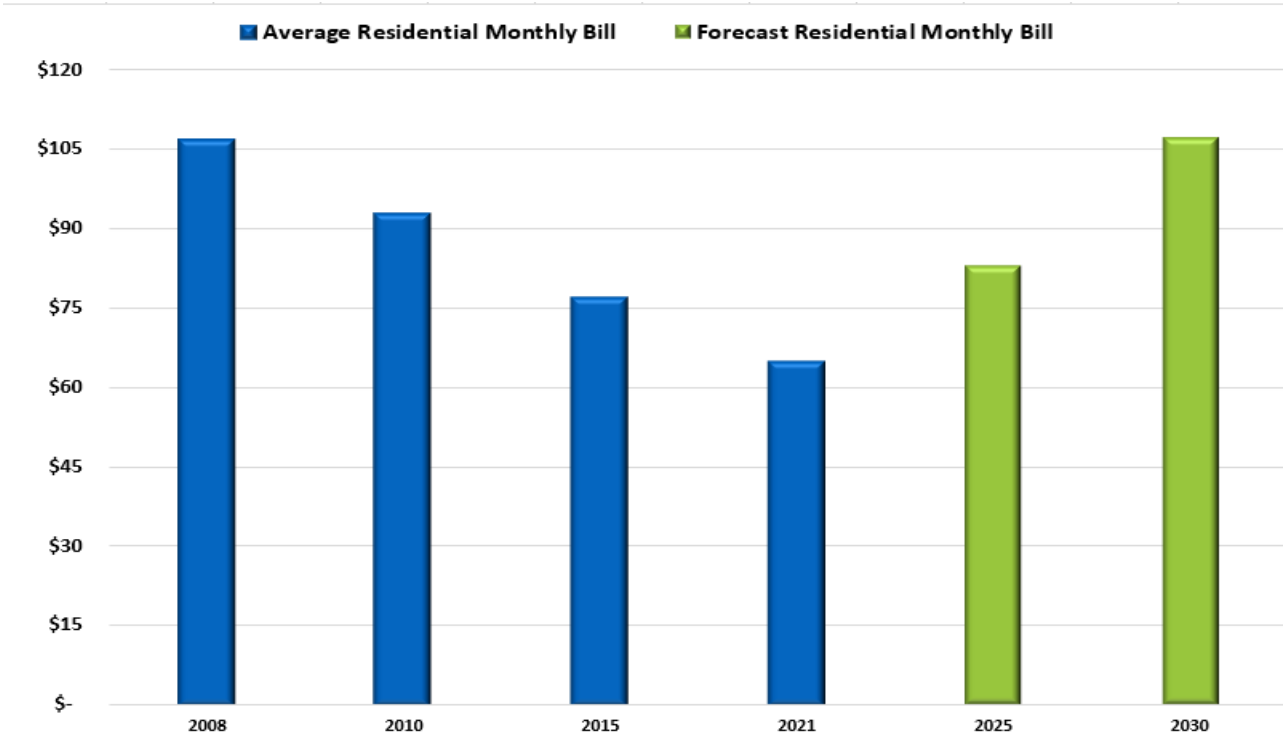
Figure 3: Average Residential Customer Bill History and Previous NGDP Forecast



As shown in Figure 3 above and Figure 4 below, the average monthly bill decreased significantly at more than 5% per year through 2021, reflecting the Company's gas supply strategy and system capital investments to maximize the value in lower gas commodity costs during this period. Over the same period, the Company increased capital investment spending by approximately 15% per year to the benefit of all customers.

Despite recent gas commodity increases, Figure 4 below has been updated with a new forecast showing a reduction in its 2030 bill projections. This re-forecasted bill growth rate will be an approximate compounded annual growth rate of approximately 5% each year through 2030 and comparable to the bill amount to that of 2008. However, even if the average bill increases to a 2008 historical value by 2030, the average forecasted bill decreases from 2008 to 2030 in real dollars when considering inflation rates from 2008 to 2030, which helps maintain affordability for customers now and in the future. Consumers Energy recognizes that historical data isn't always relevant to our customers, however, it does show the Company's commitment to be at, or below, inflation over the years and works diligently to maintain value and affordability to its customers.

Figure 4: Average Residential Customer Bill History and Updated Forecast



Going forward, the Company will continue to ensure commodity costs are in with the long-term infrastructure investment requirements needed for a safe, reliable, and clean gas system while also maintaining competitive, affordable, and predictable customer bills.

4. CLEAN

Consumers Energy is committed to Michigan, its natural resources, and a sustainable climate for generations to come. The Company's proposed Clean Energy Plan, as filed with and approved by the MPSC in June 2022, proposes to end coal use by 2025, increases renewables and energy efficiency, and meets customer needs with 90 percent clean energy resources. The Clean Energy Plan puts the Company on a trajectory to meet its net zero carbon emissions goal for the electric system by 2040.

In support of Michigan's Healthy Climate Plan 2050 carbon neutrality goal, as well as other national and international efforts, the Company is evaluating changes to the natural gas business to reduce, offset, and replace methane and carbon emissions, including customer end-use. The primary 10-year outcome for 'clean' is to reduce the Company's gas system methane emissions by 80% and achieve net-zero methane emissions by 2030, which is a first step and important component of the decarbonization plan. In addition, the Company announced in March of this year to expand on it's clean goals to include all emissions, including upstream suppliers and downstream customers, that are part of the entire gas delivery system to be carbon neutral by 2050, which includes a goals of 20% reduction in customer emissions by 2030.

- The initial step towards reducing customer end-use emissions is the launch of the MI Clean Air carbon offset voluntary program for residential, commercial, and industrial customers.

- The Company is developing a long-term strategy in collaboration with stakeholders to achieve net zero carbon emissions associated with customers' use of natural gas in their homes and businesses. This plan will focus on energy efficiency, RNG, carbon offsets, other carbon reduction pathways. This strategy will be expressed in the form of a reduction in tons of C02e per year and is discussed further in the *Gas System Decarbonization* section of the Plan.

D. Alignment with Objectives, Goals, and Outcomes

For each of the objectives, goals, and outcomes, performance targets, and completion dates were developed by analyzing the Company's historical performance and future needs of the system while benchmarking peer utilities as shown in this Plan.

The investments described in this Plan are necessitated by regulatory requirements, to improve safety, reliability, and the environment, while keeping customer bills affordable and predictable.

The Company will track these—as well as short-term operational metrics—by measuring and analyzing leading and lagging indicators. The list of headline metrics and corresponding 10-year outcomes for each objective is displayed below in Figure 5.

Figure 5: Natural Gas Delivery Plan Objectives, Goals, and Outcomes

Objective	Goal	Delivery Plan	Outcome	Year Ending 2021	2030 Target
Safe	Zero Incidents	Replace high-risk materials in service, distribution, and transmission while moving to system-wide probabilistic risk management	Reduce System Risk	5.4%	2.1%
			Increase GSMS maturity level	3.0	>4.0
Reliable	Resilient and reliable system	Ensure supply reliability and system resilience by improving fleet reliability, leveraging storage, using our multiple interconnections, and in some cases, using redundancies and/or bypass alternatives in flow paths to improve system resilience	Maintain Gas Flow Deliverability	95%	95%
			Increase Resilience	86.0%	>88.3%
Affordable	Competitive, predictable prices	Improve value through stable and predictable total bill growth and spending	Annual average of monthly residential bill	$65	$107
			Increase Customer satisfaction survey	76	85+
			Increase Energy Waste Reduction	1%	1% year over year
Clean	Decrease air emissions footprint	Reduce gas system carbon equivalent emissions by eliminating methane leaks and implementing various technologies for gas system decarbonization	Reduce Scope 1 system methane emissions	1297 Metric tons (MT)	11, 507MT
			Reduce Scope 3 customer carbon emissions	TBD	4 million metric tons

E. "Future Back" Scenario Modeling

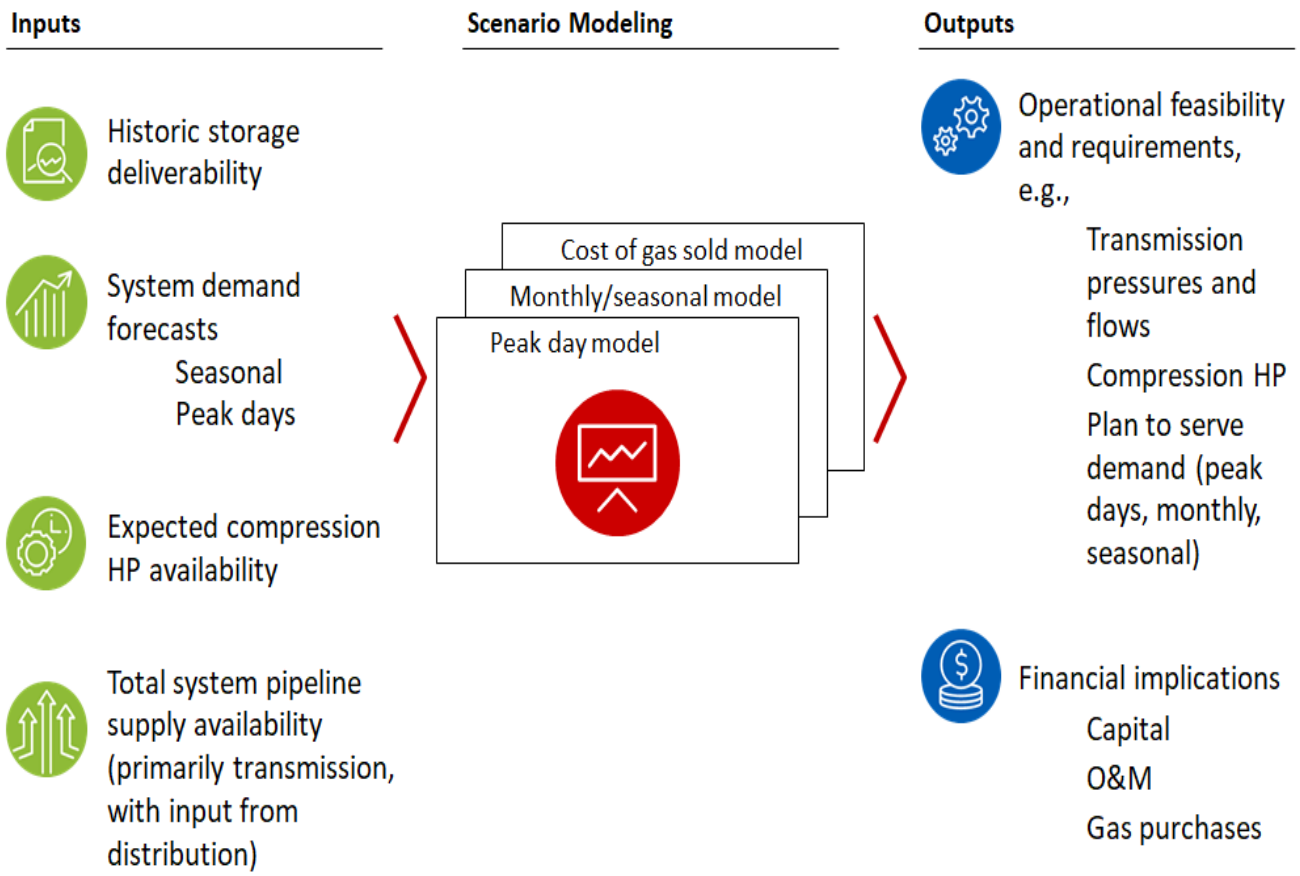
Consumers Energy worked with industry experts from October 2018 to March 2019 to support the creation of a holistic, long-term plan for the natural gas system. During that time, the Company talked with many other gas utilities to identify how to conduct a holistic review of the gas system by assessing internal risk models and system data to determine the optimal system configuration, with the goal of meeting the Company's objectives of safe, reliable, affordable, and clean.

An external consultant helped consider various internal and external factors and industry trends. The Company then assessed several possible system configurations and potential future external scenarios based on the changing nature of the Company's business, the industry, and the gas commodity environment. The intent was to determine the boundaries of possible system configurations under various peak day, monthly, and seasonal scenarios through 2030.

As part of the process, historical data from all asset areas, system demand forecasts, and total system pipeline supplies was reviewed and continues to be reviewed routinely.

The Company then inserts the updated data into various modeling tools to generate the future operational feasibility, financial implications, and other factors that could exist based on changing inputs. This approach is outlined below in Figure 6.

Figure 6: Approach to "Future Back" Scenario Modeling

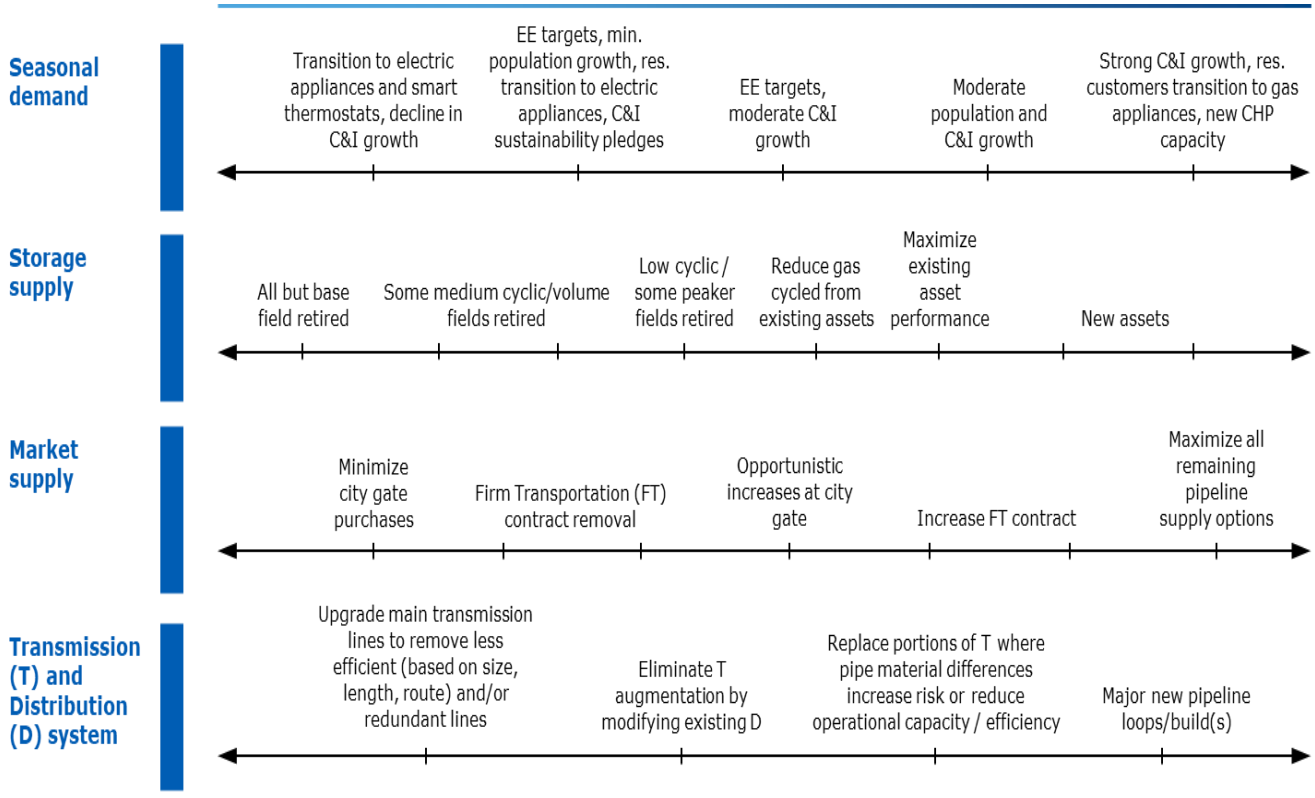


The modeling assesses a range of extreme scenarios for market supply and demand and various system configuration as illustrated below in Figure 7 and Figure 8.

Figure 7: Extreme Modeling Range

Example Extreme Scenarios	Overview
High demand	*Customer demand increases by 1-1.5% per year across residential and C&I, driven by factors such as population growth, commercial/industrial facility openings, and/or new gas-fired generation*
Low demand	*Customer demand decreases by 2-4% per year through a combination of underlying residential demand reduction (electrification and EE/DR), several large Commercial & Industrial customers defecting, and/or strategic divestiture of territories*
Extreme market supply	*Winter pipeline gas supply maximized across city gates, firm transportation opportunities, and any additional supply available to meet customer load (up to 2.5x increase from pipeline supply today); storage minimized to key fields (e.g. Ray, Overisel, Winterfield, and needle peakers) while others retired or reduced*
Extreme storage supply	*Winter storage utilization maximized and options to increase storage performance/overall volume exercised (i.e. well improvement and new field acquisitions); minimum usage of pipeline supply*

Figure 8: Scenario Modeling



This routine scenario analysis allows Consumers Energy to better understand the potential system impacts of future changes to the Company's system, market, or industry.

F. Asset Focus and Changes in the Plan

The modeling provides a data-driven, informed perspective on how to prioritize the Company's capital investments and operations and maintenance ("O&M") spending for each asset class: storage, compression, transmission, and distribution.

Consumers Energy's long-term goals and outcomes for each of the objectives were aligned for each of these asset classes to reduce asset and compliance risk by hardening the Company's assets to meet customer demand.

A summary of the focus and most significant changes for each asset class that will help the Company achieve its objectives and long-term outcomes are updated in the Plan annually. These changes for each asset class (i.e., portfolio) are outlined below and also described in more detail in the corresponding asset plan sections.

1. COMPRESSION

a. Focus

- Reduce system risk and methane emissions through retirement and decommissioning of vintage compression units and equipment to optimize customer value.
- Improve fleet reliability and maintain gas compression facility deliverability through increased system health monitoring, automation to maintain asset performance, and increase effectiveness of preventative maintenance.
- Improve system resilience and maintain gas compression facility deliverability through alternative flow path validation and creation, as well as implementation of robust design enhancements to existing equipment to protect major natural gas supplies from interruption. Use system supply requirements, station assessments, and the Total System Resilience process to inform investments.

2. STORAGE

a. Focus

- Optimize aging storage asset infrastructure to lower operating cost, maintain deliverability, and decrease emissions points.
- Assess wells to determine if they are underperforming. Optimize storage asset risk, in alignment with PHMSA requirements, and performance by coordinating remediation, plugging and decommissioning underperforming wells, maintaining storage capability with new and more efficient wells, and updating existing storage equipment and lateral pipelines.
- Increase cycling of peaker fields for cold weather events as prescribed in Gas Cost Recovery ("GCR") filings.
- Use system supply requirements, the Storage Integrity Management Program, and the Total System Resilience process to inform investments.
- Invest in digital solutions for increased storage well monitoring.

3. TRANSMISSION

a. Focus

- Obtain the necessary technology for system response and needed flexibility with capacity throughput and diversity of flow paths for total system resiliency to reduce system risk and methane reductions caused by aging infrastructure.
- Install the Mid-Michigan Pipeline to replace a portion of Line 100A.
- Increase the pipeline integrity scope to account for the additional remediation work for the transmission piping and to meet new regulatory requirements for Maximum Allowable Operating Pressure ("MAOP") reconfirmation, as well as the incremental remediation as an outcome of inspecting TOD and storage lines.
- Attain 70% of RCVs installed on valves on the transmission system. To align with the prioritization of work and system outage schedules; the installation rate has changed to assume that 70% is complete by 2028 in lieu of 2026 as stated in the previous Plan.
- Upgrade the Company's natural gas supervisory & control data systems, which allow for secure monitoring and control of the natural gas system, and upgrade city gates.
- Reduce the probability of high impact natural gas system failures having an effect on energy delivery to customers. In doing so, use the Total System Resilience process to inform investments. Be responsive to the MPSC Statewide Energy Assessment Recommendations pertaining to system resiliency.

4. DISTRIBUTION

a. Focus

- Reduce system risk and methane emissions while addressing system reliability and capacity. This will be accomplished by addressing aging or vintage infrastructure that is closest to the customers.
- Continue remediating vintage distribution main, standard pressure main, and vintage services to meet 2035 completion date. The annual targeted miles, as shown in Figure 44, is revised to balance with affordability and account for labor requirements, municipality project schedules, identified remaining segment projects, etc.
- Ensure necessary funding for civic/asset relocation work to account for additional emergent and long-range projects in public infrastructure improvement.
- Use the Total System Resilience process to inform investments.

In closing, the Plan reflects a thorough analysis of the natural gas system, the natural gas commodity market, trends and practices across the industry, as well as regulatory and customer trends. Consumers Energy intends to routinely review the validity of the inputs and assumptions that led to the creation of the Plan, update it as appropriate, and continue to share the Company's vision with stakeholders across Michigan.

G. References

1. Source: American Gas Foundation, prepared by Guidehouse. *Enhance the US Energy System's Resilience: Realize the full potential of the gas distribution system*. October 2020.
2. Consumers Energy *Climate Change Risk, Vulnerability and Resiliency Report*

III. Pipeline Supply

A. Overview of Pipeline Gas Commodity Cost Trends

Over the past decade advancements in unconventional drilling production methods alongside increased mid-stream investment turned the U.S. into a net exporter of natural gas and transformed the domestic natural gas market from scarcity into one distinguished by frequent periods of oversupply.

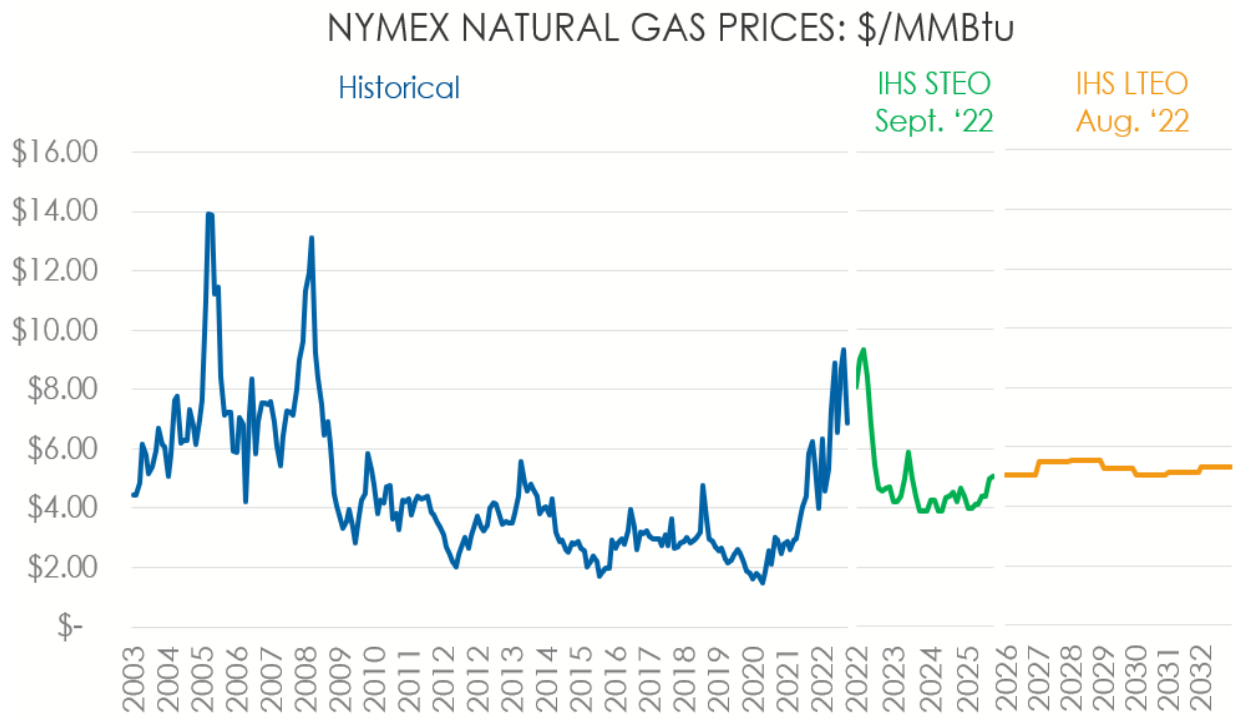
Today, the expanding U.S. natural gas market continues to be molded by structural changes characterized by capital constraints, energy transition goals, and the growth of export capacity bringing global macro-economic influences. Although the current U.S. natural gas market is in a period of undersupply under pandemic-related and geopolitical influences, the Company views these drivers as short term rather than structural, consistent with the US Energy Information Administration ("EIA") and IHS Markit forecasts.

While more recent structural market changes make it less likely periods of sustained oversupply will occur, natural gas prices are projected to remain affordable over the long term as U.S. natural gas production continues to be projected as capable of meeting expanding market demand into the future.

The growth of shale gas has been the dominant force increasing domestic gas supply and lowering gas commodity cost levels from historic highs, and is projected to remain a driving force for continued natural gas market expansion due to favorable economics, a transparent market, and a resilient transportation system. The EIA estimates U.S. natural gas proved reserves at 473 TCF or approximately 13 years at current demand levels, and Technically Recoverable Reserves estimated at 2,925 TCF as of January 1, 2020.

Consumers Energy's natural gas system in particular has been well positioned to benefit from the prodigious growth in shale production over the past decade. The largest U.S. shale production basin is in the nearby Marcellus and Utica Appalachian formations primarily in Ohio, Pennsylvania, and West Virginia. (See Reference 2 in this section for citation source.) Appalachian production accounted for approximately one third of the U.S. production in 2022.

Figure 9: NYMEX Natural Gas Price ($ per million BTU)
(See Reference 9 in this section for citation source.)



As the Figure above illustrates, natural gas commodity prices and volatility decreased substantially after 2009, coinciding with the dramatic growth in domestic natural gas shale production over the past decade. The recent pandemic shut-ins interrupted this period of price stability, dislocating supply and demand fundamentals initially compounding an oversupplied market in 2020 driving natural gas prices lower, and then transitioned into an undersupplied market as demand rebounded past supply levels, driving prices and volatility upward, exacerbated further by subsequent geopolitical events.

Continued investment in oil and gas production is expected to enable natural gas supply levels to catch up with demand. The September IHS Market and EIA short-term forecasts project domestic natural gas supply and demand levels rebalancing in 2023 around a $5/MMBtu price level consistent with longer-term price projections.

Storage Infrastructures Role

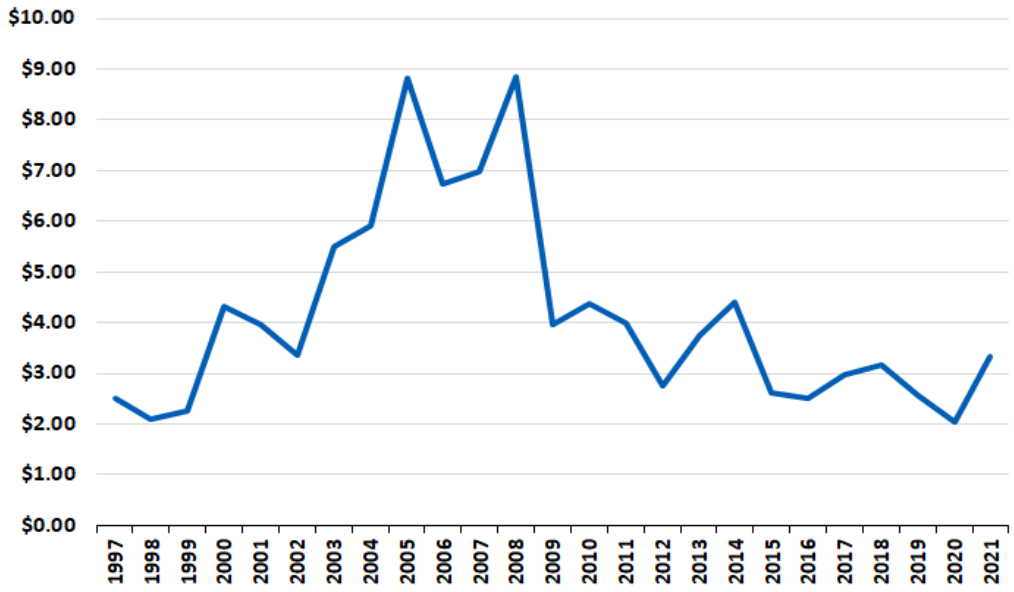
The U.S. gas market relies on storage to balance production and demand. Seasonal price differentials are the market's mechanism to achieve balance and can deviate substantially in any year. The summer/winter market natural gas price differential has averaged approximately $0.54/MMbtu in the most recent five-year period (2017-2021).

Looking forward, the New York Mercantile Exchange ("NYMEX") natural gas forward curve settlements assume an approximate $0.48 seasonal differential.

Beyond seasonal cost savings, Consumers Energy's storage fields provide customers supply resiliency and balance, changing energy demand throughout the day and reducing exposure to market pricing fluctuations and supply availability risk, as experienced dramatically by some portions of the country during the February 2021 polar vortex weather event. In addition, without storage, the interconnects to the market supply could not provide the customer demand needed on a peak day. Gas supplied by out storage fields provides the capacity to meet customer demand on the extreme cold days, as detailed in Figure 13 in the Storage Asset section. Detailed evaluations of costs versus risks and benefits should continue to be completed in the future, given the changing natural gas environment and the seasonal pricing changes as shown in the Henry Hub Prices in Figure 10.

Figure 10: Historical Winter (withdrawal season) Average Daily Henry Hub Prices

(See Reference 7 in this section for citation source.)



Delivering Customer Value through System Investment and Pipeline Supply Coordination.

To ensure customer affordability, Consumers Energy will continue to evaluate both pipeline gas commodity (i.e., GCR) and investment costs when considering the total delivered price of gas that the customer pays. In this manner the Company will balance affordability with the investments necessary to achieve the safe, reliable, and clean goals to optimize overall customer value.

The Company's system investments integrate with the commodity supply plan to partially mitigate natural gas price volatility, supply risk, and enable commodity cost minimization for our customers; this is especially relevant in the current market conditions.

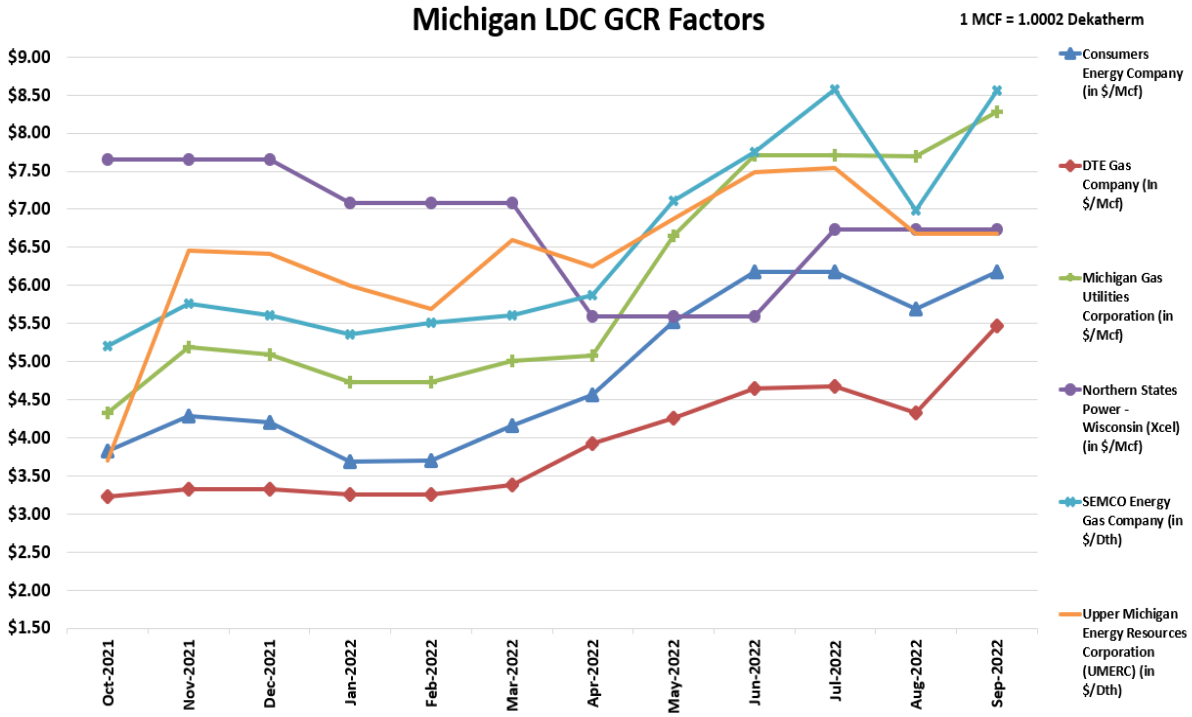
Consumers Energy's storage and system investments allow gas to be purchased in the summer months when decreased demand provides historically advantageous pricing relative to high-demand winter market conditions. The Company operates 15 underground storage fields totaling more than 149 Bcf of cyclable storage capacity, allowing approximately 50% of customers' winter natural gas needs to be met from storage and up to approximately 80% of peak day requirements if necessary.

Consumers Energy's GCR gas commodity procurement plans also take advantage of the deliverability that Company investments provide to optimize natural gas market supply options to minimize commodity fixed costs. The Company also expects to incorporate value-added services to offset a portion of supply costs. This has resulted in GCR commodity costs often lower than other Michigan regulated gas utilities over the past decade.

Figure 11 shows the Company's current GCR price when compared to other Local Distribution Companies through 2022.

Figure 11: Monthly GCR Billing Factor Price for Consumers Energy and Others

(See Reference 8 in this section for citation source.)



As part of the Plan, total customer value considerations will provide the optimal trade-offs between commodity- and investment-related alternatives to maintain affordability for customers. Considering total customer value will provide a balanced approach to accomplish the affordability objective.

B. Ongoing Refinement of Supply Plans

Consumers Energy's GCR supply plans are detailed in a separate regulatory filing and updated annually. These plans include procurement details that align with the broader objectives of creating a safer, more reliable (and resilient), affordable, and cleaner gas system. In this manner, the storage and compression asset portfolios and system investments have a significant impact on how the Company procures natural gas for customers.

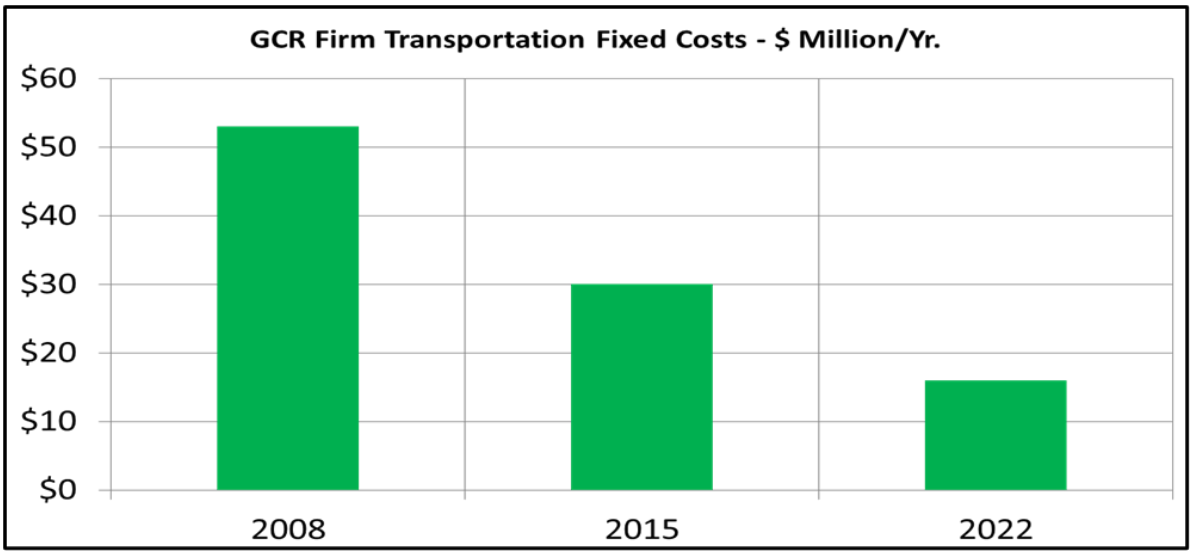
Typically, the Company procures about 75% of its GCR supply requirements in the summer months for injection into storage fields to meet winter GCR customer demand.

- Storage provides price stability, lowers supply risk, and generally lowers commodity costs in the winter months. It also provides system flexibility and resilience to enable reliable and timely delivery services by efficiently balancing variable customer load throughout the day.
- Winter GCR sales constitute about 75% of total GCR annual sales. On the coldest days, storage can provide up to 80% of total customer demand, with the balance of demand served by the fixed (ratable) flowing pipeline supply.
- Providing storage supply options is a significant benefit for Michigan because the stored gas is close to the point of use and can be dispatched quickly to meet short-term demand spikes during cold weather cycles. The Company has sole control over the storage supply, which improves timeliness of supply and provides flexibility that supports total system resilience.

In the past, higher levels of transportation contracts were used to reduce supply availability, price volatility, and system deliverability risks. Over the past several decades, the Company has made investments in its transmission pipe, storage, and compression assets to increase the deliverability of storage assets and overall system flexibility capable of balancing customer demand and less flexible pipeline supply.

These investments along with the increase in regional supply have reduced the reliance on fixed cost transportation contracts born solely by the GCR customer class to mitigate these risks as shown below in Figure 12.

Figure 12: GCR Firm Transportation Cost



The increase in regional production, and new and expanded Midwest interstate pipeline capacity transformed the area's supply fundamentals, and substantially increased the supply available at the Company's system interconnects, i.e., city gate supply.

City gate supply has proven to be a reliable and competitive alternative to upstream purchases using interstate pipeline capacity for the following reasons:

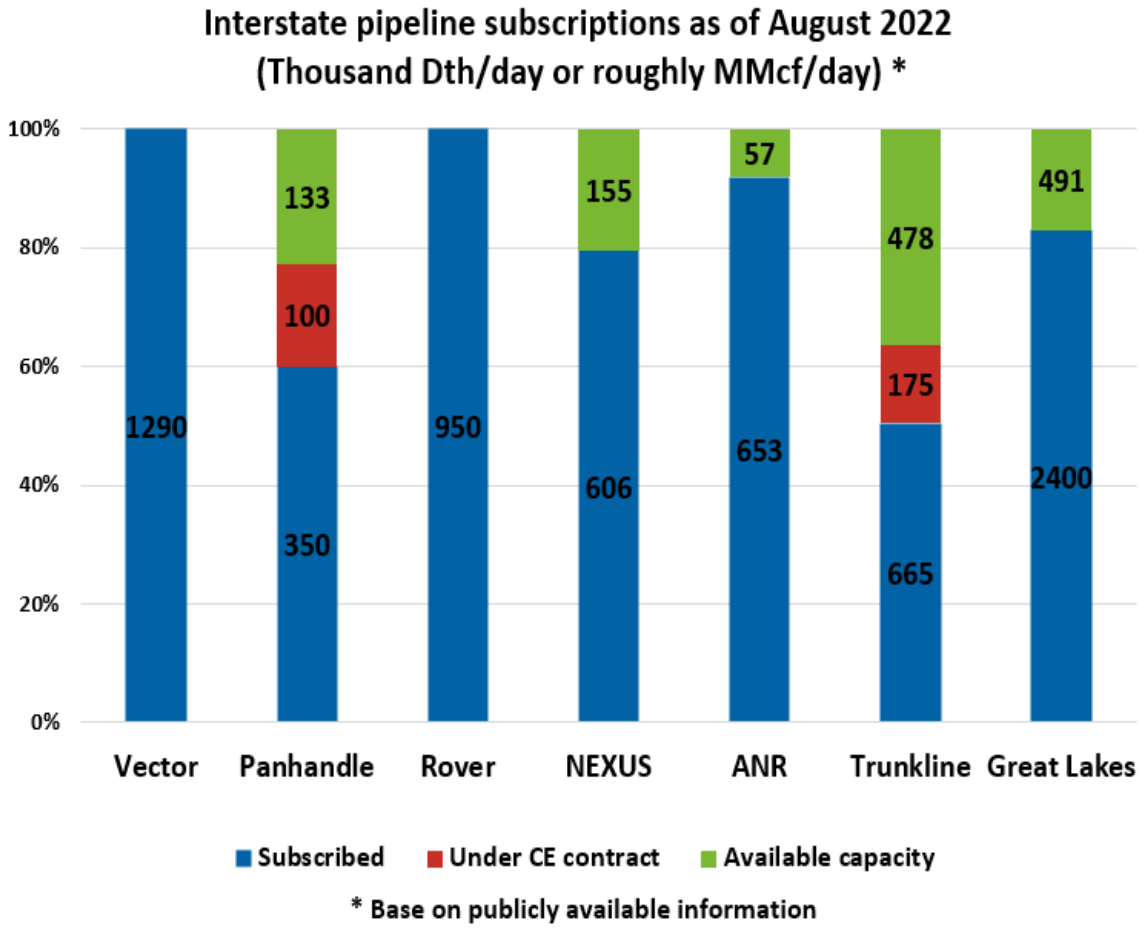
- City gate supply purchases provide advantages because they don't require fixed costs and are generally the least expensive supply option.
- City gate purchases are a resilient source of supply as suppliers have a variety of options and delivery paths due to the Company's flexible and adaptable system, with multiple interconnects and available compression capability; supplier options are more diverse and liquid than at other potential upstream purchase locations. Consumers Energy's system allows suppliers to bring the gas onto the system through its many interconnects, which is useful in situations such as a pipeline outage or system maintenance issue that prevents delivery to a specific point.
- Due to the Company's unique system configuration and requirements, and considering market fundamentals, the Company's current GCR Plan leverages the ample city gate supply in tandem with the Company's system investments to provide an economic, resilient, and reliable supply source for GCR customers, which has been stress-tested under a variety of circumstances.
  - Solid market fundamentals underpin the current GCR Plan's continued reliance on city gate supply. Nearby production in the Appalachian basin has doubled from 16 Bcf/day in 2014 to 35 Bcf/day through July 2022 (See Reference 3). Over that same period, more than 9 Bcf/day of incremental midstream takeaway capacity has been made available to bring this incremental production to our region (See Reference 9).
  - As noted earlier, Appalachian supply constitutes a third of total U.S. production. The increased regional supply availability has lowered the Company's city gate locational basis pricing over this period from a premium relative to the Henry Hub benchmark to a discount today, and this relationship is carried into the market's forward pricing for city gate supply. The Company does purchase the majority of its natural gas during the summer at lower prices, which helps reduce price and supply risk for customers.
- The Company balances city gate supply with continued reliance on some levels of FT, which has the benefit of expanding the supply footprint to a specific point beyond the city gate supply pool to provide price and supply risk diversification as well as enabling enhanced resiliency under certain circumstances.

The Company continually evaluates the evolving natural gas domestic market, and the impact to the gas supply portfolio, including an assessment of the FT contracts held. The Company could seek to add additional FT contracts to the GCR supply portfolio to address future supply, price, or resilience risk. However, some external constraints exist on the interstate pipeline network.

Depending on the interstate pipeline, there may be limited capacity available relevant to Company operating and planning needs.

Additional capacity may become available as existing contracts expire; however, many contract holders may have right of first refusal at the end of a contract. The following Figure 13 is based on publicly available information and reflects current interstate pipeline subscriptions and availability relevant to Consumers Energy's system.

Figure 13: Interstate Pipeline Subscription and Availability as of August 2022



As a result, despite some contracted capacity on those pipelines expiring, Consumers Energy may be limited in the ability to source meaningfully higher gas quantities from interstate pipelines. However, the Company will continue to monitor and communicate with the market, assess city gate supply options, and weigh the potential contracted capacity options as they become available within the context of Consumers Energy's broader system utilization and investment activities to ensure reliable, resilient, affordable, and clean natural gas delivery service.

C. References

1. https://www.eia.gov/todayinenergy/detail.php?id=45116
2. https://www.eia.gov/petroleum/drilling
3. https://www.eia.gov/outlooks/steo/report/natgas.php
4. https://www.eia.gov/petroleum/drilling/xls/dpr-data.xlsx
5. https://www.eia.gov/todayinenergy/detail.php?id=43115
6. ANDRUS, S.J. (2019). The Shale Gale turns 10. *IHS Markit*. January 23, 2019
7. Energy Information Administration Henry Hub spot prices reported daily for 1/1/97 through 10/15/18; Economist Intelligence Unit.
8. https://www.michigan.gov/documents/mpsc/gasrates_592543_7.pdf
9. https://www.eia.gov/outlooks/aeo/US Energy Information Administration – 2021 Annual Energy Outlook

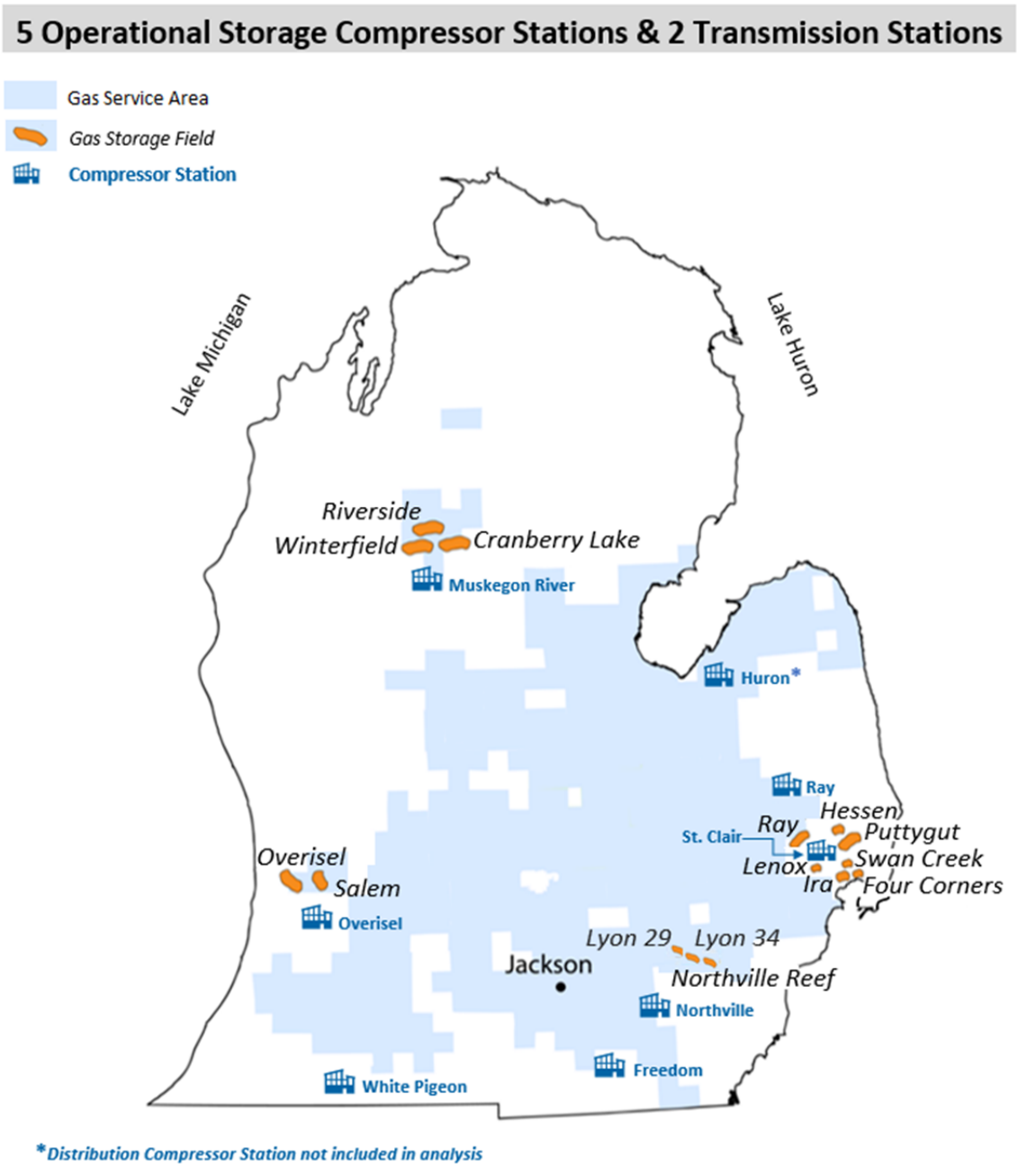
IV. Asset Classes

A. Storage Asset Plan

As a northern peninsula state, Michigan is geographically disadvantaged but geologically advantaged from a natural gas perspective.

Consumers Energy has 15 underground natural gas storage fields tapping into depleted hydrocarbon reservoirs deep underground through approximately 859 wells that tie into the Company's gas system. Figure 14 illustrates the location of the storage fields in relation to the compression assets.

Figure 14: Map of Michigan with Storage Field and Compressor Station Locations



The Company's storage assets are used to inject and withdraw natural gas to meet Michigan's winter energy needs as a safe, reliable, resilient, and low-cost alternative to traditional firm interstate transportation capacity. This storage capacity provides customer value by enabling the Company to purchase gas at lower prices in the summer and provides the capability to quickly adapt to customer demand and operational changes throughout the day, week, and month.

The flexibility of storage provides End User/Transport suppliers, Gas Customer Choice suppliers, and the Company the ability to purchase gas in ways that provide economic benefits while ensuring supply adequacy during periods of high demand. It also allows the Company to adapt to the demand of all customer classes due to warm or cold weather, and both planned and unplanned facility outages needed to support safe and reliable operations.

The storage fleet continues to play an important role during extreme weather situations and emergent operational changes by providing quick access to high volumes of gas that are geographically close to Michigan's demand centers at summer versus peak use pricing.

Michigan's winter demand peaks are due to residential heating and therefore significantly affected by weather conditions. These demand peaks often coincide with increased electric generation demand. Also, in contrast to electricity where energy moves instantaneously, natural gas moves at a slower speed.

Geographical proximity of gas storage to customer load provides a systemic advantage during the extremely cold winters. Growth of gas-fired generation to offset the retirements of coal-fired generation and support the maturation of renewable energy generation generally adds to the variation and peak needs during a day, therefore maintaining a safe and reliable storage asset portfolio is important to Michigan's electric reliability.

All the Company's gas storage fields are accessed through vertical or horizontal wells and are connected to compressor stations by storage pipelines. Improvements in field performance depend on the performance of the entire integrated facility since the gas flows through to get to the transmission system.

The Company's efforts to optimize overall field performance through multiple efforts (i.e., new wells, well rehabilitation, strategic plugging, etc.) are leading to better performing fields that allow for a more resilient overall system that can more readily adapt to system disruptions and customer demand each day. This provides quicker access to large quantities of natural gas than incremental pipeline supply purchases.

The storage fields provide approximately 149 Bcf of cyclic design capacity known as Working Gas. In addition to the natural gas cycled annually for customer use, a base level remains in place to ensure the field is adequately pressurized.

1. STORAGE ASSET MANAGEMENT

The Company's gas storage fields are segmented into baseload, intermediate, and peaking fields to serve different needs depending on daily, monthly, and seasonal demand deliverability requirements.

Storage fields in the system are used in three ways:

- Along with pipeline supply, baseload storage fields run daily during the winter to meet a foundation level of demand and provide more efficient supply paths to parts of the natural gas system further away from pipeline supply interconnects.
- Intermediate storage fields run during longer periods of higher demand.
- Peaker (and needle peaker) storage fields run during the extreme hours and days when demand changes quickly—typically in the early morning when customers start their day and their gas appliances.

Table 1 lists all of Consumers Energy's storage fields by type and the amount of working gas.

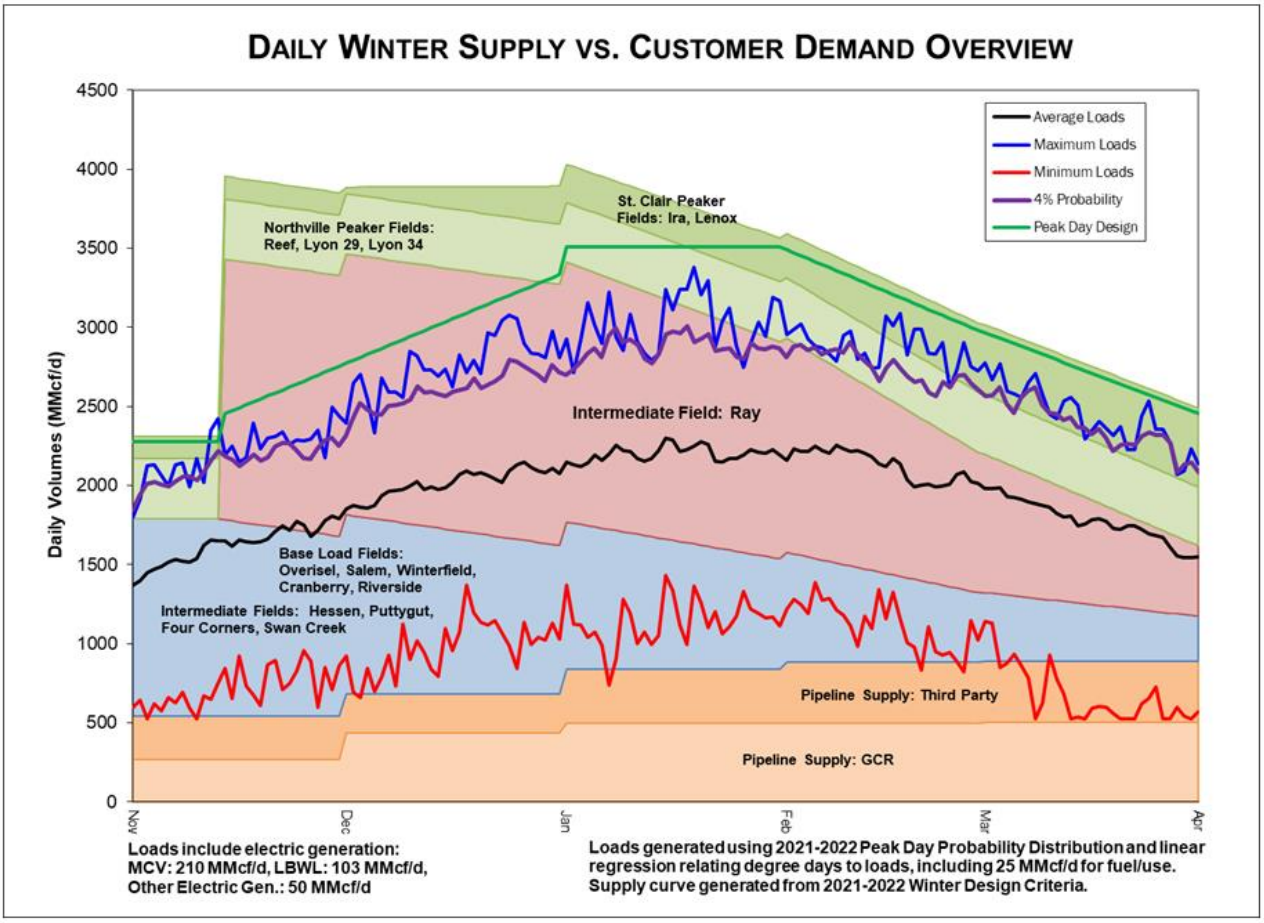
Table 1: Storage Field Types, Names, Working Gas, Base Gas, and Total Gas Volumes

Type	*Storage Field Name*	*Working Gas Volume (Bcf)**	*Base Gas Volume (Bcf)**	*Total Gas Volume (Bcf)**
Base	Winterfield	25.00	46.43	71.43
	Overisel	22.72	29.64	52.36
	Salem	11.46	18.67	30.13
	Cranberry	10.87	16.99	27.86
	Riverside	1.48	7.41	8.89
Intermediate	Hessen	12.35	4.42	16.77
	Puttygut	9.39	5.04	14.43
	Four Corners	2.36	1.37	3.73
	Swan Creek	0.41	0.23	0.64
	Ray	47.52	17.06	64.58
Needle Peaker	Ira	1.98	4.20	6.18
	Lyon 29	1.22	0.94	2.16
	Lenox	1.19	2.00	3.19
	Lyon 34	0.69	0.65	1.34
	Northville Reef	0.49	0.71	1.20
***NOTE:** All gas volumes are in MMcf at 14.65 psi dry pressure base				

Each storage field has unique reservoir characteristics, including different cyclic capacities. This includes the ability to efficiently maximize storage utilization through leveraging the design and mechanical condition of the wells, transmission pipeline, attached compressor station, and system operating conditions such as weather. During some situations additional supply can be sourced from storage if additional resources such as available compression units or higher storage inventory are available.

Figure 15 displays the wide variety of customer demand that needs to be considered as represented by the vertical space between the lime green (Minimum Loads) and the green (Design Peak Day) flows. Storage effectively allows for the variation in customer load as the Company can shut in or dispatch that supply as needed throughout the day.

Figure 15: Daily Winter Design Capacity and Loads



Delivery rate is the flow rate of gas per time (usually daily) that a specific storage field or well can provide. The above supply (Daily Volumes) are based on many assumptions and therefore Figure 14 is meant to help the reader conceptually understand how the Company's storage fields are used based on their capabilities.

Fields designated as needle peakers, such as Lyon 29, typically have high per-well delivery rate, but fewer overall wells, while baseload fields, such as Winterfield, tend to have higher well counts but lower overall deliverability on a per-well basis. Fields designated as intermediate fields also have relatively high deliverability characteristics as well as significant cyclic capacity which makes them suitable for both peaking and baseload operations. Storage field deliverability is directly tied to the amount of gas within them and as gas is removed from them to supply customers, their deliverability rate capability (Daily Volumes) decreases.

Consumers Energy's historical storage usage follows a similar annual pattern: generally steady injection from April to October and withdrawal from November to March. Injection and withdrawal plans consider the individual field capability and inventory as well as capability of the natural gas system and customer demand. Some fields take longer to fill or empty depending on their geology, inventory, and the use of compression. Their capability for accepting gas decreases as they are filled, and as field inventory decreases, the ability to provide supply decreases.

During the withdrawal season, baseload fields provide early winter gas, followed by intermediate fields such as Ray and needle peaking fields when the temperatures drop and customer demand increases. When temperatures rise storage fields can be shut in for hours or days to adapt to customer load. This shut-in capacity can be used to provide system resilience in the event of unplanned outages on the system impacting supply. The needle peaking fields serve multiple purposes:

- Use during peak/design or near peak/design days. Peaking fields may be needed when significant quantities of gas are required to meet customer demand. Because of its unique properties, the Ray field can be used as a needle peaker field when its inventory and gas conditioning equipment allow for it.
- These fields, depending on inventory, can be used to reduce interstate pipeline supply needed at the end of the winter season if they haven't been used during near design weather or beyond. They also can provide supply capacity reserve off peak/design for resiliency.
- The needle peaker fields diversify storage supply and reduce reliance on Ray to meet peaking needs and avoid relatively high fixed costs associated with interstate firm capacity and third-party storage. To aid in the reduction of our reliance on Ray, the Northville Gas Conditioning project is underway to help the fields provide quality gas when called upon.

Figure 16 and Figure 17 show Ray uniquely fills the roles of a peaker field (because it can deliver high rates of gas flow) and a baseload field because of its ability to hold a large volume of gas.

Figure 16: Daily Storage Field Injections (negative) and Withdrawals (positive) by Field from January 2015 - July 2022 (mmcf)

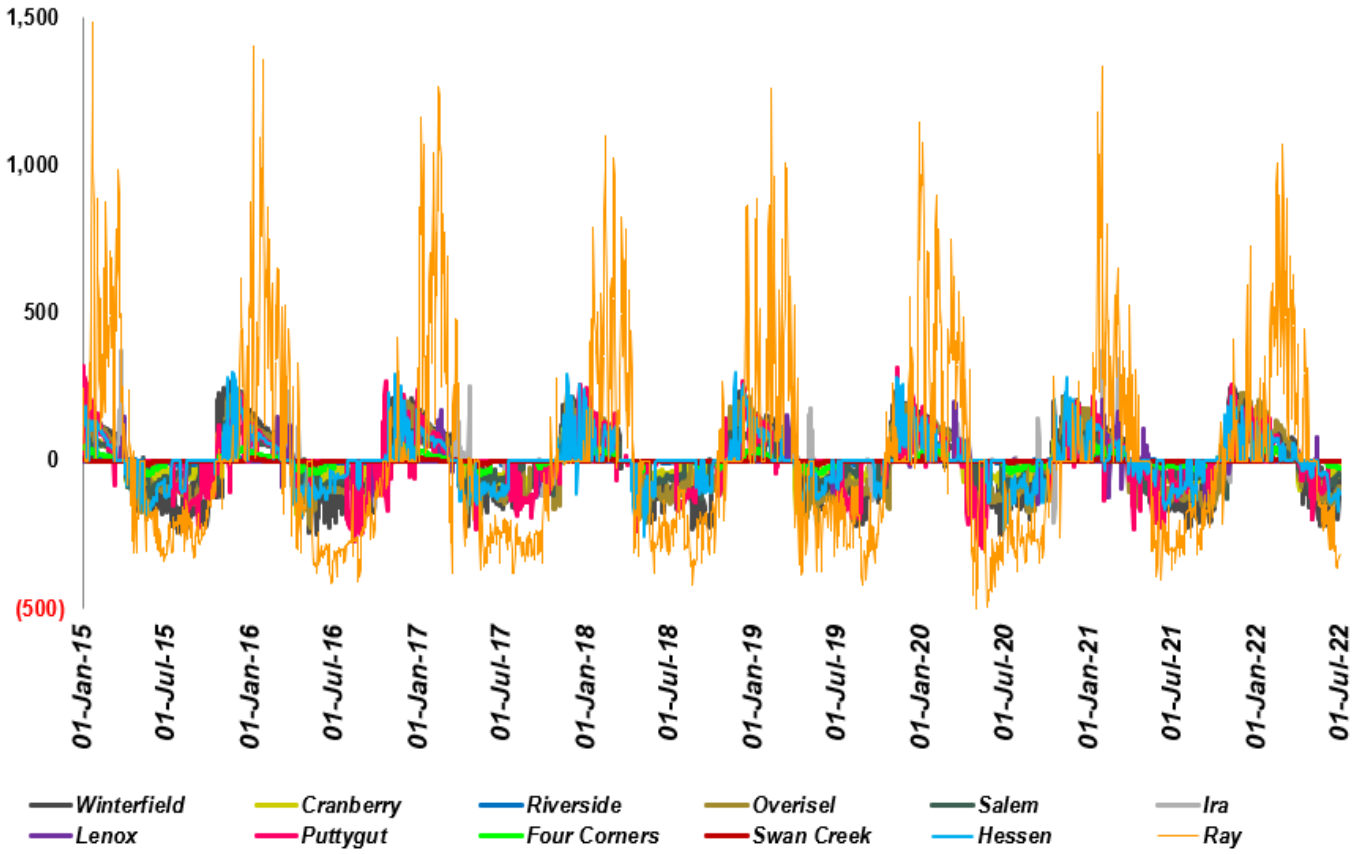
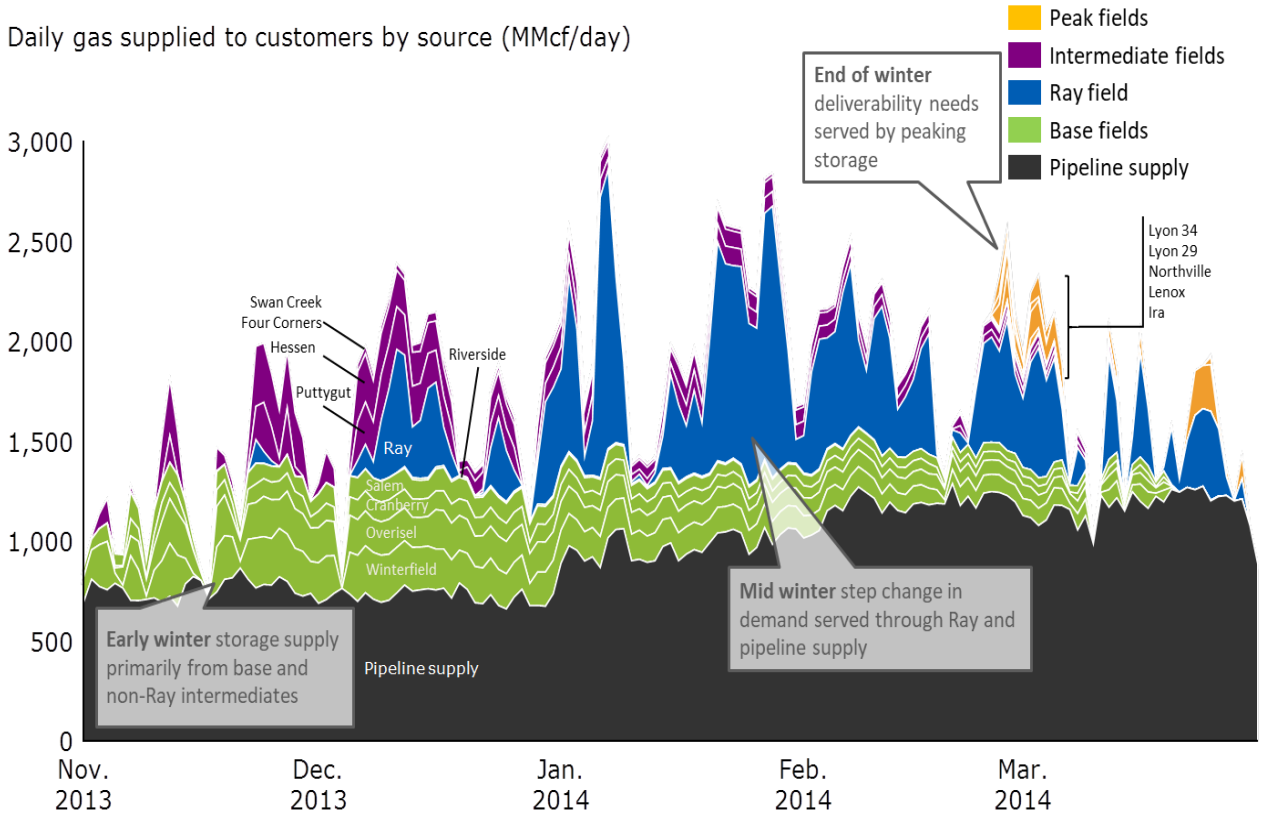


Figure 17: Gas Supply by Storage Field During Winter
(example from polar vortex of 2013-2014)



2. STORAGE WELL INTEGRITY PROGRAM

The key risk in storage field operations is degradation of the well, allowing gas stored in the reservoir below to escape and leak into the surrounding area.

PHMSA adopted the API RP 1171 by reference to establish code requirements for storage operators. The final rule for underground natural gas storage facilities was published by PHMSA in the 1st quarter of 2020.

Storage asset maintenance involves inspections (i.e., "logging"), repair, rehabilitation, plugging, and decommissioning for wells that provide less value to the customer than needed to justify remediation. In addition, new wells with horizontal drilling technology can be added to the system to enhance access to the storage field to replace decommissioned wells.

Well Inspections

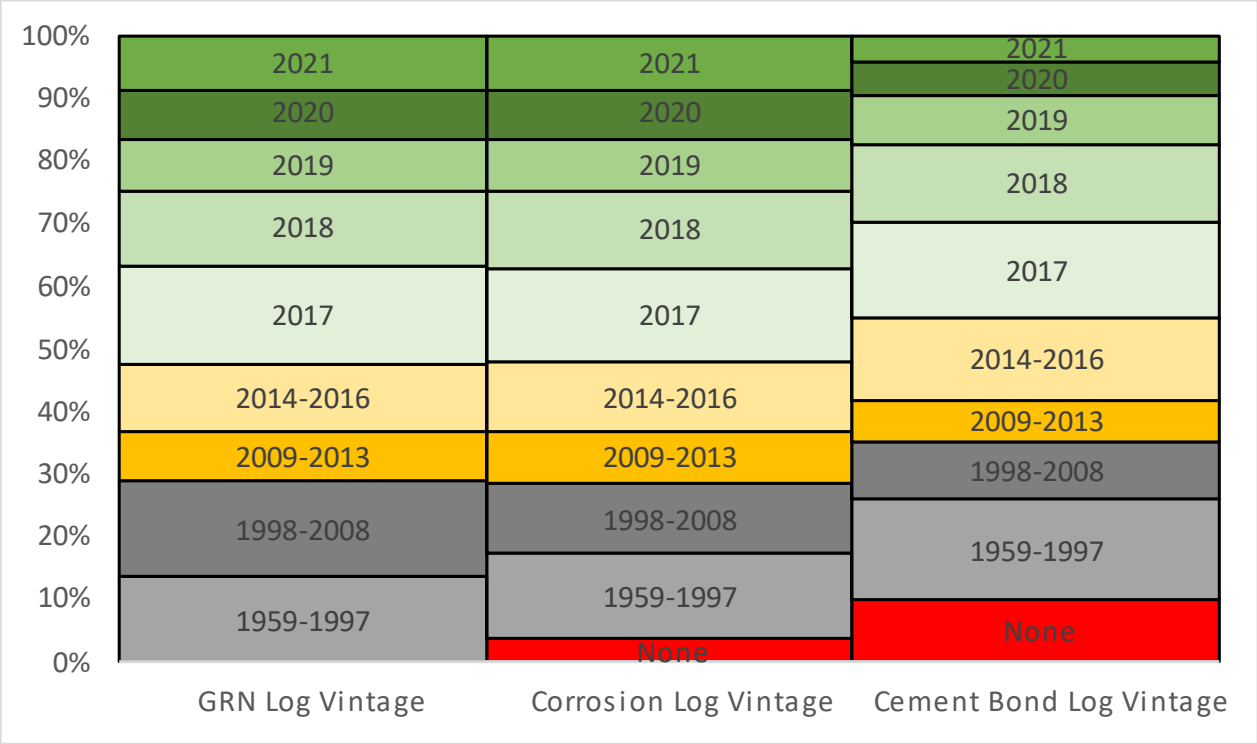
Consumers Energy inspects or logs wells to determine their current state and to assess risk.

The Company has reviewed the requirement outlined in 49 CFR 192.12, and the applicable API RP 1171. These procedures govern: operations, maintenance, integrity demonstration, and verification, monitoring, threat and hazard identification, assessment, remediation, site security, emergency response and preparedness, and recordkeeping requirements that needed to be developed by January 18, 2018, for all existing underground natural gas storage facilities.

- Integrity assessments of underground storage wells began in 2017 to support the anticipated compliance timeframe for completing all risk management activities.

- Based on these new requirements, all wells will have three current logs at the completion of the 10-year rehabilitation program. Figure 18 below outlines the portfolio of wells based on current or outdated/missing log information, highlighting the importance of well inspections going forward.

Figure 18: Breakdown of Storage Wells by Logging History (current vs. outdated or missing)



Well Rehabilitation

The Company's 10-year Well Rehabilitation Program began in 2017, following a PHMSA interim final rule to address underground storage safety issues.

This program involves remediating wells across Consumers Energy's storage portfolio to return them to 'like-new' condition as well as to comply with the baseline assessment period of the final rule from PHMSA.

- Primary benefits of the well rehabilitation include a safer and more efficient long-term storage operation by reducing risks stemming from factors such as corrosion, gas migration, leaks, and well integrity issues.
- Improved well deliverability.

New Well Drilling

The purpose of the program is to identify the best locations to drill new wells within the storage assets.

Important considerations include: the sequencing of well logging, remediation, new drilling, and plugging to ensure continued deliverability.

- Consumers Energy is taking a holistic system view that these activities follow a logical sequence. For example, new well drilling should precede well plugging and decommissioning if practical, to ensure short-term flow is not significantly compromised.

Options to accelerate drilling should be considered, when possible, to ensure remediation, new well drilling, and plugging follow an optimal schedule.

- Drilling new wells includes centralizing multiple wells to one location. This reduces overall operational maintenance and could reduce overall storage pipeline lengths.
- Using seismic mapping and reviewing of existing well information to place the well within the best part of the reservoir for increased deliverability while minimizing liquid production.
- Using safe drilling operations that provide a clean well for injection and withdrawal.
- New wells allow for drilling to current standards and potentially allow for plugging of aging wells that may present higher risk.

Well Plugging

Well plugging is performed on certain wells balancing risk with reliability and customer value.

- Plugging poor-performing, high-risk wells help reduce risk to the natural gas system.
- After a well is plugged, the Company can reduce its land footprint by restoring the area.

Plugging a well reduces methane emissions by reducing maintenance related venting, and fugitive emissions associated with system piping and wellhead components. **Storage Lateral Pipeline Replacement**

The purpose of the storage lateral pipeline replacement program is to replace and upgrade storage laterals based on their relative risk and their association with the other gas storage programs. Primary improvements anticipated from the program include:

- Installation of launcher and receiver barrels that allow for pipeline inspections.
- Potentially changing the pipeline length and size based on the new well drilling and well plugging programs.

These changes will help create a more efficient path for gas flow to the larger natural gas system.

3. STORAGE FIELD ASSET PLAN

In alignment with the Storage Well Integrity Program and based on scenario modeling completed in 2018 through the lens of Consumers Energy's four objectives, the Company assessed the potential retirement of four low-cyclic fields to consolidate the storage system.

These storage fields were: Swan Creek, Four Corners, Lyon 34, and Riverside. Collectively, these fields provide less than 1.5% of the Company's gas supply throughout the winter.

The model results indicated that three fields still provide value to the gas system and customers and showed that Riverside may be a viable candidate for retirement.

- Retiring Riverside would have minimal cyclic impact, given the small amount of working gas volume at 1.48 Bcf, but has other operational considerations because it directly supplies three small city gate stations.
- Riverside contains about 9% of the system's total number of storage wells. Retirement would eliminate an estimated 14% of total risk associated with storage wells, i.e., 5.8 metric tons of methane emissions.
- The remaining three fields represent just under 2% of the overall system risk and are currently providing significant supply resiliency. They also have a high deliverability to well count ratio that is used to supply peak demands.

Considering the items stated above, the Company has now decided to move forward with decommissioning the entire Riverside gas storage field. The Company's engineering team worked to review alternate supply options for the three city gates. As a result of the decision to decommission the field, there are multiple projects that span the distribution, transmission, and storage assets that are moving to the engineering phase of work. The execution schedule for these projects occurs between 2023 and 2027. Retirement of the Riverside storage field will reduce O&M expenses associated with these active storage and transmission assets.

The Company's Plan strives to reduce risk and cost while increasing deliverability and avoiding the capacity reduction that would impact GCR purchasing. As a result, the entire cost picture will be included in decisions going forward.

Figure 19 shows the combined approach of the Storage Well Integrity Program and the retirement of the Riverside storage field to reduce the total number of gas storage wells on the system over time.

Figure 19: Storage Well Integrity Program Overview

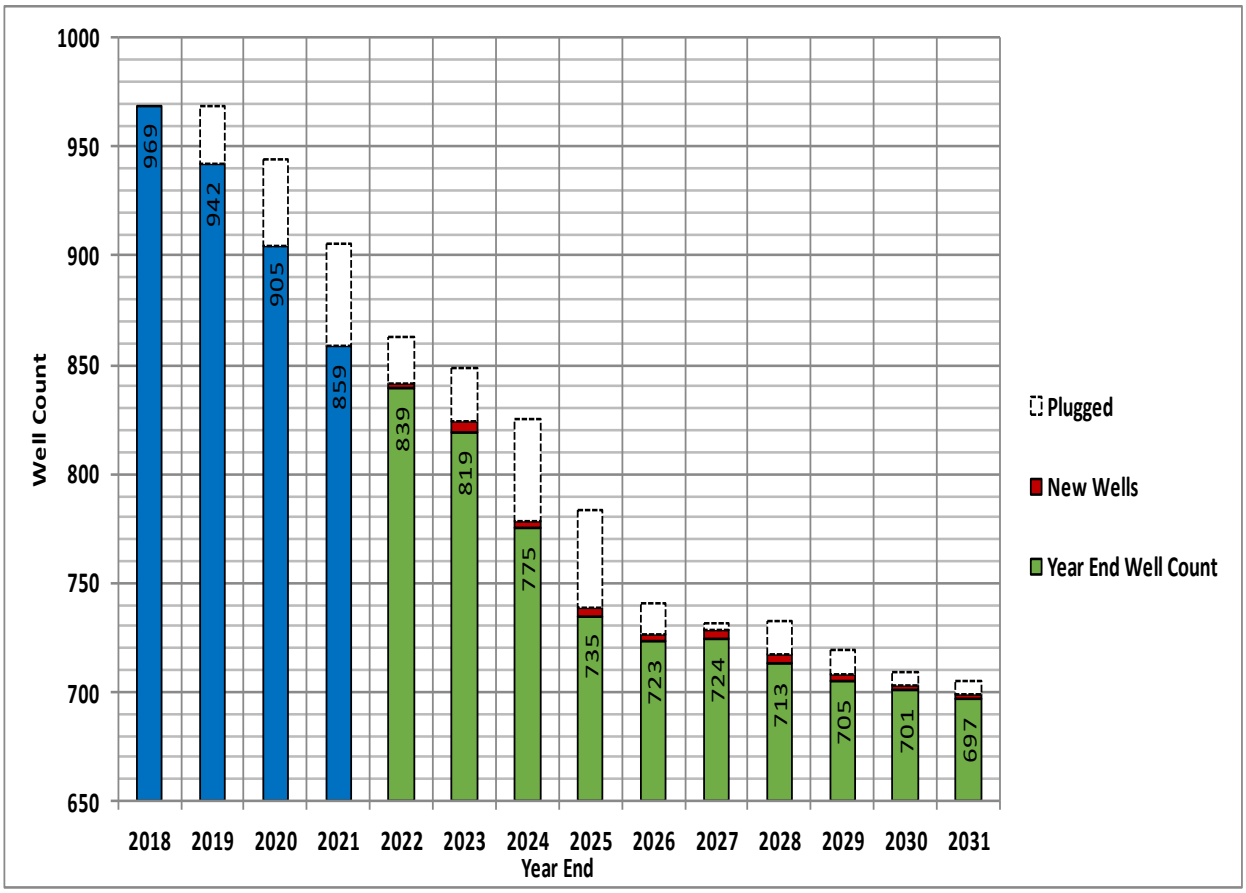


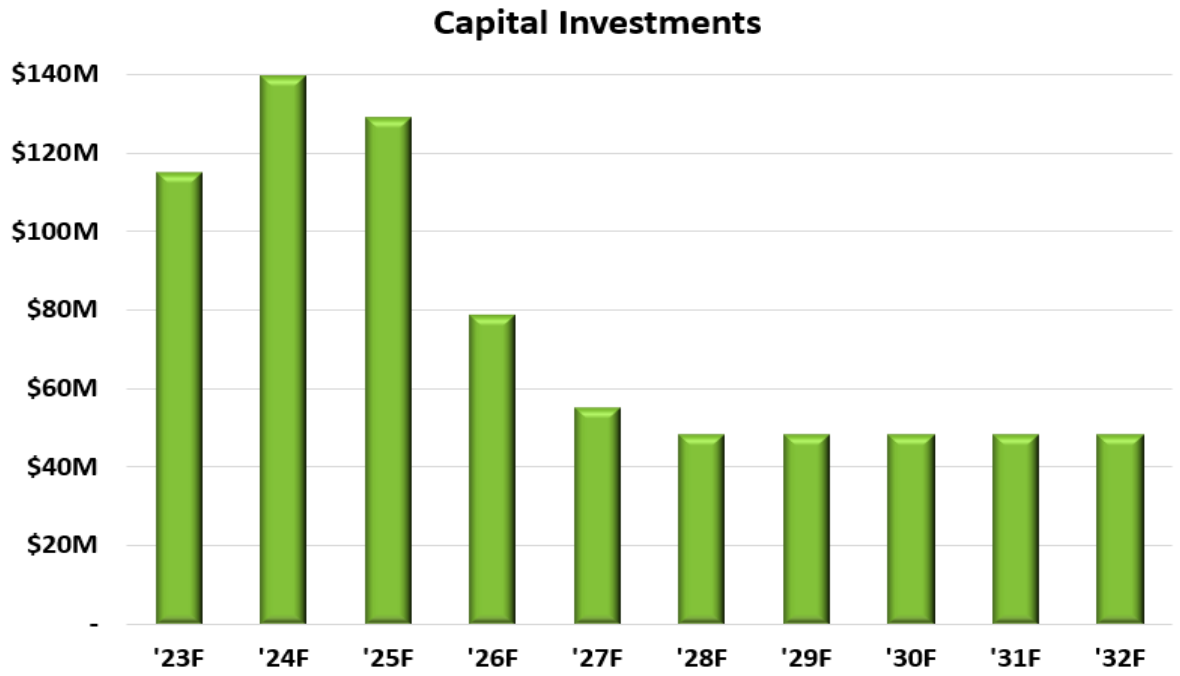
Figure 19 identifies that this Plan would reduce the overall number of wells, which will result in lower risk, operating costs, and lower methane emissions while ensuring system resiliency, deliverability of gas flow per well, and potentially improving gas quality resulting in less risk to compressor station operations and downstream facilities.

This reduction in the overall number of wells will have a minimal reduction in working gas capacity from an approximate current amount of 150.9 Bcf to a forecasted amount of 149.4 Bcf in 2027.

4. STORAGE ASSET FINANCIALS

Figure 20 shows the spending needed to efficiently and effectively execute the Storage Well Integrity Program and other investments in the storage asset area.

Figure 20: Storage Capital Investment Plan



This investment plan aligns with Company objectives by reducing asset risk (safe), increasing the deliverability of each remaining well (reliable), reducing the overall well count (affordable), reducing the emissions points in this system (clean), and positively affecting the natural gas system's resilience.

B. Compression Asset Plan

Consumers Energy has eight compressor stations that pressurize and condition natural gas for safe transport through the pipeline and distribution systems, as well as injection into and withdrawal from underground storage.

The compression fleet can be segmented, based on the purpose of the compressor station, into storage, transmission, and distribution stations, as described below in Table 2.

Table 2: Overview of the Four Types of Compressor Stations

Description	*Storage Compressor Stations*	*Transmission Compressor Stations*	*Transmission and Storage Compressor Stations*	*Distribution Compressor Station*
Purpose	Inject gas into and withdraw gas from underground storage fields. Condition gas as needed to meet customer needs.	Receive and transport gas throughout the gas delivery system. Condition gas as needed to meet customer needs.	Compression units are storage units that also provide transmission compression.	Boost gas pressure through the distribution system when agricultural processes such as grain drying increase demand in the rural Thumb region of Michigan.
Number of Stations & Station Names	***3 Stations*** • Ray • Muskegon River • St. Clair	***2 Stations*** • White Pigeon • Freedom	***2 Stations*** • Overisel • Northville	***1 Station*** • Huron

See Figure 14 for a map of Company compressor stations and the storage fields they support.

Consumers Energy operates the fleet with local Company personnel while monitoring it through Gas Control with SCADA. The Company monitors system pressures, flows, and key high-volume customers. The station control room is linked to the other utility back-up control rooms in real-time, per the control room standard for physical and cybersecurity assurance. Consumers Energy has a plan to upgrade its data historian systems to improve monitoring and system analytics.

Table 3 provides a more detailed summary of the compression units at the storage and transmission stations. At the completion of the Freedom Upgrade project in 2023, the station will have five Waukesha units totaling 18,750hp. The existing BA and TLA units will all be decommissioned by the end of the project.

Table 3: Summary of Compressor Units

Station	Mothballed/Retired				Operable			
	Units	# Units	Unit HP	Total HP	Units	# Units	Unit HP	Total HP
Ray	Quad	2	5,391	10,782	CAT 3616	5	4,735	23,675
	Turbines	2	3,538	7,076				
	Clark TCVD	1	6,000	6,000				
Muskegon River	HVC	2	3,286	6,571	TLA	2	3,400	6,800
					HBA	4	2,600	10,400
					Turbine(Suction boost)	1	10,076	10,076
					Turbine(Suction boost)	1	10,500	10,500
St. Clair					Waukesha	4	4,835	19,340
					T-4500	2	3,971	7,942
Overisel					TLA	4	2,700	10,800
Northville					TLA (Transmission)	2	2,700	5,400
					TLA (Storage)	2	2,700	5,400
White Pigeon	KVT	2	2,000	4,000	W-330	2	3,600	7,200
	W-330	2	3,600	7,200	CAT 3616	3	4,735	14,205
					V-250	2	2,000	4,000
					CAT 3608	1	2,370	2,370
Freedom	BA-5	10	1,000	7,000	Waukesha	5	3,750	18,750
	BA-6	2	1,200	2,400				
	TLA	1	3,400	3,400				
Huron					CAT 3512	1	1,035	1,035
System Total		**24**		**54,429**		**41**		**157,893**

1. COMPRESSION ASSET MANAGEMENT

The Company's 2021 system weighted average compression utilization of 19% is below industry average of about 50%. The utilization rate is a simple calculation using the amount of time that a compression unit is available to operate vs. the amount of time that it does operate.

Utilization is impacted by winter weather conditions and typically trends up when the winter is colder than normal, and a higher amount of storage is used. It will trend down when winter weather is warmer than normal, and a lower amount of storage supply is used. It also is affected by how and where gas is delivered by suppliers, the interstate pipeline delivery pressure verses company transmission line pressure, conditions outside of the Company's natural gas system, asset availability, and other factors.

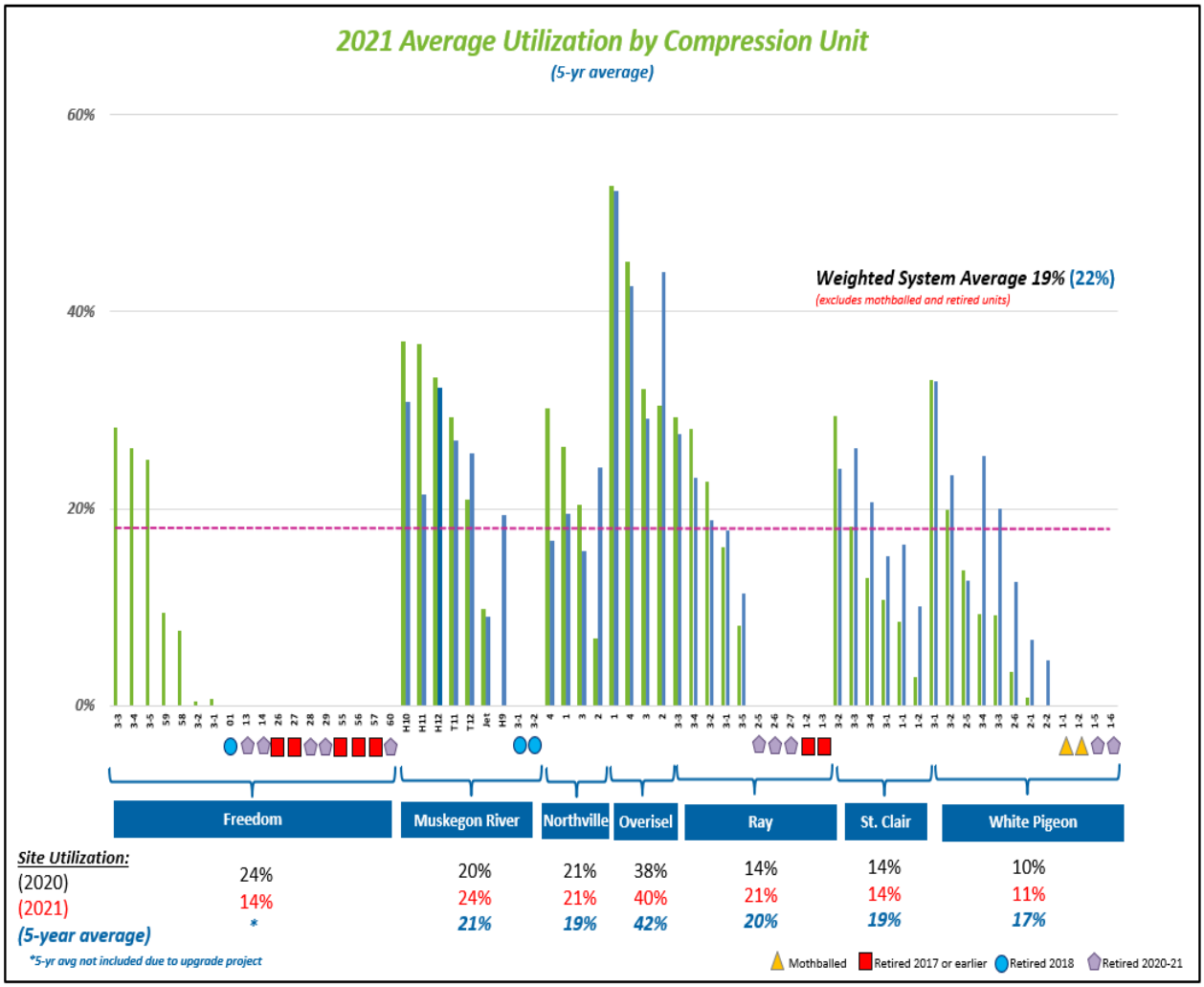
Overall, Consumers Energy doesn't anticipate compression assets having a utilization rate as high as the industry average due to the uniqueness of the Company's natural gas system.

- The Company's compression assets are used more to serve the peak day and seasonal needs of the Company's storage assets, both for injection and withdrawal. Some compression assets are needed to ensure reliability at the station to avoid negative impacts to our customers as well as to provide the flexibility necessary to enable use of citygate supply as described above in the *Ongoing Refinement of Supply Plans* sections.
- Another consideration, given the locational supply flexibility offered by the Company's natural gas system, is that interstate pipeline supply-focused compression may fall below industry average utilization depending on market pricing conditions.

The fact that the system is designed for conditions it must meet but doesn't see every day has provided affordability, reliability in near design conditions, system resilience, and allowed the Company to adapt to outages and unforeseen operating conditions, all of which speaks positively about its ability to deliver gas to our customers everyday throughout the year.

However, the Company believes that an increase from the current 19% compression utilization is possible and can be achieved through efforts to improve the reliability of compressor stations and allowing the retirement of some aging units. This will increase the utilization of the other compressor units and will be accomplished while considering the Company's natural gas system's resilience and supporting that system's maintenance needs. Figure 21 illustrates the 2021 utilization of each compressor unit.

Figure 21: 2021 Average Utilization by Compressor Unit



This chart includes mothballed units—these are units not currently in service. Overall, the Company has a goal to achieve 30-40% utilization for the entire compressor fleet (as previously defined).

Currently, daily compression data is not easily accessible nor consolidated across the system because it is in handwritten ledgers at each station. In addition, the Daily Gas Report database is limited regarding compression information because it only accesses a select pool of information from the Gas Control SCADA/Citect system and there are historical accuracy issues. The plan to address this deficiency is to address it through the gas compression historian upgrade.

In 2022, Gas Compression initiated the Gas Compression Digital Mobility Project that will increase productivity by eliminating the need to return to a desktop computer or kiosk to complete work, improve quality by using software technology, improve accuracy by recording information just in time and done at place of work, and improve safety by providing access to safety information on location.

This will be followed by the roll out of Digital Work Management Projects in 2023 that will provide value to the Company through increased productivity by reducing the need to return to the desktop kiosk for updates, improved quality through increased accuracy of updates completed at the time and place of work, and improved safety through real-time information used at work sites rather than printed procedures.

The Compression Demand Schedule as seen below, is a communication tool that describes how much hp is needed at each station to meet planned needs for anticipated operational conditions, including design conditions. RORs are used to analyze potential compression buffer or shortfalls in terms of units and hp at each station.

The Company is the supplier of last resort and must be prepared for design conditions that are not regularly seen, and that contribute to lower than peer compression utilization. Figure 22 shows the monthly compression demand schedule that indicates the required quantity of units, hp, and projected peak demand months for each station.

Figure 22: 2022 Monthly Compression Demand Schedule (Example)

2022 MONTHLY COMPRESSION DEMAND SCHEDULE (6-24-2022)

				WITHDRAWAL			INJECTION							WITHDRAWAL	
Compressor Stations	#Units	Unit HP	Total HP	Jan 2022	Feb 2022	March 2022	April 2022	May 2022	June 2022	July 2022	Aug 2022	Sept 2022	Oct 2022	Nov 2022	Dec 2022
WHITE PIGEON	Min Req'd HP***			18,670	18,670	18,670	18,670	18,670	18,670	18,670	18,670	18,670	18,670	18,670	18,670
W-330 (2-5,2-6)	2	3,600	7,200	4	4	4	4	4	4	4	4	4	4	4	4
CAT 3616 (3-2,3-3,3-4)	3	4,735	14,205												
V-250 (2-1, 2-2)	2	2,000	4,000	1	1	1	1	1	1	1	1	1	1	1	1
CAT 3608 (3-1)	1	2,370	2,370												
Unavailable Units (Notes)															
FREEDOM	Min Req'd HP			8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	11,250	11,250	11,250	11,250
Waukesha (3-1,3-2,3-3,3-4,3-5)	5	3,750	18,750	2	2	2	2	2	2	2	2	3	3	3	3
BA Plt 2 (58,59)	2	1,000	2,000	1	1	1	1	1	1	1	1	0	0	0	0
Unavailable Units (Notes)	Plant 1 retired											Plt 2 unavailable	Plt 2 unavailable	Plt 2 unavailable	Plt 2 unavailable
OVERISEL	Min Req'd HP			8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100
TLA (1,2,3,4)	4	2,700	10,800	3	3	3	3	3	3	3	3	3	3	3	3
Unavailable Units (Notes)	Fuel gas & Unitized cooling project			fuel gas	fuel gas		Unitized cooling	Unitized cooling	Unitized cooling	Unitized cooling	fuel gas				
RAY	Min Req'd HP			-	23,675	23,675	14,205	14,205	18,940	18,940	23,675	23,675	23,675	18,940	-
CAT 3616 (3-1,3-2,3-3,3-4,3-5)	5	4,735	23,675	0	5	5	3	3	4	4	5	5	5	4	0
Unavailable Units (Notes)															
ST. CLAIR	Min Req'd HP***			22,222	22,222	22,222	12,702	12,702	14,280	14,280	14,280	14,280	14,280	12,702	12,702
Waukesha (3-1,3-2,3-3,3-4)	4	4,760	19,040	5 Units	5 Units	**5 Units	3 Units	3 Units	3	3	3	3	3	3 Units	3 Units
Turbine (1-1,1-2)	2	3,971	7,942						Turbines used only while Field Pressures allow for injection						
Unavailable Units (Notes)															
MUSKEGON RIVER	Min Req'd HP***			26,019	26,019	14,600	8,600	8,600	8,600	8,600	8,600	8,600	8,600	14,600	25,100
TLA (T-11, T-12)	2	3,400	6,800	2	2	2	1	1	1	1	1	1	1	2	2
HBA (H-9,H-10,H-11,H-12)	4	2,600	10,400	3	3	3	2	2	2	2	2	2	2	3	3
Turbine (Suction Boost-existing)	1	10,500	10,500	1	1	0	0	0	0	0	0	0	0	0	1
Turbine (Suction Boost-new)	1	11,419	11,419												
Unavailable Units (Notes)	New turbine ETA late 2022 H-9 Rebuild through Summer 2022			H-9	H-9	H-9	H-9	H-9	H-9	H-9	H-9				
NORTHVILLE	Min Req'd HP			5,400	5,400	5,400	2,700	2,700	2,700	2,700	5,400	5,400	5,400	5,400	5,400
Unit 1&2 (Transmission)	2	2,700	5,400	1	1	1	1	1	1	1	1	1	1	1	1
Unit 3&4 (Storage)	2	2,700	5,400	1	1	1	0	0	0	0	1	1	1	1	1
Unavailable Units (Notes)															
Total	42		159,901	88,911	112,586	101,167	73,477	73,477	79,790	79,790	87,225	89,975	89,975	89,662	81,222

Minimum required horsepower reflects what is required to pump Design rates, backup engines are required for planned and unplanned outages.
* Ray HP in November required up to the start of Ray field survey, 2 units available post survey
** St Clair turbines are availabe for March withdrawals if base field pressures allow or for use with peaker fields
*** If the indicated number of units cannot be met then other units (engines or turbines where applicable) must be substituted to try to meet HP Demand requirements even if there is no requirement for the units

The demand schedule highlights the variation in monthly peak demands for storage and transmission compressor stations. In general, storage compressor stations tend to have greater variability in hp requirements month-to-month as they are used to adapt to varying customer demand while meeting summer injection and winter withdrawal needs.

- The lower hp utilization at St. Clair and Ray reflects how the Company uses the capability of those facilities to adapt to operational conditions. This reflects their ability to be adjusted as needed to meet continuously varying customer demand and system conditions.
- High utilization of most of the hp typically occurs when those facilities are using field inventory and that compression is needed for withdrawal, which occurs later in the winter, generally during February and March.

Late season focus remains on cycling the base fields to reduce the risk of gas migration in the fields, and this results in some stations utilization being comparatively low. That hp is necessary for supply reliability in meeting design winter conditions and system resilience. Using compression to cycle fields allows the Company to hold inventory in more prolific storage, and thus reduces the need to procure large quantities of more expensive pipeline transportation and supply during the winter, which is not guaranteed to be available.

Peak day demands, including those that may be associated with gas-fired generation, are expected to primarily be met with peaking storage at Northville, St. Clair, and Ray, given their high deliverability characteristics and their ability to be used to respond throughout the day needed by the varying electric generation load.

- To manage reliance on Ray, and to support the system resilience, hp is needed to refill Northville and St. Clair after a peak demand period in the winter to facilitate more frequent cycling of the needle peakers.
- The lower utilization at White Pigeon reflects market conditions and locational pricing that is currently more favorable for supply to be received through Freedom and Northville.

Swings in utilization at the transmission compressor facilities will vary with market conditions and planned and unplanned upstream facility outages.

Maintaining access to supply and flexibility for changes in the location in supply helps keep consumer market prices lower and the natural gas system more resilient.

Transmission compressor stations, on the other hand, have more stable daily and monthly peak demands to meet ongoing gas demand and transport needs throughout the year. While this is true, there are changing conditions at those stations throughout the year that affect utilization, like available interstate pipeline pressures.

2. COMPRESSION ASSET PLAN

Based on the scenario modeling, five long-term recommendations for compression reflect new operating realities and align with the Company's objective of continuously improving the system's reliability and resiliency. The recommendations are:

a. Accelerate the implementation of preventative maintenance program and practices, and gradually implement more predictive technologies.

b. Decommission retired/mothballed compressor units

c. Optimize the fleet of compressor units at Muskegon River to meet volume and pressure requirements.

d. Evaluate contingency options for resiliency and opportunities that mitigate risk of outages at the compression stations.

e. Assess feasibility of retiring additional compression assets to focus investment on most critical units and optimize portfolio.

f. Implementation of API RP 1164 Cyber Security.

The following sections describe each recommendation in more detail.

Implement Enhanced Maintenance Program and Practices, and More Predictive Technologies

Consumers Energy will enhance maintenance practices to ensure the implementation of more proactive and efficient prevention programs. This will eliminate expensive, reactive events, improve the compression fleet's ROR, reduce downtime and overall maintenance costs.

The Company's current compression maintenance practices don't allow for analytics-based decision making or preventative and predictive maintenance. This is primarily due to the following:

- Compression is operating on a break-fix cycle.
- Maintenance data (such as failure records and work order maintenance logs) is incomplete.
- Equipment condition data, such as temperature and in-flow pressure, is limited.

The Company also needs to improve record-keeping practices across compressor stations because there is no standardized entry methodology or nomenclature for SAP entries. Station performance and maintenance schedules and data are stored separately at each station in local templates. Investing in digital infrastructure will enable these important factors to be standardized across the fleet, and for performance monitoring and improvement to occur more efficiently.

Decommission Retired or Mothballed Compressor Units/Auxiliary Assets

Currently, there are 22 retired or mothballed compressor units not being operated. But all those units have not been officially retired, disconnected, and removed from the system.

The retired or mothballed units, are located at Muskegon River, Freedom, St. Clair, Ray, and White Pigeon:

- Muskegon River –Two HVC units (3-1 & 3-2)
- Freedom – Ten BA-5 units (13, 14, 28, 29, 55, 56, 57, 58, 59, 60), two BA-6 units (126, 127) and one TLA unit
- Ray – Two Quad units (1-1, 1-2), two turbines (2-5, 2-6) and one Clark TCVI (2-7)
- White Pigeon – Two KVT units (1-1, 1-2) and two W-330's (1-5, 1-6)

To meet this decommissioning goal, the Company will develop business cases for the unused units and auxiliary assets, complete stage gate reviews, create detailed execution plans, and document resource requirements.

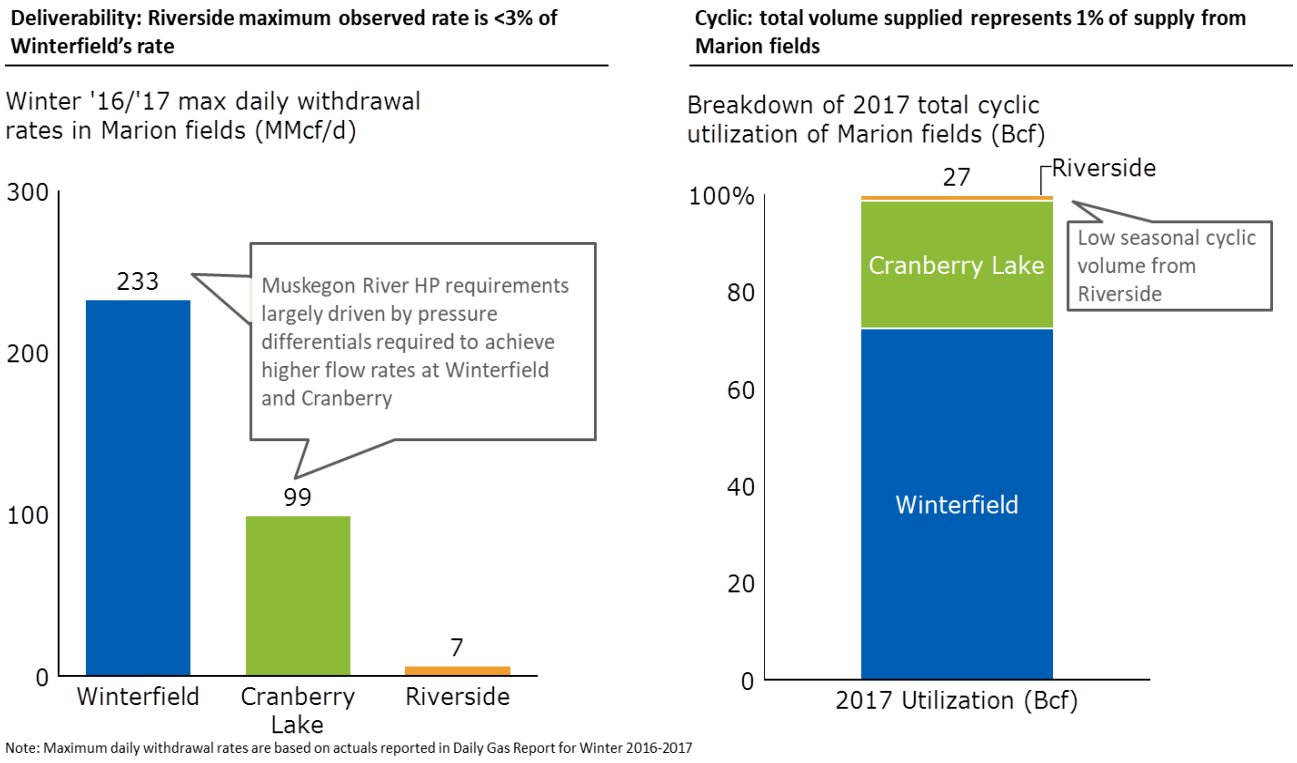
Four KVG units (306, 316, 319, 320) at Muskegon River were decommissioned during 2020 and three HVC units (2-2, 2-3, 2-4) at St. Clair were decommissioned in 2021-2022. Engineering and planning activities are underway to support decommissioning activities at Ray, Muskegon River, and White Pigeon. The existing units in Plant 1 and Plant 2 at Freedom will be decommissioned after the completion of the Plant 3 Upgrade project.

Optimize Fleet of Compressor Units at Muskegon River to Meet Volume and Pressure Requirements

With the decision made to retire the Riverside storage field complete, another high-level evaluation was completed that determined the Muskegon River compressor station without the Riverside station still brings value to the system:

- The Muskegon River storage compressor station will still be used to pressurize gas to inject into and withdraw from two storage fields at Marion: Winterfield and Cranberry Lake.
- Muskegon River hp requirements are largely driven by pressure differentials required to achieve higher flow rates at Winterfield and Cranberry Lake, and the total cyclic volume supplied from Riverside is 1% of the supply from Marion field, as shown in Figure 23. Replacing the antiquated suction boosting compression with a new turbine will enable more reliable suction boosting and higher cycling from the remaining Marion storage fields. Therefore, the impact at the Muskegon River compressor station from retiring Riverside is minimal, if any.

Figure 23: Maximum Daily Flow and Cyclic Capacities for Storage Fields Supported by Muskegon River (i.e., at Marion)



Note: Maximum daily withdrawal rates are based on actuals reported in Daily Gas Report for Winter 2016-2017

In the near term, the plan is to keep the fleet of operational compressor units at Muskegon River and look for opportunities to further optimize the fleet based on the deliverability of Winterfield and Cranberry Lake.

Consumers Energy is optimizing the fleet of compressors at Muskegon River to meet volume and pressure requirements by:

- Completing the retirement of Plant 3 HVC pressure boosting units due to their age and ROR performance (2018).

- Completing installation of an in-kind replacement for suction boosting turbine. (Commissioning in winter 2022-23)
- Retiring the existing turbine after the installation of the new turbine is complete.
- Rebuilding to like-new the existing HBA and TLA units to extend their useful operating life.

Evaluate Contingency Options for Resiliency and Opportunities that Mitigate Risk of Outages at Compression Stations

The Company will be further analyzing resiliency in Compression, Storage, and Transmission (since that was a direct linkage to the January 2019 Ray fire event), including gas flow path analysis and review of design improvements and hazard assessments.

A logical review of interrelated systems will occur in a manner that can identify specific potential failure points and quantifiable impacts. The components reviewed are typical of the following:

- Compression: compressors and engines including coolers, unit control and unit specific auxiliaries
- Gas Conditioning equipment
- De-hydration equipment
- Natural Gas Heaters
- Slug catchers
- Filter-separators
- Scrubbers
- Mechanical-Structural
- Main Gas Headers
- Isolation and control valves, regulators, and fire gate valves
- Fuel / Pilot Gas Systems
- Compressed Air Systems
- Electrical Instrument & Controls
- Transformers, Switchgear, MCCs, Panels
- Station Control and Network Systems
- Instruments

In addition, the Company will evaluate the overall gas compression system to identify recommended investments to support an overall increase to system resiliency:

- Areas that will be evaluated include, but are not limited to, a bypass out of the Ray Storage facility directly into the transmission pipeline system, mitigation of single point failures in the system, and fleet-wide system improvements.
- Results from site hazard assessments and focused self-assessments have been used to evaluate each station to make recommendations to standardize system design to mitigate overall risk to the system.

Annually Assess Feasibility of Retiring Additional Compressor Units to Prioritize Investment on Most Critical Units for an Optimized Portfolio

The Company will annually assess the feasibility of retiring additional compression assets to prioritize investment on the most critical assets for an optimized portfolio. This includes the following:

- Monitor signposts such as reliability, performance and load changes over time.
- Evaluate station/asset reliability and required units.
- Incorporate system resilience assessments.

- Assess station layout risk and developing mitigations.
- Develop business cases for retirements/additions.

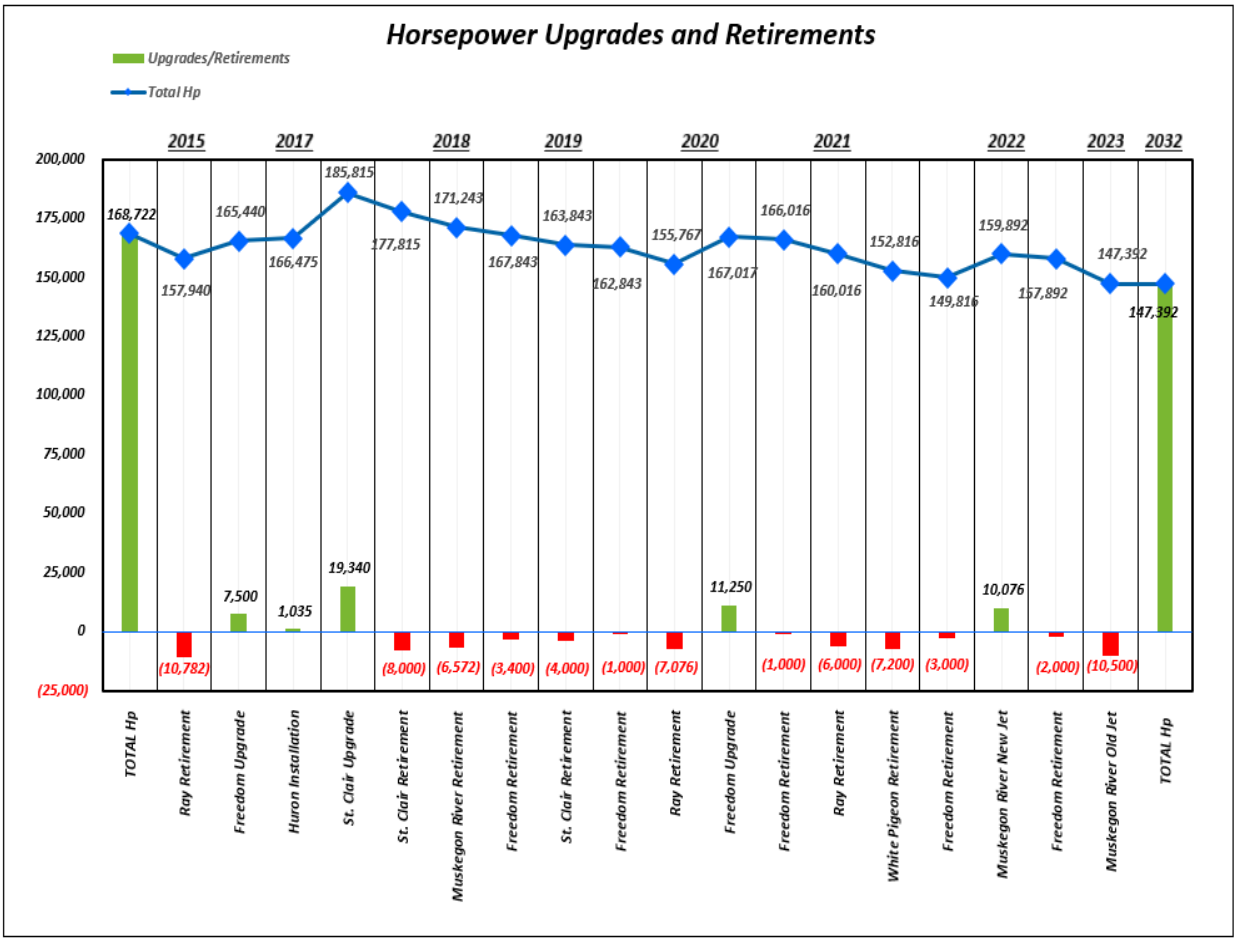
A transformation of compression maintenance practices to be more predictive and proactive, for example, will reduce ROR and increase the reliability and performance of compression assets.

Once reliability improvements have been demonstrated, the Company will evaluate the compression portfolio to identify the appropriate number of reserved capacity assets and amount of capability required at each station to meet peak demand. This aligns with the Plan's aim to improve supply resiliency and system optimization, including increasing the weighted average compression utilization rate as one of the 10-year outcomes.

Furthermore, the Company will monitor other factors that may impact the evaluation of whether to retire or upgrade compressors over time. For example, increasing market supply, storage cycling, or storage deliverability via compressor stations such as Overisel and Northville may require increasing hp at these two stations to reliably handle the increase in peak or seasonal throughput.

Figure 24 shows the Company's current plan to optimize the compression fleet with an approximate net reduction of 21,328 hp from 2014 to 2032 without impacting customer deliverability.

Figure 24: Compression Fleet Optimization (2014-2032)



Implementation of API 1164 Cyber Security Upgrades

The Company will work to implement major modifications to the gas SCADA environment to ensure compliance with API 1164, Transportation Security Administration ("TSA") cyber security standards, and the internal Operational Technology Security Reference Architecture ("OTSRA").

- Within this charter, the API RP 1164, TSA, and OTSRA requirements will collectively be referred to as the "Gas Security Standards."
- The project will design, acquire, install, and implement network equipment, processes, and site modifications needed to comply with the Gas Security Standards.

Key Objectives:

- Modernize and standardize the gas SCADA networks at the gas compressor stations and control rooms.
- Mitigate cyber security vulnerabilities in the gas SCADA networks.
- Allow Consumers Energy to fully comply with the Gas Security Standards.
- Fulfill the Company's commitment to the MPSC to provide a secure gas system to meet customer needs.

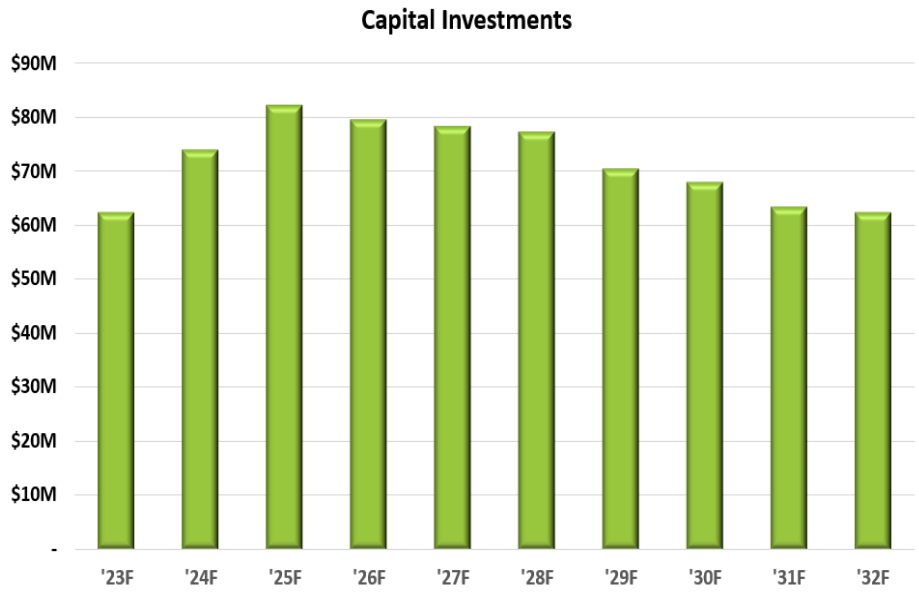
In addition to meeting the API RP 1164 standard, the systems will be upgraded to be compliant with the Consumers Energy OTSRA, and the recently expanded TSA Pipeline Security Guidelines.

3. COMPRESSION ASSET FINANCIALS

Based on the modeling and planning to date, the forecasted capital investment plan for the Company's compression assets is shown in Figure 25.

This capital investment plan will be updated routinely as the assessments are completed, and business cases are created to support the necessary spend plan in the future.

Figure 25: Compression Capital Investment Plan



Overall, this investment plan for the compression asset aligns with the Company's objectives by reducing asset risk (safe), increasing the lowering of the ROR and increasing utilization rates (reliable), reducing the number of outages during the winter seasons (affordable), and reducing the amount of equipment emissions (clean).

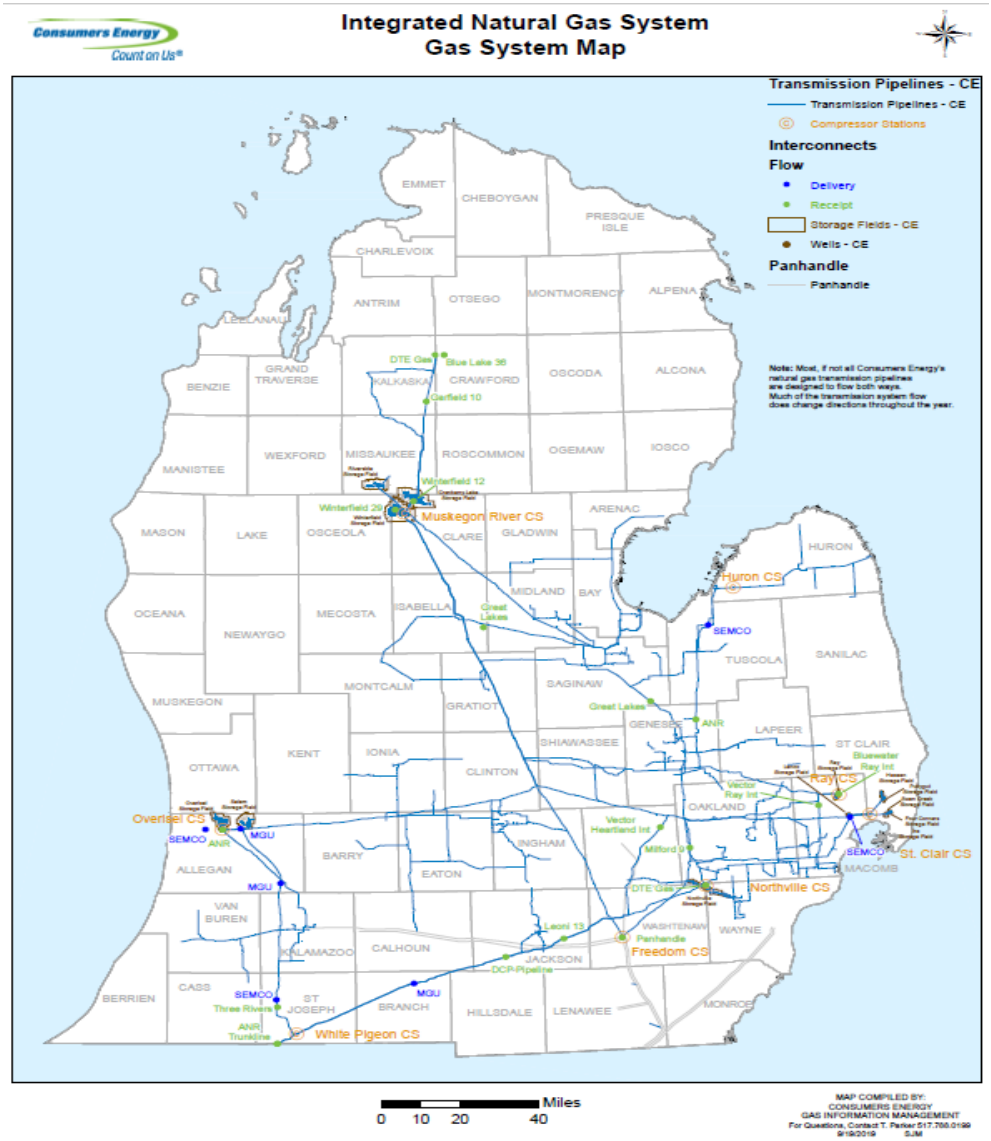
C. Transmission Asset Plan

The Company's transmission system is the 'expressway' of the gas system, transmitting large quantities of gas in pipe diameters ranging from 4 inches to 36 inches, at high pressures. Per the Company's 2021 Transmission DOT Report filing, there are 2,380 miles of pipeline that consists of:

- 1,576 miles of mainline pipelines—pipeline that the Company operates that connects with interstate supply
- 22 miles of pipeline within compression stations
- 259 miles of storage pipes—pipeline connecting from transmission to storage supply
- 523 miles of TOD, which are higher pressure distribution pipeline downstream of city gates but operating at transmission pressures and maintained using transmission standards

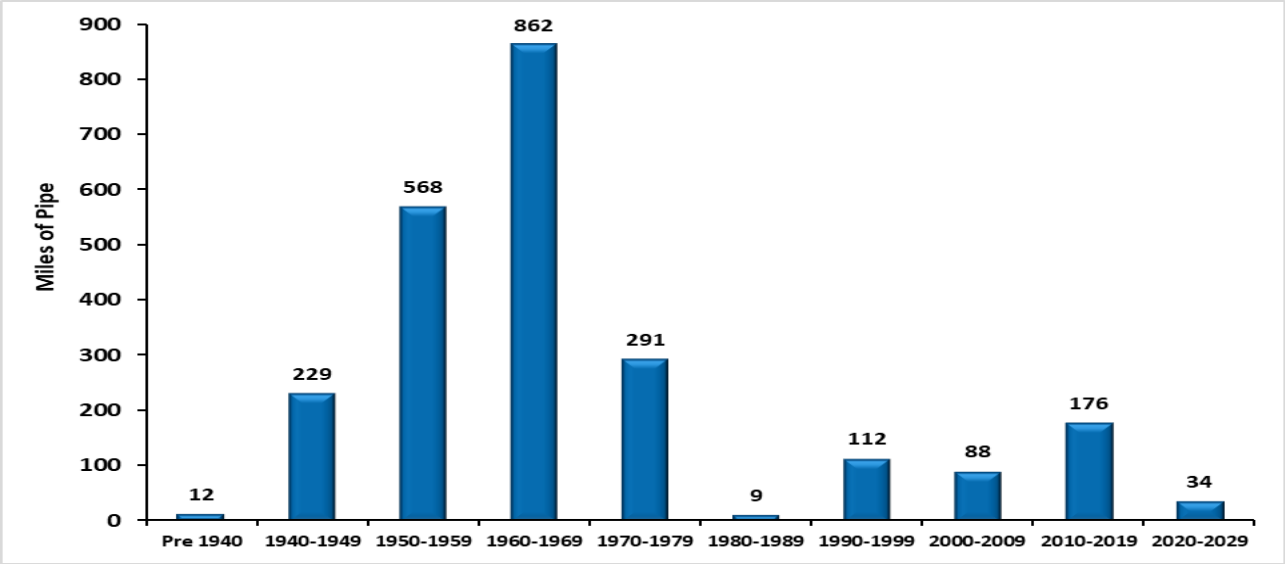
Figure 26 provides an overview of the Company's transmission system.

Figure 26: Map of Integrated Natural Gas Transmission System



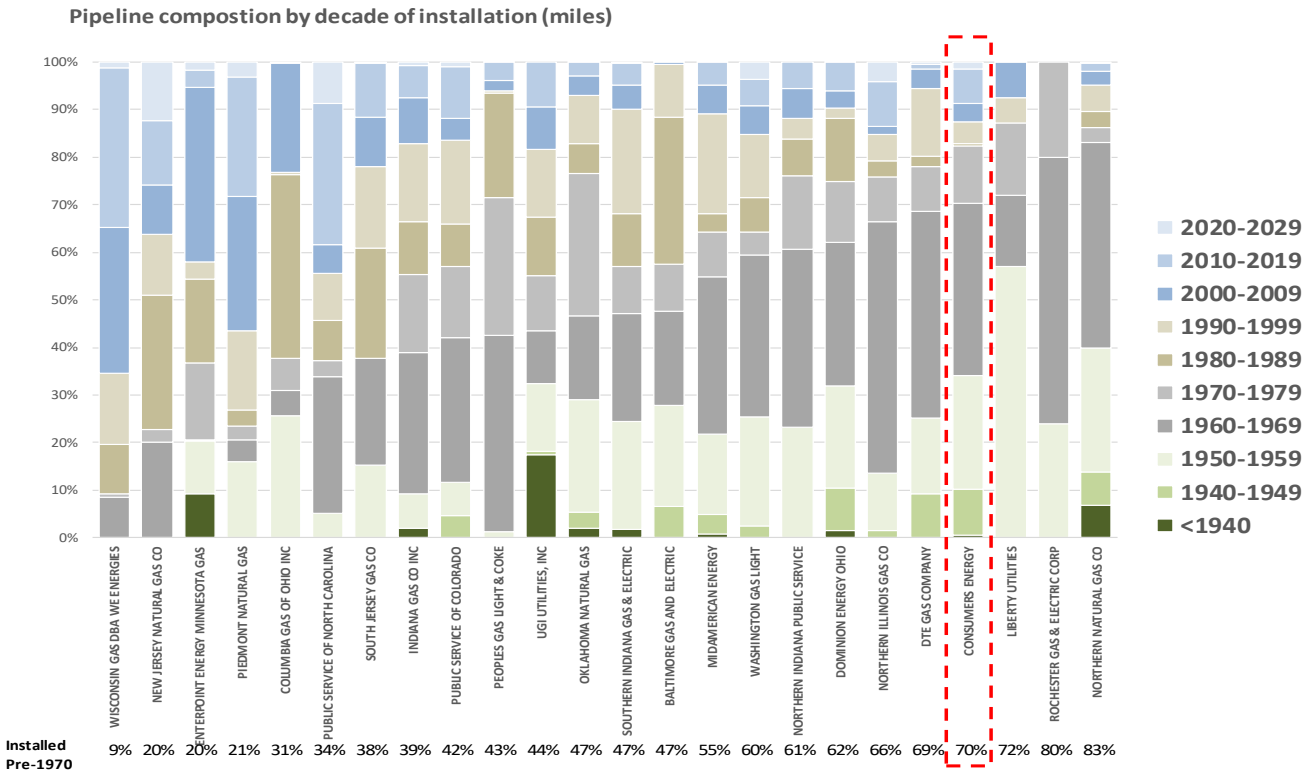
The weighted average age by miles for the transmission pipeline system is 51 years old. Approximately 1,962miles, or 82%, of transmission pipe was installed in the 1970s or earlier, as shown in Figure 27. (See Reference 1 in this section for citation source.)

Figure 27: Transmission Pipeline by Decade of Installation



Consumers Energy operates one of the oldest transmission systems in the country compared to industry peers as shown in Figure 28. (See Reference 1 in this section for citation source.)

Figure 28: Transmission Pipeline Age Relative to Peer



1. TRANSMISSION ASSET MANAGEMENT

a. Capital remediation for transmission pipeline (i.e., "mainlines")

By year's end 2025, all transmission mainline miles will be inspected regardless of consequence area classification. This does not include transmission miles within the storage fields, TOD segments or transmission lines installed within the last 10 years. Within the transmission mainline miles are high-consequence areas ("HCA") and medium consequence areas ("MCA"). HCA and MCA classifications are currently inspected on a recurring basis, six and nine years, respectively. In addition to the planned, on-cycle inspections, the Company is planning risk mitigation inspections for transmission lines that display early signs of deteriorating conditions, as summarized below:

- Stress Corrosion Cracking ("SCC") – This is a form of environmental cracking that requires three conditions to develop:
  - A susceptible material – (pipeline steel).
  - Stresses on the pipeline that are higher than the threshold stress for SCC – (supplied by pressurized gas).
  - An environment that supports cracking such as local soils and groundwater.
  - There are two types of SCC commonly identified in the pipeline industry: high pH and -near neutral ph.
- Many factors can affect the initiation and propagation of SCC, but a pipeline's coating system provides the primary barrier to SCC.
  - **Cathodic protection** is a secondary barrier. The environmental factors that support SCC can develop under the right conditions when the coating on a pipe is compromised.
  - In 2015, one of the Company's pipelines ruptured due to SCC. Since that time, the Company has assessed pipelines that have the highest potential for SCC to occur, and there have been instances where SCC was found and remediated.
  - **Coating Dis-bondment** – The National Association of Corrosion Engineers defines this as any loss of adhesion between the protective coating and a pipe surface as a result of adhesive failure, chemical attack, mechanical damage, hydrogen concentrations, etc.

The Company plans to start the construction of the Mid-Michigan Pipeline project in 2023 to replace an existing 70-year-old pipeline that has shown signs of SCC and experienced a rupture in 2015.

- In accordance with 1929 Public Act 9, the Company received certificate of necessity approval in November 2020 to construct and operate the 36-inch Mid-Michigan pipeline. Phase 1 construction is planned for 2023, and Phase 2 construction is planned for 2024, with final restoration in 2025.

b. Inspection for Transmission Operated by Distribution (TOD) pipelines

The Company has 523 miles of TOD pipelines. Within this total, 116 miles of TOD reside within HCAs and will follow the inspection cadence discussed above.

The Company is looking at how to best approach inspection of the remaining non-HCA TOD pipeline to ensure continued safe operation.

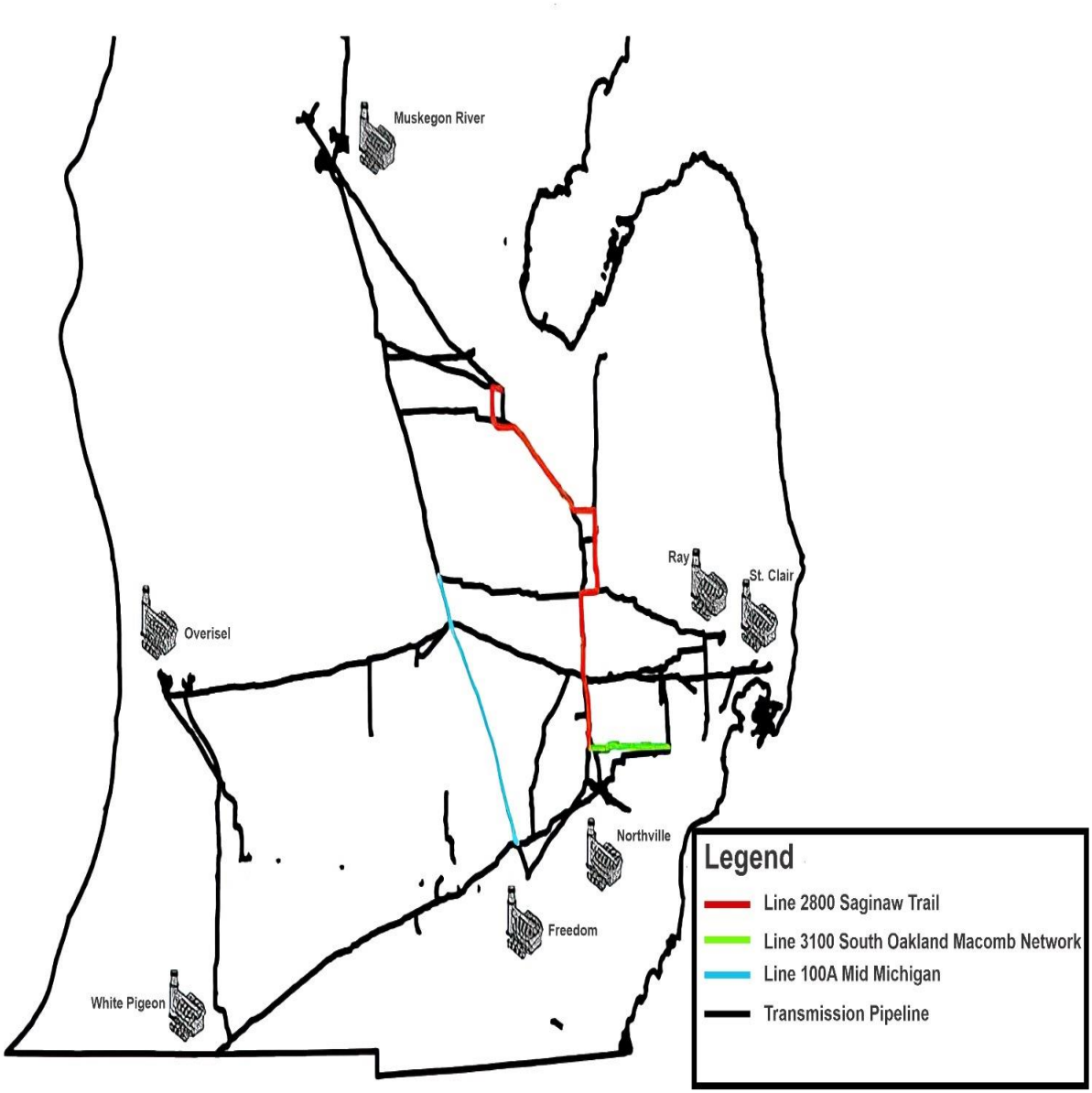
c. Transmission Enhancements for Deliverability and Integrity projects

Transmission Enhancements for Deliverability and Integrity ("TED-I") pipeline projects focus on maintaining integrity and deliverability and include transmission pipeline replacements of higher relative risk pipe to ensure safe operation.

Higher relative risk pipe includes segments with previous anomalies or stress characteristics related to integrity management risk mitigation. Consumers Energy identified certain transmission pipelines to replace or upgrade due to their condition.

The major TED-I projects are Saginaw Trail Pipeline (started in 2017 and completed in 2020), the South Oakland Macomb Network (started in 2018 with construction and completed in 2021), and Mid-Michigan Pipeline (construction 2023 and 2024). They are shown below in Figure 29.

Figure 29: Map of TED-I Gas Transmission Pipeline Projects



As transmission lines age, there are two primary factors considered for replacement, capacity needs and integrity. All transmission lines are continuously evaluated based on these two factors, which forms the basis for prudent decision making in repair versus replacement. Capacity requirements are factored into line replacements to ensure customer deliverability.

- TED-I pipeline projects improve customer reliability and advance public safety by replacing or retiring higher relative risk pipe segments and, in some cases, increasing capacity which in many cases enhances system resilience.
- Additionally, the replaced pipelines also have enhanced pipeline pressure control and isolation capabilities.

The TED-I plan will be continually evaluated based on integrity assessment results, analysis, construction efficiencies, and system modeling.

d. City Gates

Consumers Energy operates 88 city gates as of December 31, 2021, where pressure is regulated, and the natural gas is odorized for safe delivery to homes and businesses. For the purposes of this document, a city gate is a distribution center and / or fuel station. Over-pressure protection and SCADA monitoring equipment are located at city gates.

City gates are an important component to the natural gas system in that they reduce transmission line pressure for distribution use and in some cases improve the quality of gas before entering the distribution systems.

Most city gates also inject an odorant into the gas stream for leak detection through the sense of smell. Please see the section titled *Odorizers* below in the distribution asset plan.

Additionally, city gate facilities and the equipment located within them have a reasonable life span of about 50 years. However, age alone is not the primary factor for rebuilding a city gate.

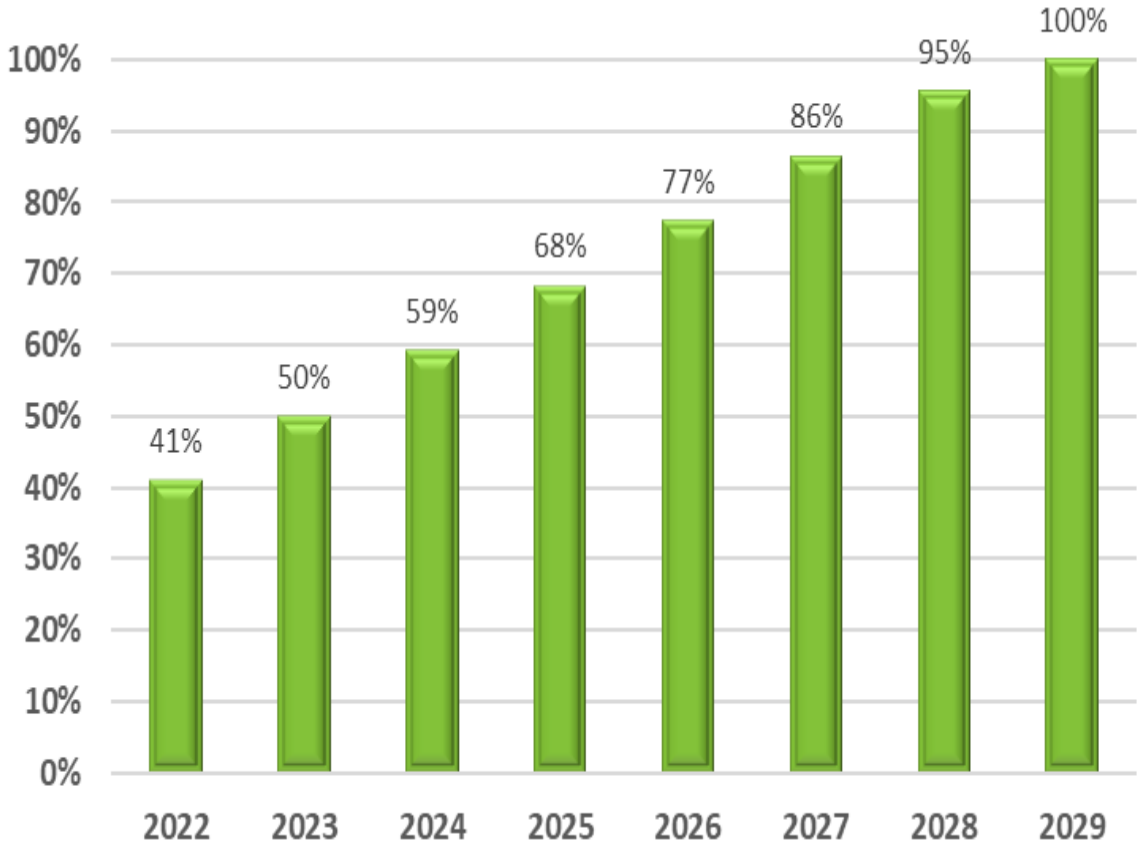
The Company has developed a ranking rubric that provides quantifiable risk ranking for each city gate. With expert judgement, the risk ranking model will help provide input into the rebuild prioritization.

The city gate fleet goal is to ‘modernize’ 90% of the Company’s city gates within this 10-year plan. *Modernization* is defined as upgrading the following mechanisms: emergency shutoff system, bath heater system, separation systems, and the required SCADA transducers for each stage.

The 10-year plan shown on Figure 30 calls for the modernization of 4-8 city gates each year. In addition to full rebuilds, components required for modernization will be rebuilt or added as appropriate rather than full rebuilds as specific station needs dictate to consider customer affordability.

After modernization is complete, city gates will be rebuilt on a cycle that will ensure the entire fleet is rebuilt within 50 years, or as required for safety, customer demand, and high-performance demand.

Figure 30: City Gate Attribute Modernization Plan



To achieve this target, the continued level of spending at between $1 to $9 million per city gate, or $40 to $55 million annually for the entire program for the next 10 years is prudent. (See Reference 3 in this section for citation source.) In addition, a Gas SCADA system upgrade is conducted.

e. Remote Control Valves (RCV)

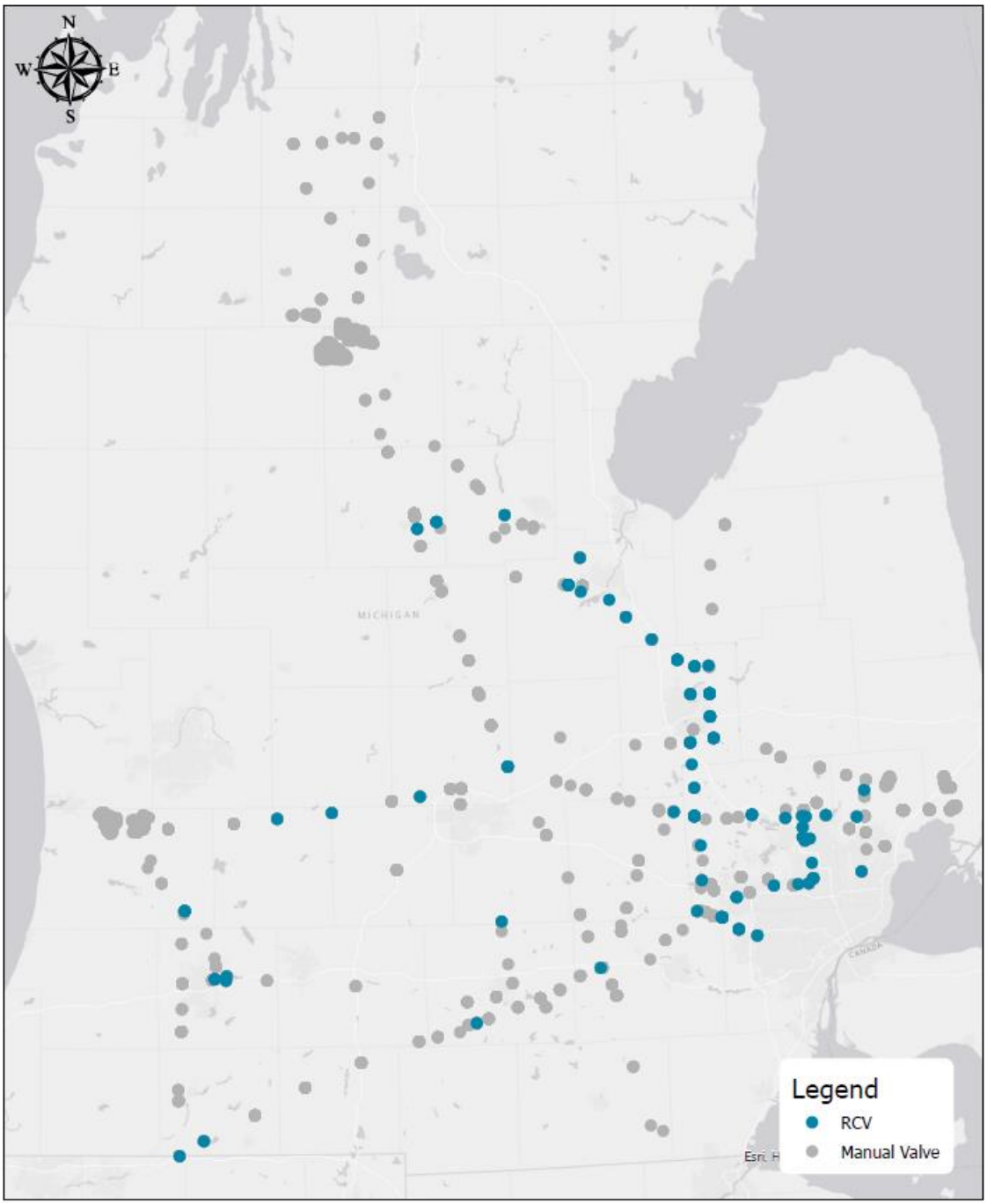
RCVs are important safety components in the natural gas system. RCVs reduce response time in the event of damage to a transmission line or a rupture event. The ability to remotely and quickly stop the flow of gas is essential, and RCVs are the standard for achieving this across the system.

It is important to note that RCVs do not prevent failures from occurring but are intended to minimize the time gas flows after a failure. These RCVs also allow for manual operations if a condition calls for an operator to override the RCV.

- Check valves will also be used on transmission tap lines when appropriate to aid RCVs in the isolation of a particular transmission segment.
- Check valve technology prevents the back feeding of gas in the event of an emergency.

In 2017, RCVs were first installed in HCAs and at flexible points in the system, as mapped in Figure 31. (See Reference 2 in this section for citation source.)

Figure 31: RCVs as of April 2022

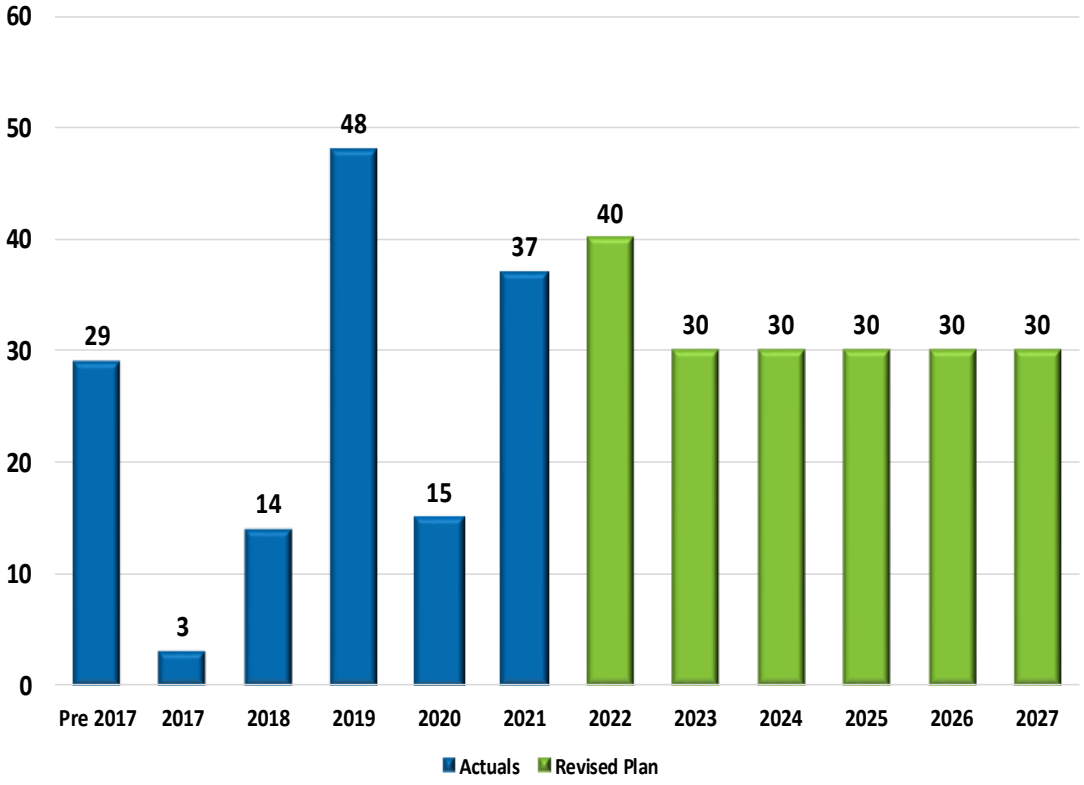


To leverage RCVs as a means of increasing the safety of the transmission system, the Company is planning an installation rate toward a goal of 70% of the system valves by 2028, as shown in Figure 32.

This safety benefit is the time reduction to isolate the system during an emergency or abnormal operating condition. The goal was originally set at 2023. However, since that time the goal has been revised to 2028, to align with the continuously evolving prioritization of work, available resources, and system outage schedules.

In addition, a Gas SCADA system upgrade is being conducted to support this plan. Currently, the Company has 481 valves on the transmission system, requiring approximately 336 additional RCVs to reach the 70% goal. Figure 32 below represents the year in which the RCVs have been installed and are planning to be installed with final commissioning of RCVs typically occuring in the subsequent year.

Figure 32: Current RCV Installation Rate



Total # of RCVs	**32**	**46**	**94**	**109**	**146**	**186**	**216**	**246**	**276**	**306**	**336**
Percent Completed	**7%**	**10%**	**20%**	**23%**	**30%**	**39%**	**45%**	**51%**	**57%**	**64%**	**70%**

f. Other Transmission Investments

In addition to the Transmission Investments mentioned above the Company routinely invests in other programs that ensure safety, resiliency, reliability, and compliance with regulations. These include:

- Asset Relocation Transmission Investments include gas transmission infrastructure replacement projects that are required due to civic improvement activities initiated by federal, state, or local governmental units where transmission pipeline location or depth of cover requires relocation of an existing pipeline to prevent third-party damage, eliminate physical conflicts with other utilities, and to ensure continued safe operation. A major project in the near term is the relocation of a transmission line in Sleepy Hollow State Park in 2023 in conjunction with the Mid-Michigan Pipeline project.
- Cathodic Protection Program allows the Company to maintain compliance with federal regulations for cathodic protection of facilities.

- MAOP Compliance – Pipeline investments involve MAOP verification and remediation of the Company's transmission pipelines, including Transmission Operated by Distribution pipelines.
- Deliverability Base Field Measurement investments are essential to ensure accurate gas quality and measurement. As part of this program the Company is planning a transmission interconnect with DTE Gas in 2025 that will improve overall system resiliency to the benefit of customers of both Companies.
- Deliverability Base Pipeline expenditures support maintaining operations in accordance with the Michigan Gas Safety Standards ("MGSS"). Types of projects include:

  (i) the replacement of valves, and if necessary, the associated valve operators, when inspection determines that the valves no longer perform as needed, which may mean valves no longer turn or they may not fully seal off the flow of gas (MGSS Rules 192.145, 192.150, 192.179);

  (ii) the replacement of piping due to MAOP revisions identified as a result of class location changes (49 CFR 192.5 and 192.611);

  (iii) construction of new sectionalizing valves and tap valves to improve system deliverability, and help meet valve spacing requirements defined by 49 CFR 192.179; (iv) reconfiguration of tap piping (i.e., laterals) and associated valving upstream of city gate facilities as companion projects to city gate rebuilds; and

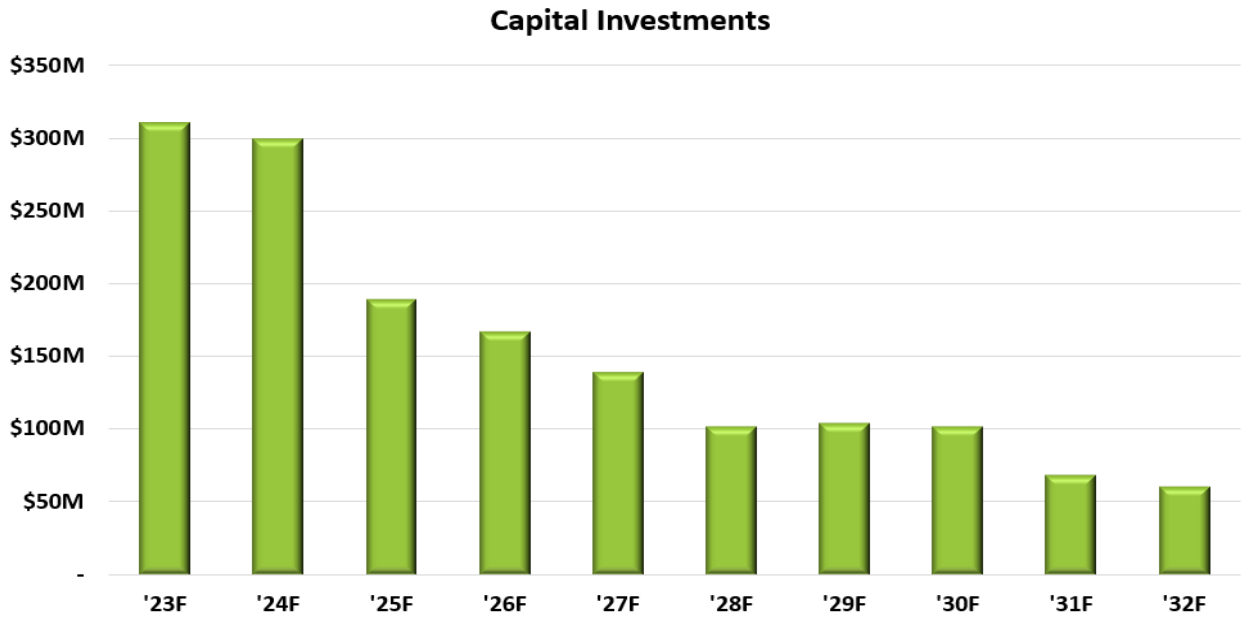
  (v) installation or retirement of pipeline taps to TMS facilities being attached to the Company's system.

2. TRANSMISSION ASSET PLAN AND FINANCIALS

Consumers Energy's transmission inspections, remediation work, city gate modernizations, and RCV installations provide the basis for the capital investment plan shown in Figure 33.

Overall, this investment plan for the transmission asset class aligns with the objectives by reducing asset risk (safe), ensuring the pipelines can flow when required (reliable), providing the necessary resilience to obtain either pipeline or storage gas supplies and being remote controlled for system agility (affordable), and reducing the amount of emissions in this system (clean).

Figure 33: Transmission Capital Investment Plan



3. REFERENCES

1. U.S. DOT PHMSA reported figures (March 2022)
2. Geographic Information System (GIS) database
3. Capital Budget O&M (September 2021), Capital Budget Engineering (September 2021)

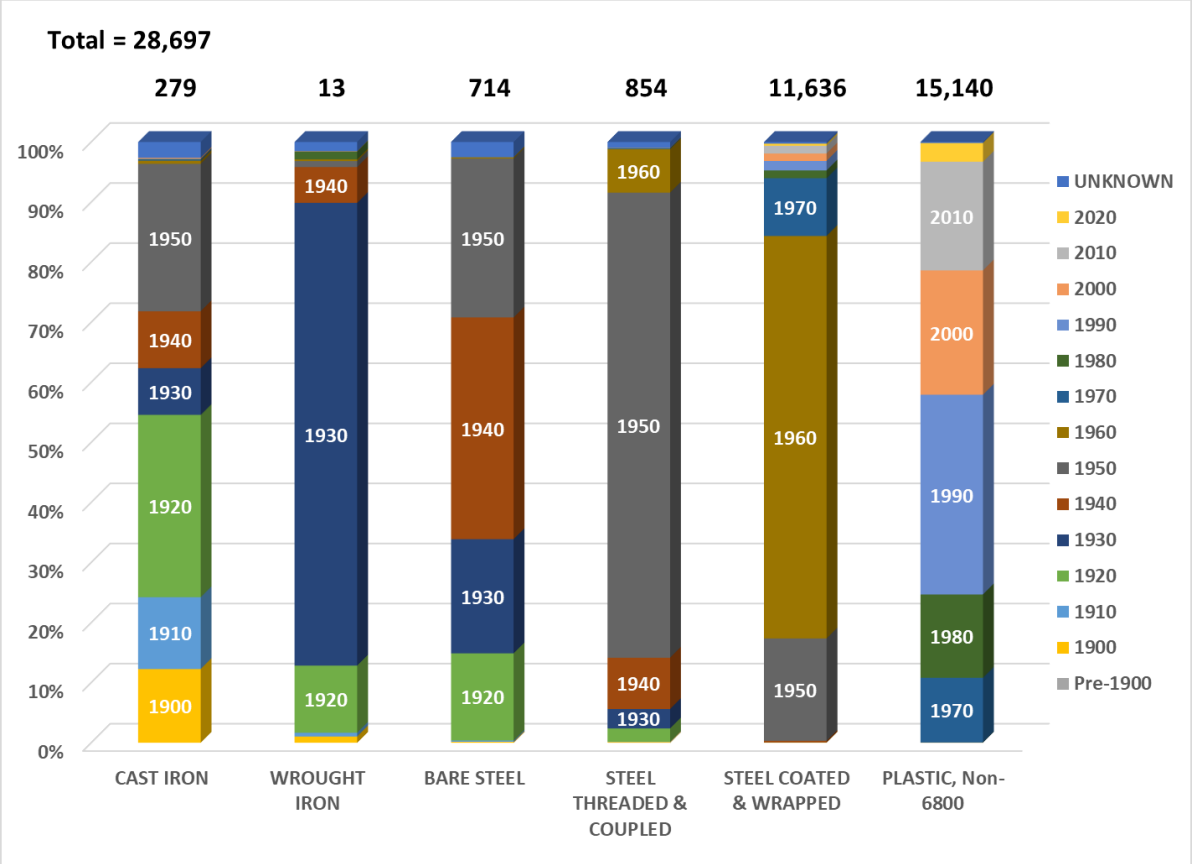
D. Distribution Asset Plan

The distribution system moves gas from city gates through pressure regulation stations to neighborhoods, C&I districts, and customer homes and businesses.

- Consumers Energy had 28,170 miles of distribution pipeline, 526 miles of TOD pipeline, and 1.6 million services at the end of 2021.
- Gas enters the distribution system at 60–400 psi, and residential meter service pressures are less than 1 psi. The distribution system includes some of the Company's oldest facilities and is situated closest to the public. Therefore, reducing risk in this area is a critical focus of the plan for safety and reliability.

The Company's system is comprised of a variety of materials with installations dating as far back as the early 1900s as shown in Figure 34 below. (See Reference 1 in this section for citation source.)

Figure 34: Distribution Main by Materials and Installation Date



Cast and wrought iron pipelines are among the oldest in the Company's distribution system. Many of these pipelines were installed over 100 years ago and still deliver natural gas to customers today.

The age of the pipelines makes them susceptible to corrosion and cracking due to the degradation of the iron alloys (i.e., pipes rust and get brittle with age) and pipe joint design.

- Bare steel (also called 'uncoated') pipelines are considered higher risk due to corrosion and cracking caused by age and lack of protective coating. External corrosion occurs on metal pipe due to soil and moisture conditions. Bare steel pipe is in direct contact with these corrosive conditions.

- Fluctuations of temperatures during the seasons, as experienced in Michigan, create additional risks. Once the ground freezes at low temperatures, pipelines are susceptible to frost heave causing new cracks to form and existing cracks to expand.
- Natural gas vapors are lighter than air and will generally rise and dissipate quickly. These vapors will move through the soil finding the path of least resistance. Frozen ground acts as a vertical barrier causing gas to gather and pushing it horizontally until it finds an opening (porous/cracked foundations, water/sewer lines) often leading into a building.
- Water infiltration - In underground low-pressure gas pipelines, a leak may result in water infiltration (also called 'water ingress'). Groundwater enters the gas pipeline through a crack or corroded section of pipe, and eventually blocks the gas flow to the customer. In winter months, the water can freeze causing additional blockages, customer meter freeze-offs, and/or expanding existing pipeline cracks.

The above factors have greatly increased the risk involved with a system than contains vintage materials.

The Company's distribution mains are approximately 53% plastic, 44% protected steel, and 3% unprotected steel and vintage materials such as cast iron, wrought iron, and bare steel.

PHMSA classifies the highest risk materials, in order of risk, as:

- Cast iron (279 miles in the system)
- Bare steel (714 miles in the system)
- Threaded & coupled steel (854 miles in the system)

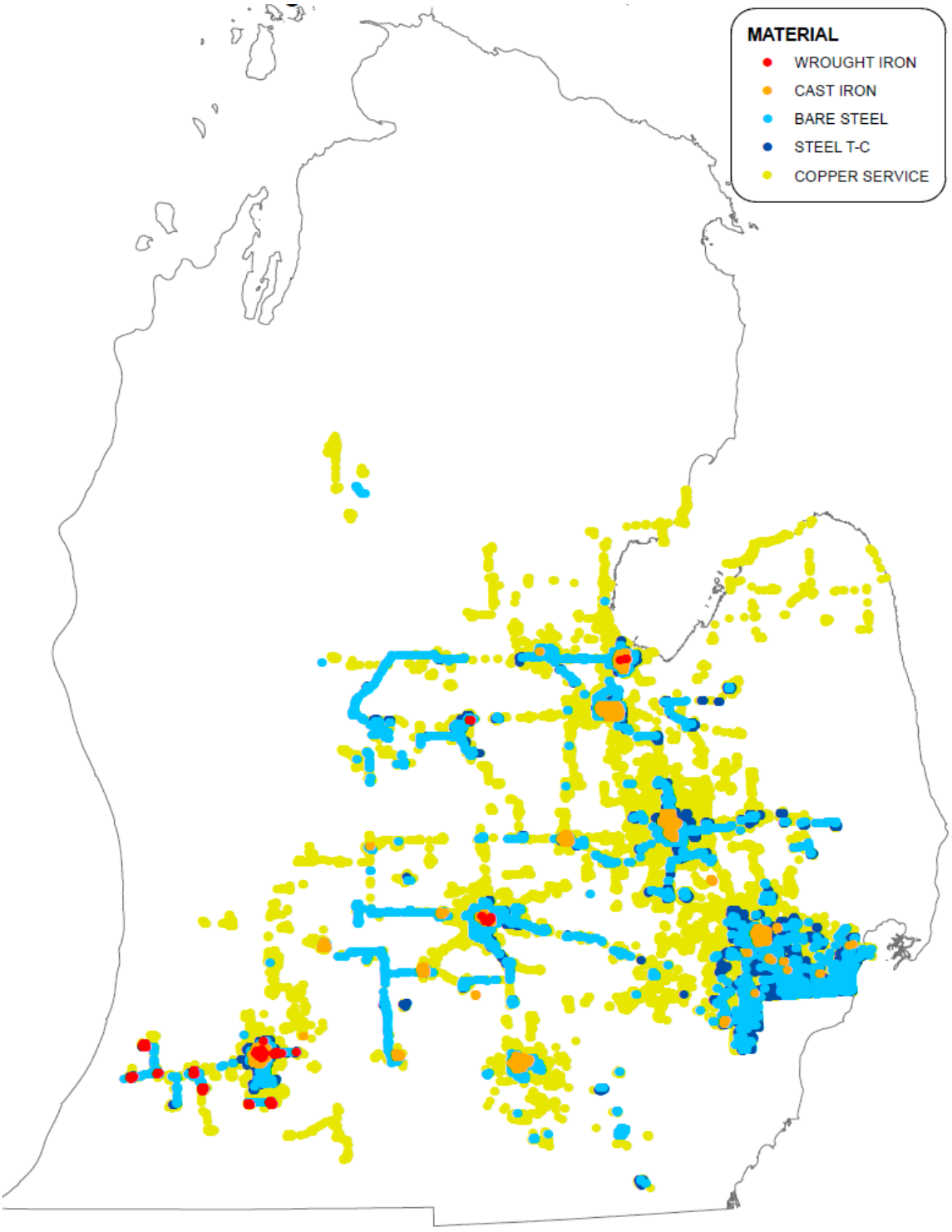
And as more infrequent materials:

- Wrought iron (13.5 miles in the system).

These at-risk materials total 1,861 miles of main or approximately 6.5% of all distribution main miles. Of the remaining 1,861 miles, 1,627 miles are located within the SP/MP system and 234 are in the HP system.

Figure 35, on the following page, is a map of these at-risk materials for the Company's system. (See Reference 2 in this section for citation source.)

Figure 35: Map of Vintage Distribution Materials



Another distribution integrity risk is pipes operating at standard (utilization) low pressure. Gas needs to reach each customer with enough flow rate and pressure to fuel equipment and appliances while staying below the maximum operating pressure for each segment within the system.

The standard pressure system operates at 7" water column ("WC") (about a ¼ psig) and does not require a pressure regulator for each customer's service. The challenges of operating a standard pressure system are the dynamic flow and pressure changes due to varying customer demand within a narrow pressure operating range.

This system struggles to operate at higher pressures on extreme cold weather days, respond to customer demand changes, etc.—and requires accurate and timely pressure control to meet deliverability requirements. If the pressure is not maintained and drops below 7" WC, customers may experience heating and other appliance problems due to low gas pressure.

In January 2018, in Rhode Island, it was reported that thousands of Newport residents went several days without natural gas. Rhode Island PUC blamed the outage on low pipeline pressure due to weather-driven high gas demand and malfunctioning equipment.

Other factors that can contribute to low gas pressure are:

- Standard-pressure portions of the system, largely vintage materials, which are susceptible to fluid infiltration from the ground. This fluid can travel through the system, including to customers' meters.
- In freezing temperatures, this fluid may seal the orifices of the meter and/or regulator and interrupt gas flow. This poses a risk to customers during the heating season. Furthermore, removal of this fluid requires maintenance of documented 'drip' points on the standard-pressure system with additional costs for removing/pumping the fluids.

The Company's 1,861 vintage miles cover all but approximately 94 miles of the standard-pressure system. Therefore, the plan is to add the 94 miles of standard low-pressure pipe into the vintage remediation goals, to be discussed in further sections.

Finally, the standard pressure system requires additional regulation facilities that could be retired with the elimination of this portion of the system.

1. DISTRIBUTION ASSET MANAGEMENT

Overview of the Current Main and Service Remediation Program (i.e., EIRP)

The *Pipeline Inspection, Protection, Enforcement, and Safety Act* ("PIPES") of 2006, Public Law No: 109-468, mandated that PHMSA, within the U.S. Department of Transportation, prescribe standards for *Distribution Pipeline Integrity Management Programs* ("DIMPs").

Federal DIMP rules were subsequently established under Subpart P of the U.S. Code of Federal Regulations, Title 49, Part 192. The Company's current replacement program (part of Consumers Energy's DIMP to remediate at-risk cast iron, bare steel, and threaded and coupled steel) is the EIRP.

The EIRP was launched in mid-2012, with the first full program year in 2013. Since inception, the program has remediated 231 miles of cast iron, 208 miles of bare steel, 115 miles of threaded and coupled steel, 5 miles of wrought iron, 1 mile of x-trube, 19 miles TOD, 38 miles of Low Frequency Electric Resistance Welded ("LFERW"), for a total of 617 miles, as outlined in Table 4.

Figure 36: Vintage Miles of Main Remaining by Material Type

Figure 36 above shows the miles of historic Vintage Material remaining on the system based on data submitted on and supplemental data to the Distribution DOT annual report for that year. Bare steel TOD is included in the Bare Steel. This figure shows 1,861 total miles of SP/MP Vintage and HP Vintage main remaining on the system at the time of the 2021 DOT Report submittal and is represented by the first two bars in Figure 37 (Remaining EIRP Program Retirement miles) on the following page.

Table 4: Miles Remediated Under EIRP

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
	Miles remediated in EIRP Program										
Cast Iron	5.3	29.9	28.7	32.9	23.1	24.0	13.3	9.3	13.9	50.6	231.0
Threaded & Coupled	1.0	6.0	10.3	11.0	17.1	14.2	11.2	9.6	19.8	14.9	115.0
Bare Steel	5.0	16.9	12.9	25.1	25.8	21.7	14.0	14.0	26.6	46.4	208.4
Wrought Iron	0.0	0.2	0.8	2.7	0.3	0.8	0.0	0.0	0.0	0.4	5.1
X-trube	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Copper	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.6
TOD	0.0	0.0	0.0	3.8	1.0	0.0	3.6	1.6	2.3	6.7	18.9
LFERW	17.0	8.0	3.6	2.5	2.5	2.6	1.4	0.8	0.0	0.0	38.4

The numbers in Table 4 above do not include miles remediated as part of other programs, such as Asset Relocation, which is relocation or replacement work completed due to municipality needs. The Company also refers to this as Civic work. The data is specific to the EIRP Program and based on the EIRP Annual Performance report data. The totals may not sum to the individual years due to rounding.

Figure 37 shown below shows a breakdown of the remaining EIRP program miles by material, pressure class, and expected Other Program impact as of 2/7/2022.

Figure 37: Remaining EIRP Program Retirement Miles

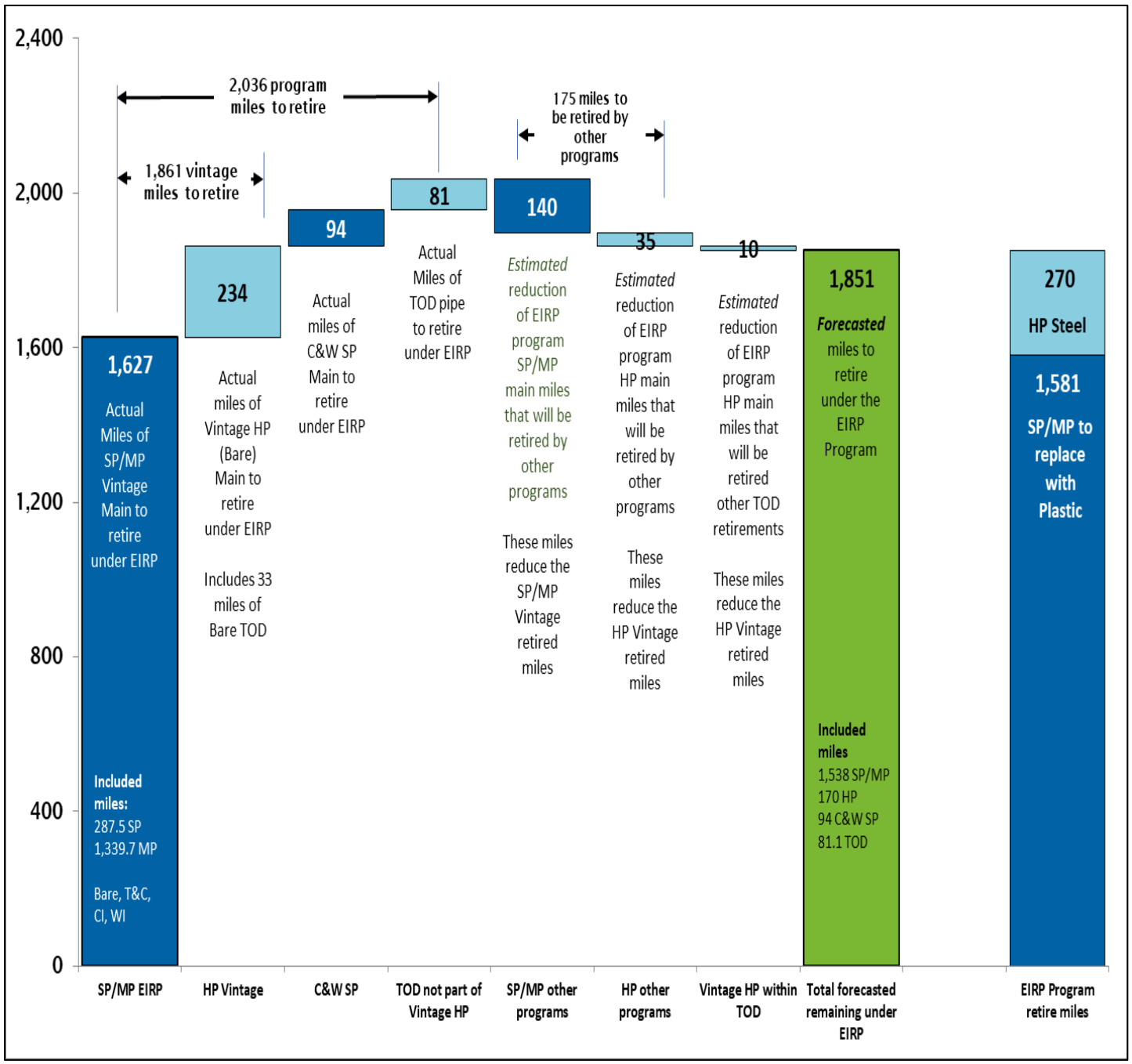
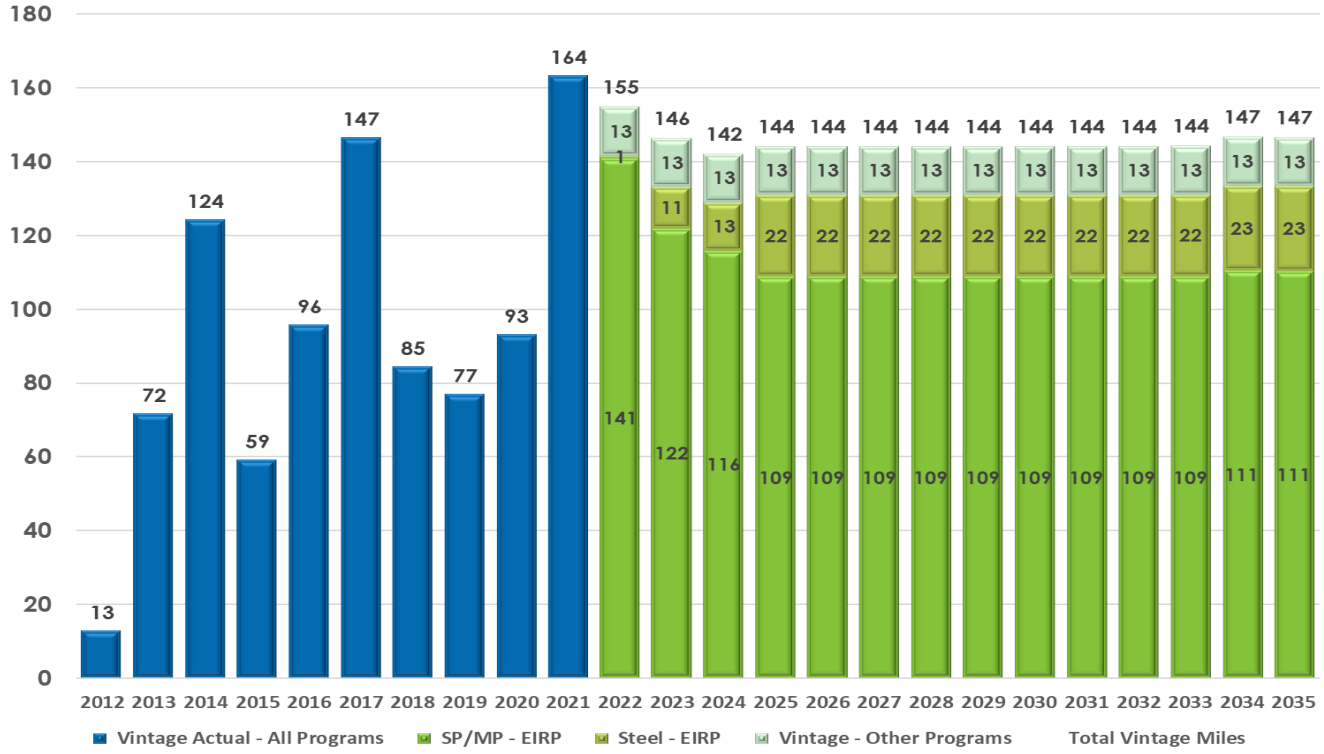


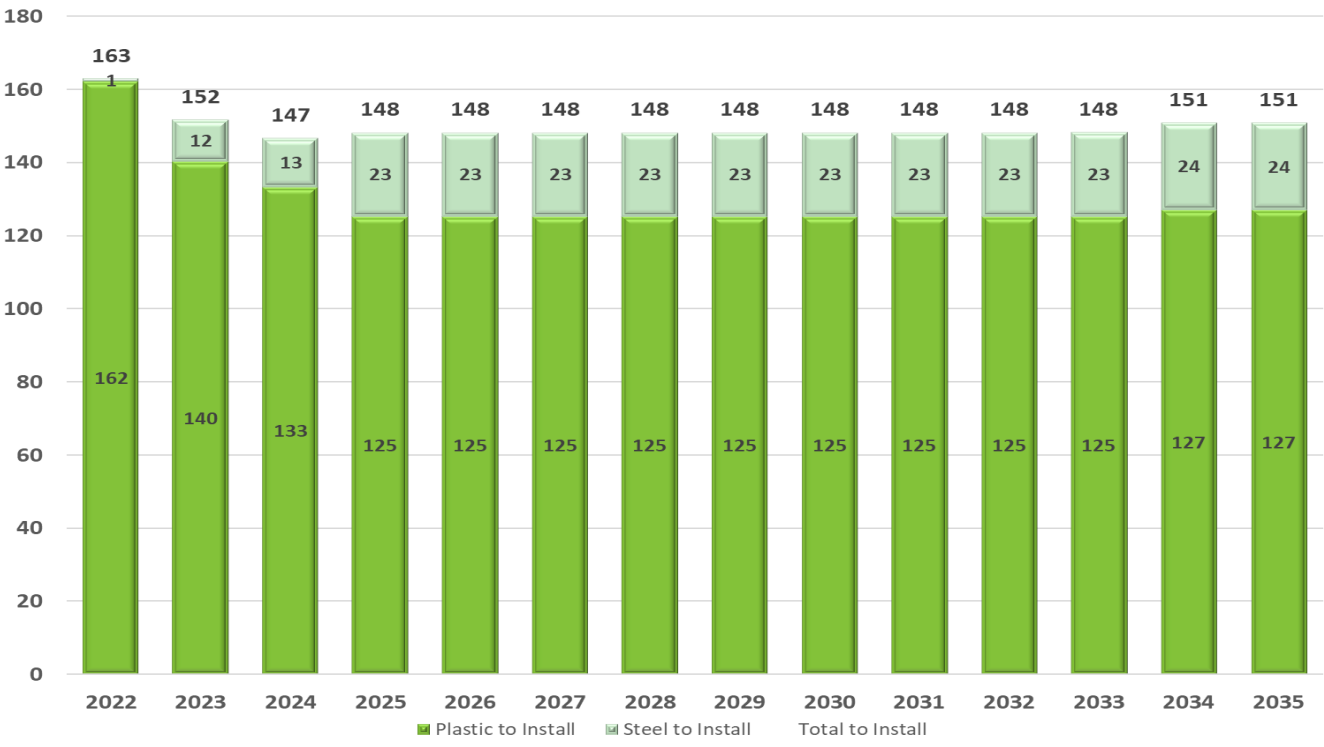
Figure 38 represents the historic 2012-2021 vintage miles retired by all programs and illustrates the new plan for the 2,036 remaining miles to retire from 2022-2035.

Figure 38: Retired Vintage Miles for All Programs



Retired pipe refers to the amount of existing vintage pipe on the system needing to be replaced. Installed pipe refers to the amount of new pipe needed to be installed to replace the existing retired pipe. Figure 39 represents the forecasted installed miles based on the 2022-2035 retirement plan identified above in Figure 38.

Figure 39: Forecasted Installed Miles through the EIRP



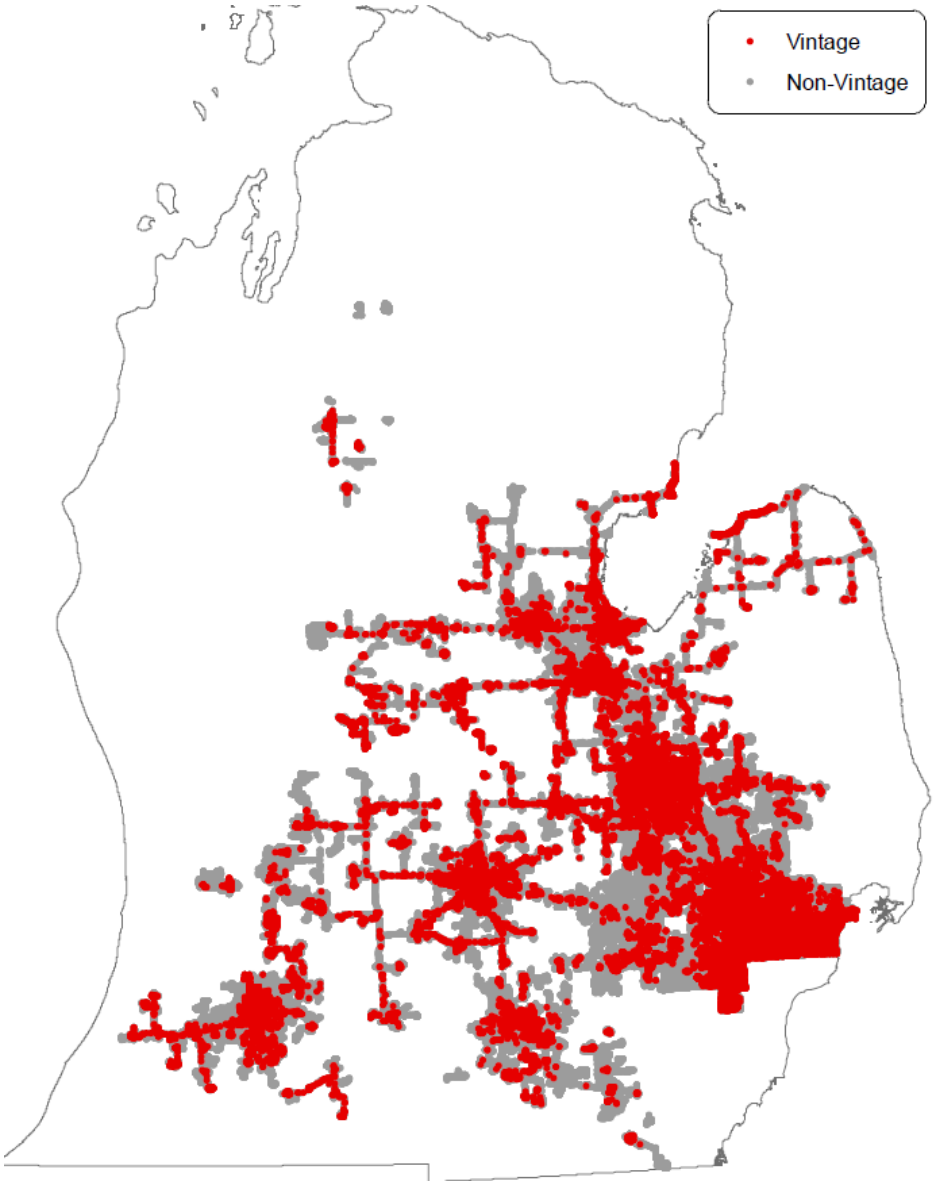
2. OVERVIEW OF DISTRIBUTION SERVICES AND VINTAGE SERVICE REPLACEMENT PROGRAM

The Consumers Energy distribution system includes approximately 1.6 million service lines that connect the distribution main to homes and businesses. Service lines can contain at-risk materials.

- As of 12/31/21, the system contains approximately 108,400 copper services, or 6.7% of all services and, in a much smaller quantity, the system also contains 8, 177 bare steel services. The Company's VSR Program will also replace services for which the material is unknown.

Current vintage services are dispersed evenly across the system, as mapped in Figure 40. (See Reference 2 in this section for the citation source.)

Figure 40: Map of Copper and Bare Steel Services



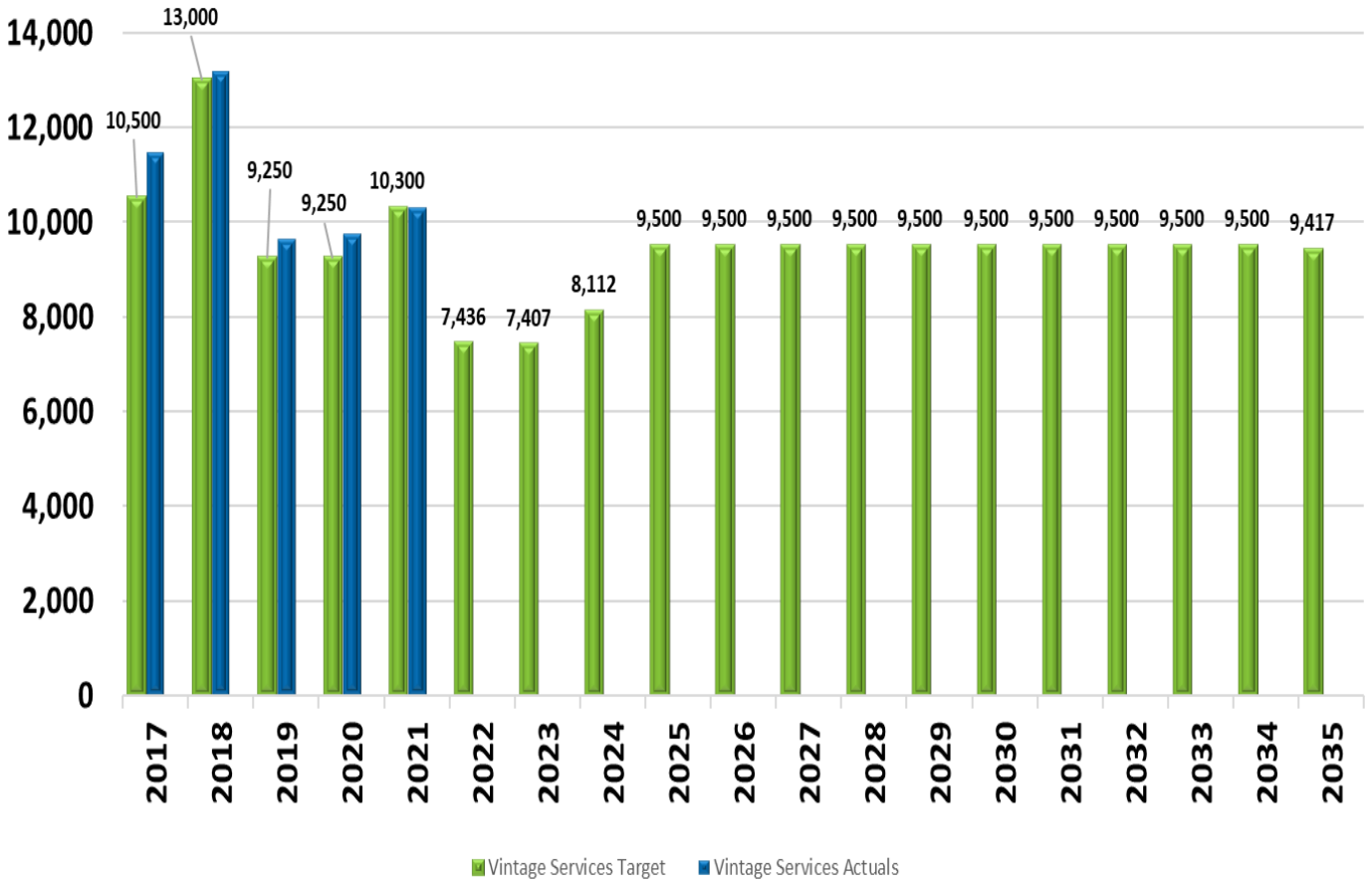
Consumers Energy launched a VSR Program in 2017. This program, as well as other programs that replace mains and services, remediated approximately 11,500 services in 2017; 13,400 services in 2018; 9,600 services in 2019; 9,743 services in 2020; and 10,301 services in 2021. It is projected to remediate 7,436 services in 2022 with an increasing pace for the future.

This pace will position the Company to remediate all copper services by 2035. (See Reference 1 in this section for citation source.)

Similar to vintage main replacement, to align service line replacements with the 2035 vintage main goal, the Company has streamlined planning across all vintage remediation programs and leveraged construction efficiencies to minimize customer impact.

Figure 41 illustrates the new plan that would level the pace in 2025 for completion by 2035. (See Reference 1 in this section for citation source.)

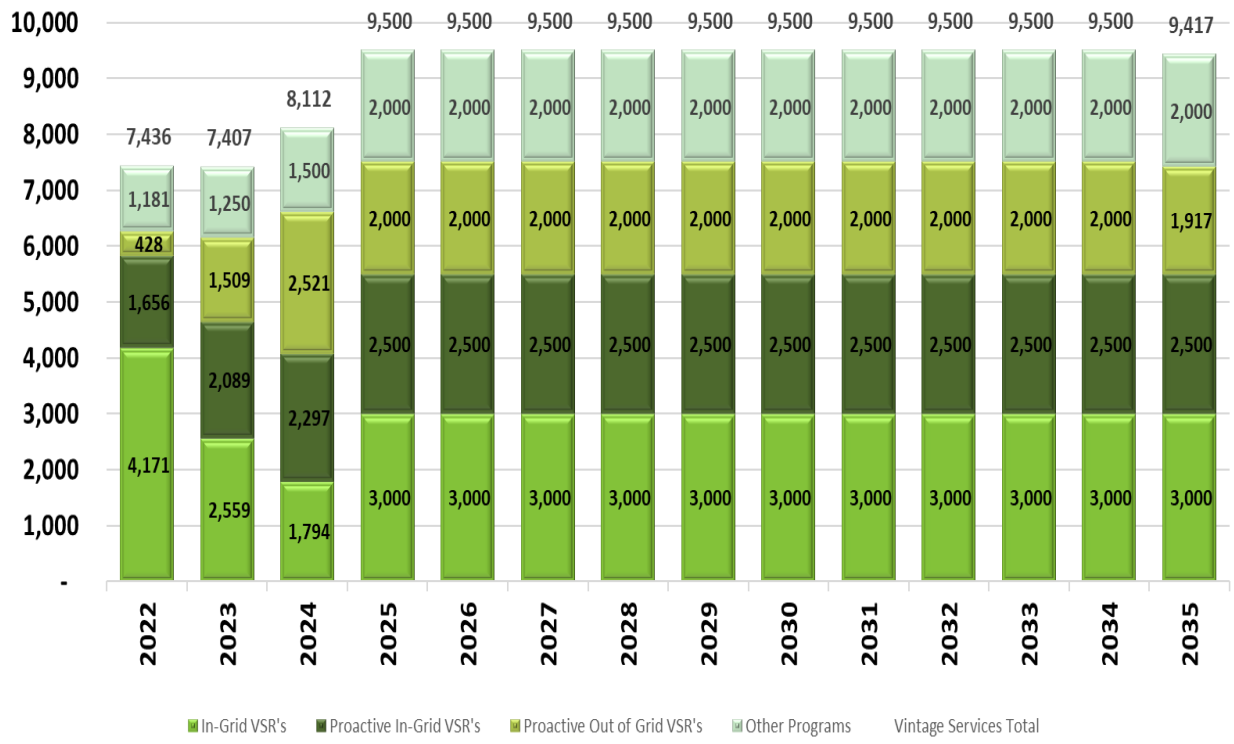
Figure 41: New Remediation Plan for Vintage Services



- Vintage services are replaced across multiple programs. The Company has categorized vintage services to forecast the quantities to be replaced by program. In-Grid VSR's: Vintage services attached to a vintage main and located within an EIRP grid project.
- Proactive In-Grid VSR's: Vintage services attached to a non-vintage main and located within an EIRP grid project
- Proactive Out-of-Grid VSR's: Vintage services located outside of an EIRP grid. These services could be replaced by various programs including VSR, Civic, Leak, etc.

Figure 42 below shows the forecasted yearly targets by category.

Figure 42: New Remediation Plan by Category for Vintage Services



3. MAINTAIN PACE OF VINTAGE MATERIAL REMEDIATION

To reduce risk, improve reliability, and reduce methane emissions, Consumers Energy has accelerated the remediation of all vintage materials. In an effort to balance safety with affordability, the Company decided to levelized the miles and services of vintage materials over the future years and extend the program end date from 2030 to 2035.

Benefits to Customers of Vintage Material Remediation

- A target of 2035 would still position the Company to remove risk from assets and help ensure the safety of customers and the public while balancing with affordability.
- Maximize the customer experience by replacing mains and services using the grid approach for efficiencies and less disruptions to customer property by reducing project mobilization and demobilization to the same or nearby neighborhoods.
- Remediating vintage materials also drastically reduces methane emissions. Methane studies estimate that cast iron pipes leak almost 23 times more methane than plastic pipes, while unprotected steel leaks almost 10 times more.
- Improved local coordination with municipalities to better align the timing of Company-planned project work with public works projects.
- Improved customer safety and reliability by more rapidly eliminating the higher-risk vintage main pipe and services from the system.
- Improved system efficiency due to higher operating pressure and reduction of standard pressure on the system.

- Lower gas losses and reduced methane emissions into the atmosphere.
- Reduced O&M costs.

Therefore, considering all these factors, the Company is looking at a holistic view of all distribution work and has implemented a grid approach by increasing the geographical area of a project, which allows for improved economies of scale, reduced complexity of management/permitting, and streamlined planning (discussed further in the Operational Capabilities section).

This approach will allow the Company to complete more work and lower the cost per unit from the segment approach used prior to 2021.

Consumers Energy recognizes the challenge of managing unit costs, and Table 5 shows some of the major components to enable cost reductions.

Table 5: Sources to Planning Enablers

Component	Potential Sources of Cost Reduction
Outside Services	• Assess vendor approach • Review of *HydroVAC* approval process • Assess *Aggregate, Sewer Locates & Traffic Control contract* services
Labor	• Assess work approach of current workforce • Assess trained workforce levels and push restoration work down to the lowest level enabling higher skill level employees to keep focused on pipe installation and service work
Direct Assessments	• Assess equipment time/ rental approach • Assess direct assessment costs to projects • Improve digital tools to enable efficiencies
Total	• Optimization/ CE-Way trainings for field leaders and more lower management levels • Reduce damages / incentivize crews to reduce frequency of damages

In addition to these enablers to support the potential cost reductions, grids are generally defined as a square mile section, and project planning assembles multiple grids together to create a grid project. The approach also prioritizes the grids by using the current risk model, and replaces all the vintage materials at one time, instead of removing mains in a segment approach with services being replaced at a different time.

The exception to the grid approach will be several pipe segments that do not have enough surrounding miles of vintage main pipe to create a grid.

Figure 43 and Figure 44 show an example of this grid approach using the risk model as the means of prioritizing the work with the high-risk segments in red and the lighter the blue color indicating the lower the risk for any given pipe segment. (See Reference 3 in this section for citation source.) Risk modeling allows Consumers Energy to prioritize the grid projects in high-risk areas within a given gas distribution area.

Figure 43: Distribution Main Risk per Grid

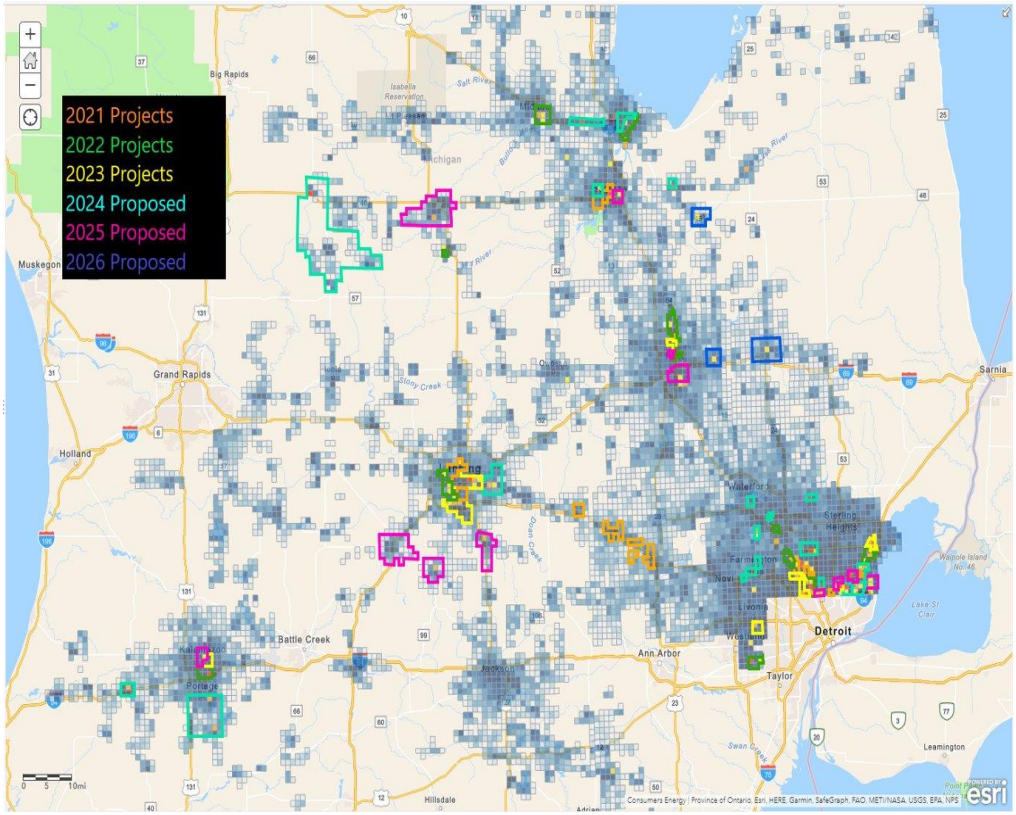
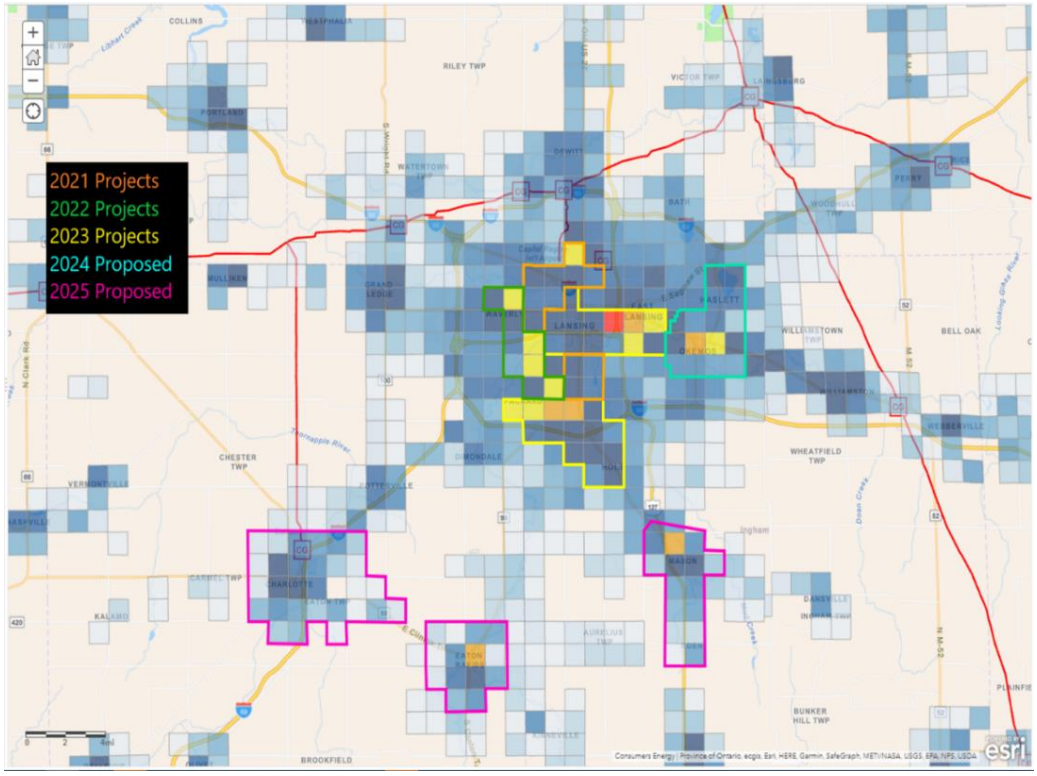


Figure 44: Central Michigan Zoomed in Distribution Main Risk per Grid



4. Next Infrastructure Risk Reduction Program Considerations

Consumers Energy is in the process of replacing our high-risk vintage mains and services as discuss earlier in the Natural Gas Delivery Plan. As a next step, Consumers Energy has begun identifying the next areas of high-risk after completion of the vintage material replacements in 2035. Currently under consideration are the following higher risk areas.

Services

- Consumers has approximately 9,000 vintage service stubs made out of Copper, Bare Steel, and X-Trube Steel on the system. Consumers Energy would replace these services to eliminate vintage stubs. The service stubs are a result of historical maintenance where a service was not retired or replaced due to limited access to the main.
- The Company would target replacement of metallic services that are currently not cathodically protected, as the cost of replacement of that service with plastic would be more economical than the cost to add cathodic protection
- X-Trube services are of 1950-1960s vintage. X-Trube is protective-coated thin wall steel pipe. This material has the highest leak rate. Consumers Energy has approximately 100,000 X-Trube services on the system.

Mains

- The Company could target replacement of metallic mains that are currently not cathodically protected, as the cost of replacement of that main with plastic would be more economical than the cost to add cathodic protection. Cathodic protection did not begin until about 1970, but Consumers Energy has been installing Coated and Wrapped (C&W) main since 1950's These mains therefore were utilized for up to 20 years without cathodic protection. C&W unprotected pipe within the date range above and additionally currently cathodically unprotected pipe would be evaluated and criteria developed to determine the focus area.
- There are currently 523 miles of Transmission Operated by Distribution (TOD) main on Consumers Energy's system. Currently there is a remaining 81 miles is forecasted to be retired as part of the EIRP. The remaining TOD miles will be approximately 442 miles at the end of the EIRP. This pipe must be replaced to lower the SMYS below 20% , which addresses MAOP concerns and reduces operating costs.

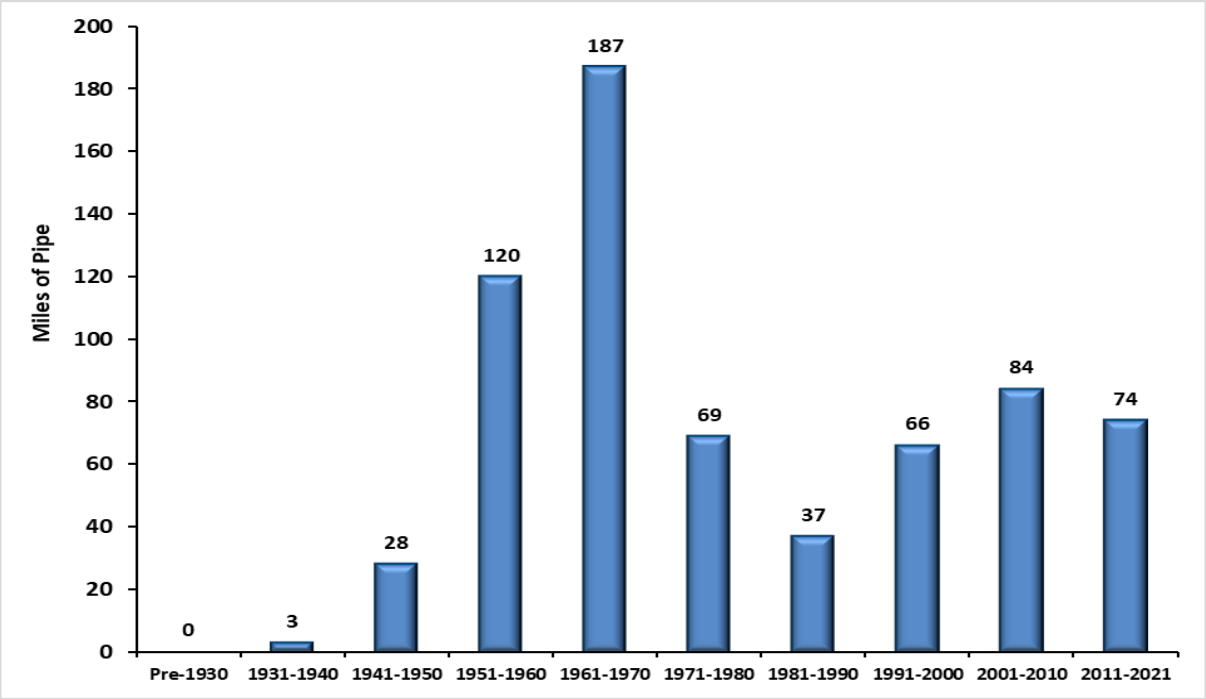
5. INTRODUCTION AND RECOMMENDATION FOR REGULATOR STATIONS, ODORIZERS, AND STANDS

Currently, the Company operates and maintains approximately 690 regulator stations, 1,200 regulator stands, and 100 odorizers as of December 31, 2021. These are important assets on the distribution system, where natural gas pressure is regulated for safe delivery to customers. Regulator *stations* include 2" and larger pipe that feeds a distribution region, and Regulator *stands* include 1" regulator units that feed smaller distribution systems.

a. Regulator Stations

Regulator stations reduce pressure supplied from a higher-pressure system. Investments made into regulator stations improve safety and maintain the integrity of the asset. These investments include over-pressure protection and SCADA monitoring equipment. Approximately half of the regulator stations were installed before 1970, as shown in Figure 45. (See Reference 4 in this section for citation source.) The 10-year goal for the regulator station fleet is to ensure 60% of all regulator stations are not in service longer than 50 years.

Figure 45: Distribution of Regulator Station in Service Dates



A reasonable expectation of life span for a regulator station is approximately 50 years. To maintain an average lifespan of 50 years across the fleet of regulator stations, the Company must rebuild 8-12 stations per year at an average cost of $3 million per regulator station while retiring four standard pressure serving regulator stations. This equates to an average program cost of approximately $30 million per year in station rebuilds.

Adding more distribution systems monitoring through SCADA, particularly at regulator stations and odorizers requires technology updates, including upgrades to the SCADA historian and monitoring systems. These enhancements allow for additional data points to be monitored along with additional storage for that data. See the *Technology – Digital Approach section* for additional discussion on SCADA monitoring.

b. Odorizers

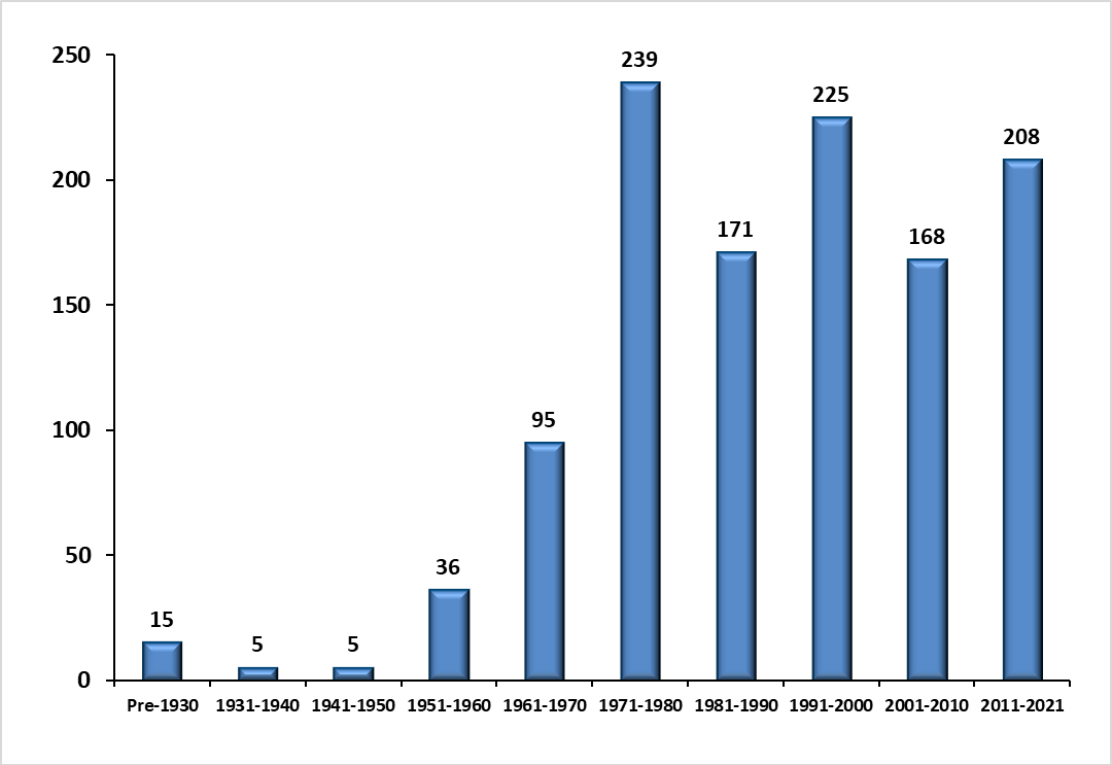
Odorizers are assets that add odor to the downstream gas system, which is a critical safety element required by code. Odorizers are co-located at city gates and transmission valve sites and deliver a potent smell so that someone with a normal sense of smell can detect a gas leak. The year-over-year goal for the odorizer fleet is to ensure odorizer pumps are 30 years old or less, and that any exceptions are planned for replacement.

Currently, all odorizer pumps in the system are less than 30 years in service, reflecting a 100% compliance. The Plan allows for one odorizer station to be rebuilt per year independent of a city gate rebuild. This is a stable and reasonable trend that should continue for the next 10 years, maintaining all pump in-service dates less than 30 years.

c. Regulator Stands

In addition to stations, the Company currently operates and maintains 1,207 regulator stands. Approximately 14% of the regulator stands were installed before 1970, as shown in Figure 46 (see Reference 4 in this section for citation source.)

Figure 46: Distribution of Regulator Stands Age Distribution



Due to the age of regulator stands, the Company will be continuing to invest in these assets comparable to historical years.

6. LEAK REMEDIATION

Consumers Energy does not have continuous leak detection monitoring on the distribution system but uses other methods to identify leaks and maintain safety.

- Regular leak surveys are conducted to identify and remediate potentially hazardous gas leaks.
- As discussed above, a potent odorant chemical is delivered to the system through odorizers. This odorant can allow customers and other third parties to identify gas leaks before they become hazardous.

Once the Company is notified of a potential leak, the goal is to respond within 30 minutes and complete a leak analysis to determine the appropriate leak classification for repair scheduling.

Employee and public safety are Consumers Energy's primary concerns. Factors used in the analysis include gas concentration readings, the distance of the leak from the outside of a building, and potential that gas could migrate into a building. Leak repair scheduling is required per code – Michigan Gas Safety Code 192.703, 192.709, 192.711 and Michigan rules 318 and 327.

Minimum requirements for distribution system leak survey programs outlined in 49 C.F.R 192 are:

- At least once each calendar year, at intervals not exceeding 15 months, a leak survey using leak detecting equipment must be performed in business districts at all locations. This provides an opportunity to locate gas leaks (e.g., gas, electric, and water system manholes and sidewalk/pavement cracks).
- Outside of business districts, leak surveys must be performed at least every five years. For cathodically unprotected distribution lines, leak surveys must be conducted every three years.

Table 6 provides an explanation of how the Company classifies leaks on the gas system, with Table 7 and Figure 47 providing additional classification details for above and below grade leaks, respectively.

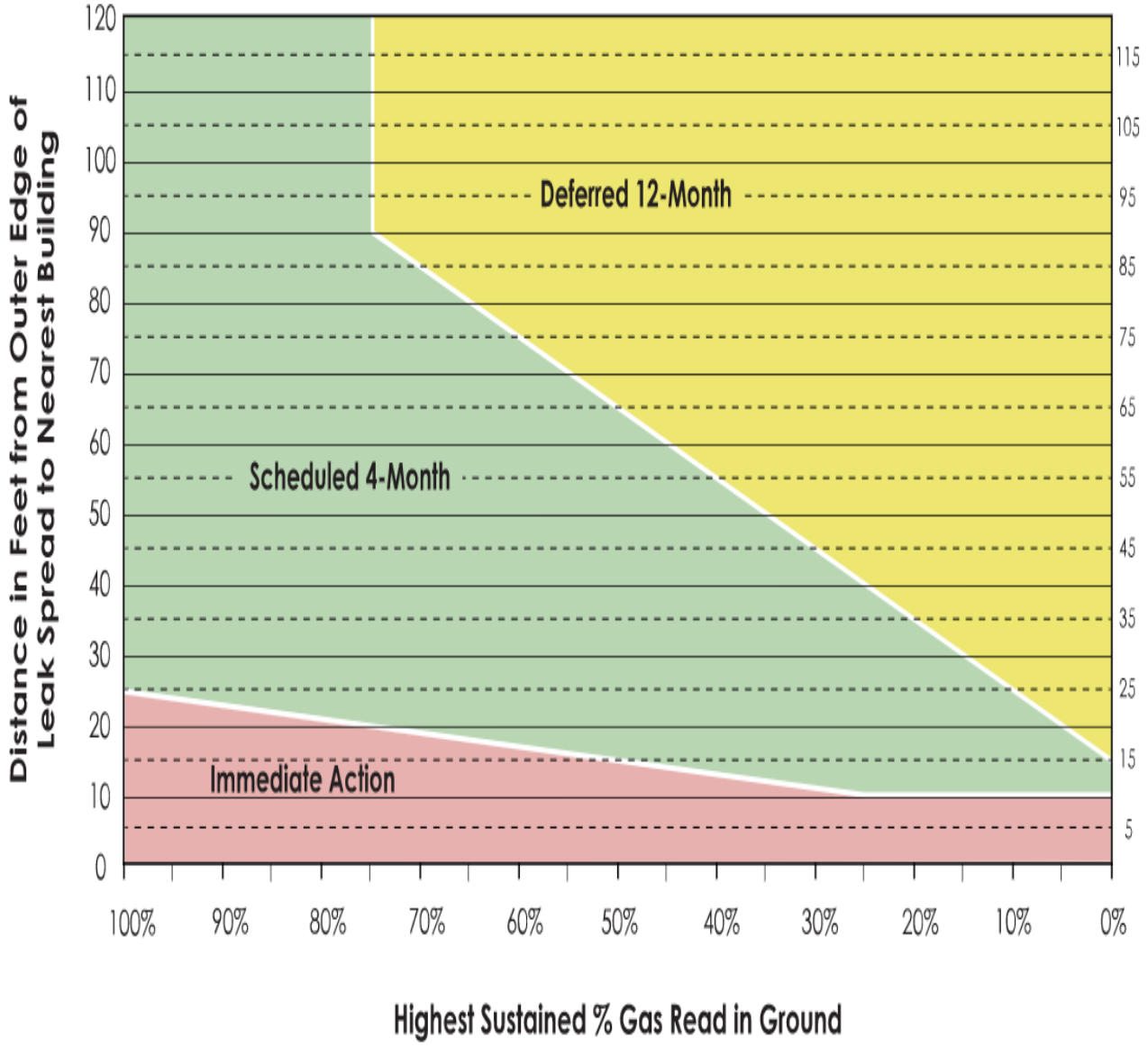
Table 6: Leak Classification at Consumers Energy

LEAK CLASSIFICATION – EVALUATION OF LEAK SEVERITY AND PRIORITIZATION OF REPAIRS	
Leak Classification	**Definition**
Immediate Action	• Repair immediately (temporary or permanent repair), OR • Take corrective action to reduce the hazardous condition to a level at which the leak can be reclassified as a Scheduled Action
Scheduled Action	• Repair or reinvestigate the leak within the specified time frame: ◦ Distribution – 4 months ◦ T&S – 4 months • A documented classification is required for each reinvestigation. • Permanent repair must be completed within the specified time frame: ◦ Distribution – Within one year of the leak being found ◦ T&S – As soon as feasible, based on reinvestigation, ongoing review of system outages, and upcoming projects
Deferred Action	• Reinvestigate the leak within one year of the date the leak was found. • A documented classification is required for each reinvestigation. • If deferred again, reinvestigate within a year from the new date.

Table 7: Above Grade Leak Classification (Distribution)

Field Conditions Found	Classify Leak As
• Gas leak on transmission operated by distribution (≥20% SMYS), OR • Blows soap off leak area, OR • Leak can be heard, OR • Gas detector read 4% (100% LEL) or greater within 3' of leak source, OR • Gas is entering or about to enter building(s), OR • Regulator is leaking	Immediate Action – Immediate corrective action, repair, or replace.
• Soap bubbles grow and break quickly, or leak holds a bubble, OR • Gas detector read less than 4% (100% LEL) within 3' of leak source, AND gas has not and will not enter building(s)	Scheduled Action – 4-month repair or reinvestigation
• Fish egg bubbles or small slow bubbles, OR • Would not generate additional leak calls, AND Gas has not and will not enter building(s)	Deferred Action – 12 months

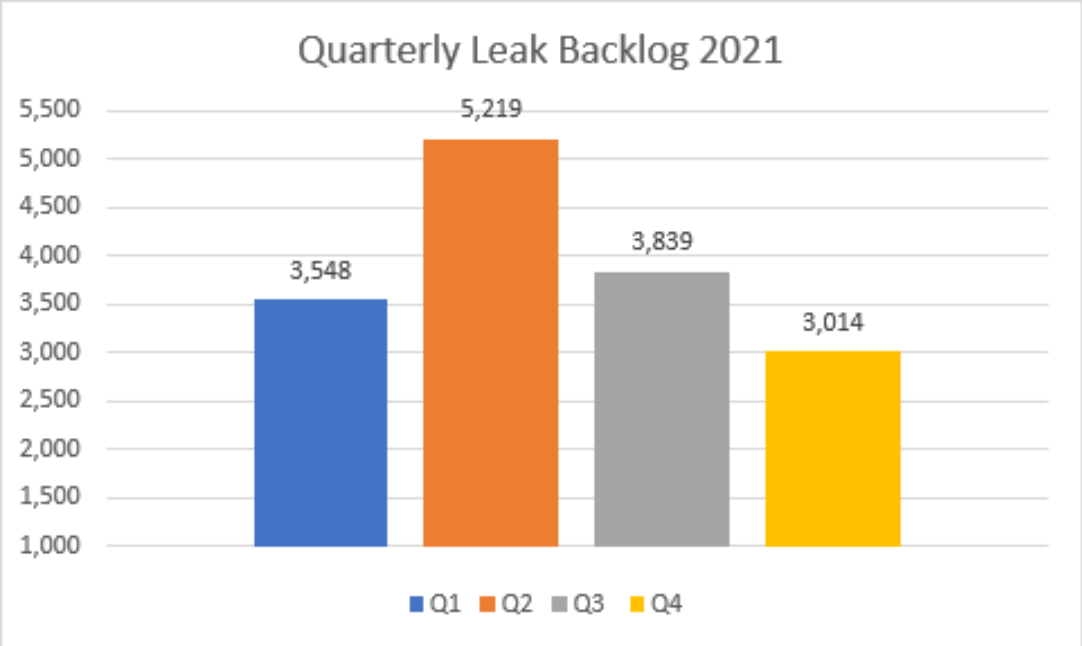
Figure 47: Below Grade Leak Classification (Distribution)



As of December 2021, the Company has approximately 3,014 total active leaks, which is a decrease of 679 leaks from 2020 with 2021 quarterly leak backlog progress shown in Figure 48.

The Company plans to decrease leaks to 1500 by year-end 2023. This data further shows the need to maintain the vintage material remediation to continuously reduce the leak backlog over time.

Figure 48: Quarterly Leak Backlog in 2021



7. AUGMENTATION

The Company is currently planning to install HP augments in 2022 through 2024 to remove bottlenecks outside Galesburg city gate (the Celery & River Street project), Climax CG (44th Street project), and Coleman-Beaverton CG (the Shaffer Road and Beaverton projects). Other distribution system augmentation projects include the Gratiot Avenue project and the Lk. Pleasant Rd. project, as well as several smaller augmentation projects. These distribution system augmentation projects will require an estimated total capital investment of $22.4 million dollars during 2022 through 2024.

8. MAOP COMPLIANCE PROJECTS

Compliance with federal pipeline operator safety standards support the Company's goal of providing safe and reliable natural gas service to customers. Various distribution line segments are being evaluated for compliance with MAOP standards contained in 49 CFR 192. Specifically, regulation 49 CFR 192.619 requires the Company to operate gas distribution line segments in a manner consistent with maximum allowable operating pressures, and regulation 49 CFR 192.624 requires the Company to have a plan to reconfirm pressure test records and remediate line segments for which the Company does not have pressure test records that meet PHMSA's expectations for traceable, verifiable, and complete documentation. Compliance milestones related to MAOP projects include a requirement to complete all actions required by 49 CFR 192.624 on 50% of the pipeline mileage subject to MAOP reconfirmation requirements by July 3, 2028, and complete all actions required by 49 CFR 192.624 on 100% of the pipeline mileage subject to MAOP reconfirmation requirements by July 2, 2035.

In addition to the work being done by the Company to evaluate compliance with MAOP standards, the Company has received notice from the staff of the Michigan Public Service Commission that Line 1080, which serves customers to the west of Kalamazoo, needs to be operated at a lower pressure to comply with 49 CFR 192.619. Options to remediate the pressure on this line segment have been reviewed by the Company, and pipeline modifications are planned for construction during 2025 and 2026.

To fully comply with the regulations described above, the Company is developing replacement project plans for line segments that require action to comply with the requirements of 49 CFR 192. Twenty projects, representing approximately 19 miles of distribution main have been identified to date, and these are identified in the following Table 8:

Table 8: MAOP Compliance Projects

Line Segment	Estimated Capital Cost ($)	Length (miles)	Expected Pipe Size	Construction Complete Year
Line 1009 Huron Park - I94	6,000,000	0.5	12"	2024
Line 1002f	1,050,000	0.07	26"	2025
Line 1009/1009c I94 - Little Mack, 10 Mile - 11 Mile	18,000,000	1.5	12"	2025
Line 1020	454,546	0.038	12"	2025
Line 1022f	284,091	0.028	8"	2025
Line 1087b	6,480,000	0.54	12"	2025
Line 1006, Groebel Dr - Mound Rd	4,650,000	0.31	24"	2026
Line 1009c, 9 Mile - 10 Mile	14,400,000	1.2	12"	2026
Line 1026f	7,588,825	0.759	8"	2026
Line 1026i	846,969	0.085	8"	2026
Line 1006, 11 Mile Mound - RR St.	6,116,477	0.408	24"	2027
Line 1009, 11 Mile - Little Mack - RS22	6,000,000	0.5	12"	2027
Line 1041	49,204,546	4.1	12"	2027
Line 1080	79,682,880	6.7	12"	2027
Line 1093	25,341,875	1.719	16"	2027
Line 1006, 11 Mile Dequindre - David Givens Rd	4,950,000	0.33	24"	2029
Line 1022d	1,415,720	0.142	8"	2029
Line 1071h	37,879	0.004	8"	2029
Line 1088g	96,400	0.01	8"	2029
Line 1088j	312,000	0.024	16"	2029

The Line 1080 project is scheduled to complete survey and field investigations during 2022. Project planning and city gate facility upgrades are planned for 2023. Project milestones during 2024 include acquisition of real estate, completion of construction plans, delivery of long lead time materials, and issuing requests for construction bids.

Construction contracts are expected to be executed early in 2025 so that actual construction will take place during 2025 and 2026. The Company is planning to improve upon resilience concerns that currently exist with this line segment due to limited sources of supply. This will be achieved by constructing a 6.7-mile parallel main to the existing main. Other alternatives to develop loops of main in that area to create connections to additional city gates to provide additional supply locations and improve resilience are expected to be excessive in terms of the cost to construct versus the overall resilience risk reduction.

The Line 1009 Huron Park to I-94 project is also scheduled to begin in 2023. Activities to be completed during 2023 include survey and project design for a half-mile main replacement. Project construction is planned for 2024. This replacement will ensure that this line segment is in compliance with 49 CFR 192.624.

The table above reflects projects that have been confirmed during 2022 to require main construction to achieve compliance with 49 CFR 192. Additional line segments are currently being reviewed to determine if additional main construction projects will be required.

9. CUSTOMER METERING

The Company routinely purchases meters, regulators, and related equipment. Meters and related equipment are used in serving new business connections, for the Routine Meter Exchange Program (an MPSC requirement), service renewal meter move-outs, and for normal replacement of obsolete or broken meters.

The Company currently uses temperature-compensated diaphragm (regulated and top connect) meters, rotary meters, and also purchases gas meter communication modules, gas electronic volume corrector units, and testing equipment.

The level of equipment purchased annually varies depending upon needs of the business. To better explain the timeline:

- Starting in June 2015, Consumers Energy began installation of Itron 100G ERT Gas Communication Modules (“GCM”) on approximately 700,000 combination electric/gas customer meters as part of the Advanced Metering Infrastructure (“AMI”) also known as the Smart Energy Program.
- In September 2017, the Company continued GCM installations on 1.1 million gas-only customer meters as part of the Gas Automated Meter Reading (“AMR”) project.
- The AMI deployment completed in December 2017, and the Gas AMR deployment completed in June 2019.
- On June 23, 2020, Consumers Energy received an end-of-life sales letter (PIL-20-1207) from Itron indicating that the 100G ERT module would no longer be available for purchase beginning March 31, 2021. On December 3, 2020, an update to PIL-20-1207 was issued by Itron stating that the 100G ERT module sales will continue until further notice in response to customer requests for additional time for technology transition planning. Consumers Energy will continue to purchase the 100G module while evaluating evolving AMI/AMR technologies.
- On September 10, 2020, the Company received an end-of-life sales letter (PIL-20-1247) from Itron indicating the end sales of diaphragm meters in favor of their new solid-state Intelis gas smart meter by March 31, 2021. The solid-state gas meter has an integrated 500G ERT incorporated into the unit. This ERT cannot currently be interfaced with Consumers’ current data collection engine.
- From October 2020 through Q1 2021, Consumers Energy conducted an evaluation of available gas meters and data collection technologies available in the market to determine if there is a vendor-agnostic metering, communication, and data technology solution available that will facilitate a switch from diaphragm gas meters to a solid-state solution. The determination was made that an acceptable vendor-agnostic solution is not currently available. With that determination, the Company has decided to make the top connect diaphragm meter the standard for new business and meter replacements through 2024, as meter, communication, and data collection technologies continue to evolve.

The Itron announcement regarding the end of life for their diaphragm meter product line impacts approximately 1,600,000 installed regulated diaphragms (“RM”) customer meters. These meters have a different connection method as compared to the top connect (“TC”) meter and will require a meter stand re-build to accept a TC meter. Therefore, the Company is looking at a Meter Bypass effort with the following current plan:

- In 2020, the Company began converting RM meters to TC meters on existing customer installations requiring a meter stand rebuild. As part of the conversion, a gas meter bypass has been added to the meter stand.

- In 2021, meter bypass stands for new business customers started to be installed. The meter bypass provides several benefits, including:

  Safety

  – Reduced number of appliance light-ups

  – Less entering customers' homes

  Improved Customer Experience

  – Reduction in interruptions of customers' service

  O&M Cost Savings

  – Reductions in re-light calls (Field, Call Center)

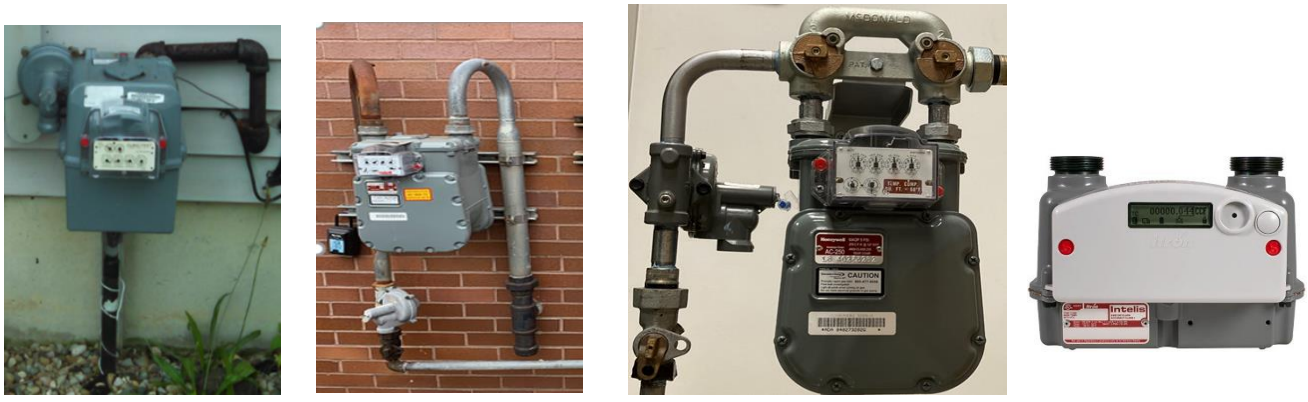
  – Reduction in time needed to exchange a meter

- In 2022 and 2023, the Company will investigate various scenarios, including projected costs and schedule, for conversion of all RM meter stands to TC meter stands. The conversion will require a new TC meter be purchased to replace the RM meter. The Company will continue to evaluate changes in metering technology to incorporate the migration of customers to gas smart meters into the scenarios evaluated.

  The new meter stands will accept the industry standard top connect meter and will enable the Company to improve multi-meter installation designs by allowing the installation of one master regulator to serve multiple meters.

  Installation of TC meter stands will also provide the opportunity for future gas smart meter technology upgrades with minimal field changes. The different types of meters, including an example of a residential gas smart meter (Itron Intellis Ultrasonic Meter (USM)), are shown in Figure 49.

Figure 49: Meter Types



Regulated Meter (RM) | Top Connect (TC) Meter | Top Connect (TC) Meter w/Bypass | Itron Intellis USM

10. NEW BUSINESS

The New Business Program consists of the capital costs of adding new commercial, industrial, and residential customers, and residential developments.

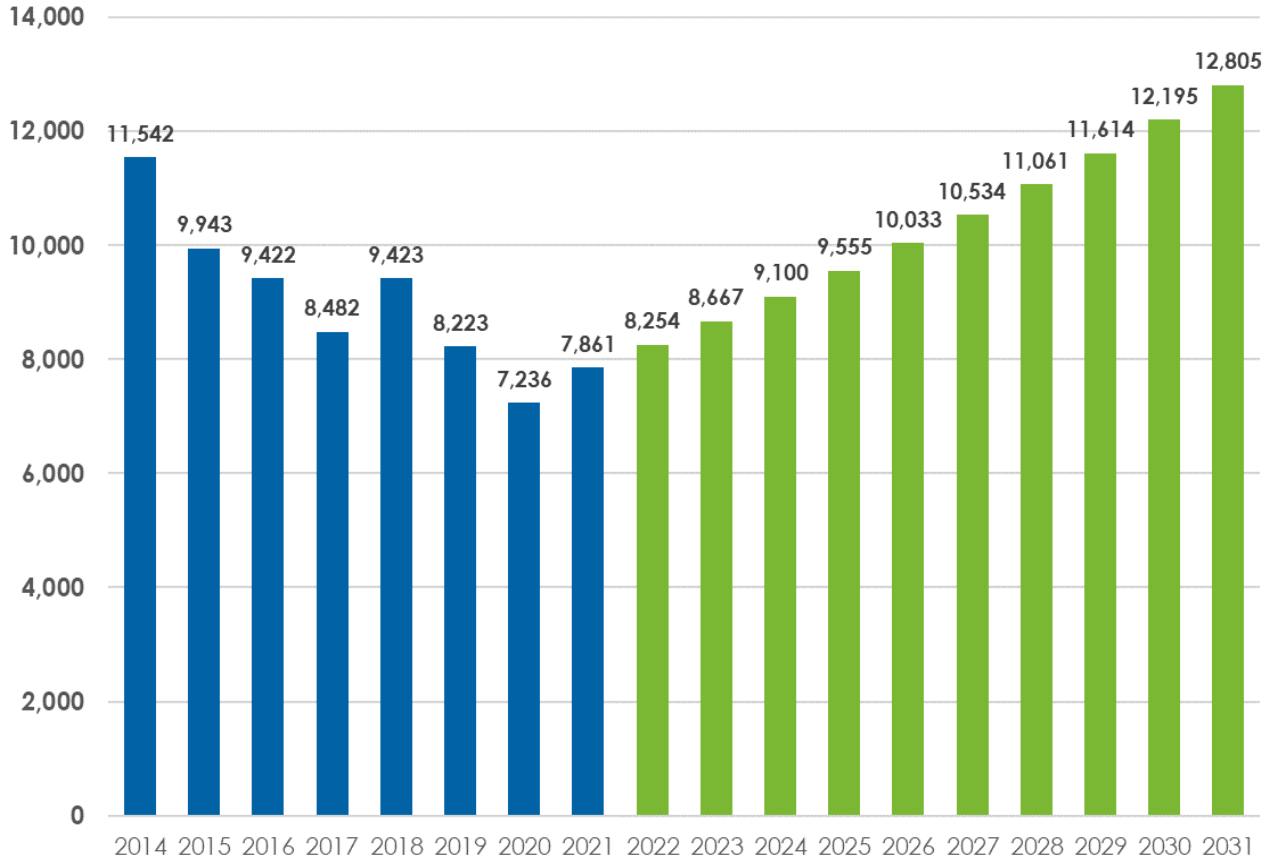
The program costs include the cost of installing mains and services, and the cost of meter stands to serve new customers. These projects are required in response to customer requests for new gas service.

Customers who request service share in the construction costs with the Company based on the appropriate tariffs approved by the MPSC.

The Company uses forecasting data from multiple sources to forecast and plan for new business growth.

Based on historical data from the most recent eight years, the Company believes that 2020 and 2021 represent historical years impacted by response to COVID and is forecasting a growth of 5% per year through 2031 as shown below in Figure 50.

Figure 50: New Business (Number of Service Connections)



The Large New Business Program includes new customer connection projects where the estimated infrastructure cost exceeds $500,000, and therefore is a separate program that requires special tracking and project management. Projects are generally created under this program when the customer has signed a contract with the Company locking in the load requirements and revenue expectations.

Currently there are no new projects planned for this program for 2022 or 2023. However, new requests for load can come in at any time, meaning the Company may add projects to this program throughout the year.

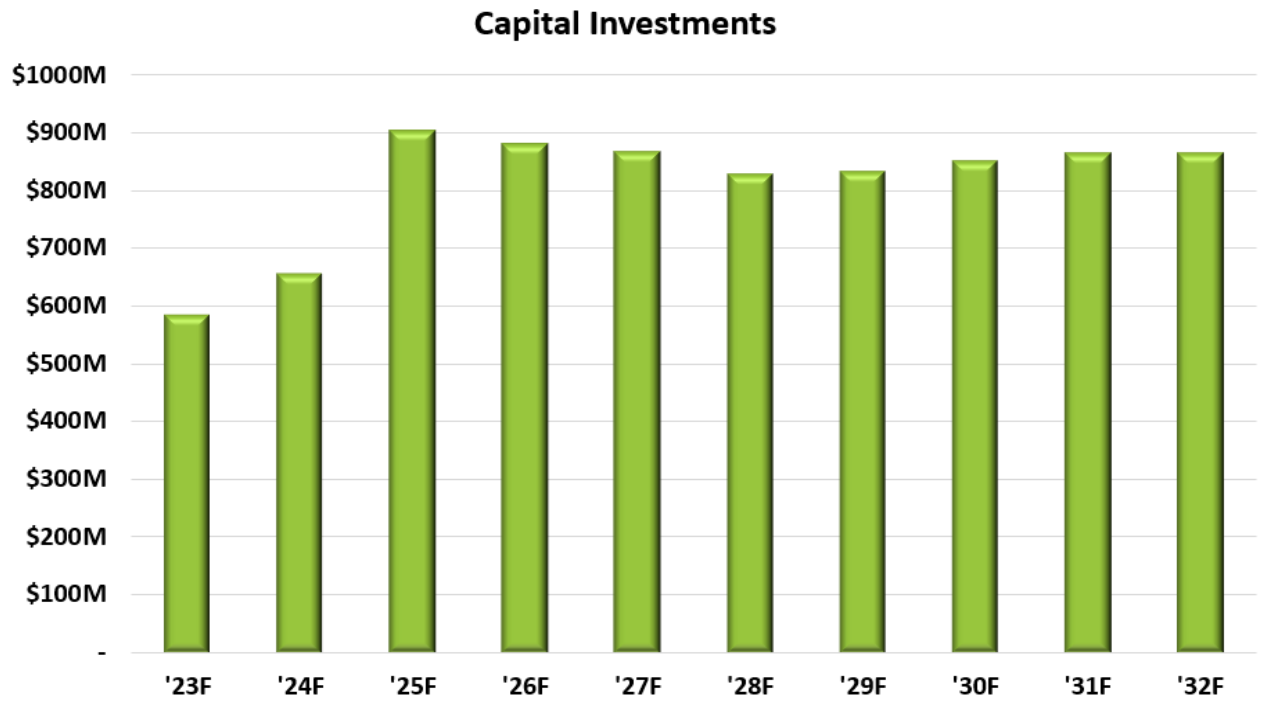
11. DISTRIBUTION ASSET FINANCIALS

Consumers Energy's largest capital increase is due to vintage material remediation. The Company believes it can lower remediation costs through economies of scale and work management improvements, and therefore expects the total main and services remediation to cost approximately $6 billion.

The grid approach, explained above in *Maintain Pace of Vintage Material Remediation*, was piloted in 2020. The preliminary results indicated a 30% lower cost per mile, 40% more main miles completed, and an improved customer experience. We have modified our processes to incorporate a 30% and 60% design review, in addition to the 90% design review, enabling input from internal and external stakeholders sooner in the process, improving efficiencies by reducing design rework.

The capital investment plan for the entire distribution asset class is shown in Figure 51.

Figure 51: Distribution Capital Investment Plan



Overall, this investment plan for the distribution asset class aligns with the objectives by reducing asset risk that is closest to the customer (safe), ensuring the system is able to flow as required (reliable), providing the necessary approach to accelerate the completion of this work (affordable), and reducing the amount of emissions in this system, which equates to over one-third of the Company's methane emissions (clean).

12. REFERENCES

1. PHMSA reported figures (March 2021)
2. GIS database visualized through Power BI
3. DIMP database visualized through Power BI
4. GIS database
5. Active leak register - GIS database combined against active leaks and mapped on Power BI
6. *Gas Distribution Pipeline Inventory Reports*

V. Operational Capabilities

As Consumers Energy moves forward with the Plan, there will be intentional actions by the Company in the areas of people, process, and technology for each of the asset areas to successfully achieve the 10-year objectives, goals, and outcomes.

A. People – Talent and Workforce Approach

From a people perspective, the Company is focused on how to safely deliver for customers by ensuring Consumers Energy has the right people, with the right skills, at the right place and time.

- To make sure these commitments are met, the Company is placing a strong focus on hiring an increasing number of skilled trade workers and engineers, and also creating the right employee experience to ensure the Company is attracting and retaining the most qualified candidates.
- In addition, Consumers Energy has developed a full-scale Gas City Training Village that allows the Company to train employees through real-time, hands-on situations and continue relentless focus on making safety the top priority. The Company will need enhanced and evolving cybersecurity skills to protect assets as technology becomes more integrated with assets. As customer expectations shift to on-demand expert advisement and more personalized experience, the Company will need a workforce skilled in leveraging the power of data to meet customer needs.
  - A variety of new skills will be needed to deliver on business plans over the next 10 years. This framework will provide a means to build these skillsets at scale, including developing current employees and adding new employees with different talents.
  - The knowledge, skills, and abilities of employees are key determinants in the quality and timeliness of service that customers receive. The Company's ability to deliver what customers expect—such as reliable and safe energy delivery, on-time completion of service orders, energy savings, accurate billing and easy-to-navigate Web site and mobile applications—depends upon having the right talent in the right job at the right time.
- This framework will facilitate the matching of employees, capabilities, and qualifications to the requirements of the business to minimize the risk and costs of employee turnover. Consumers Energy also developed a competitive Michigan workforce of more than 550 employees that constructs infrastructure projects.

The Company continues to evolve its processes to ensure it has an effective talent pipeline, diverse candidate pools, and support of the diversity, equity, and inclusion goals for gas delivery co-workers, as the following shows:

1. **Creating the Talent Pipeline** – The Company is taking the following steps to attract, retain, and grow its people:

   a. **Career Awareness Activities**

   - **Michigan Career Quests:** There are 10 MI Career Quest events held throughout the State each year. These day-long events provide hands-on career exploration for high school students. Consumers Energy is a sponsor and have a prominent presence. Thousands of students participate in each session, with the largest in Southeast Michigan hosting over 10,000 high schoolers.

- **Careers in Energy Week:** Each year the third week of October is declared to be *Careers in Energy Week* by the Governor. The Company makes a concerted effort to promote skilled trades, engineering, renewables, and IT career fields within energy via a series of tours, events, school career fairs, social media contests and campaigns, and public relations activities.
- **Talent Ambassadors (Formerly Education Champions):** Nearly 450 employees raise their hand each year to support local school district career fairs, mock interviews, and to speak with classes about careers in energy, their personal experience and career pathway.
- **Summer Youth Energy Academies:** The Company expanded this year to add Pontiac and Flint to the two summer youth employment programs started in 2021 in Jackson and Grand Rapids. This 6-week academy provides participants with exposure to energy careers while gaining pre-employment essential skills. Intentional efforts to partner with diverse partners and communities resulted in women and minorities as the majority of participants. Each student leaves the program with a career pathway plan including next steps.
- **Elementary School Energy Safety and Careers Presentations**: Beginning in 2022, the Company offers these hands-on, one-hour presentations for 4th and 5th graders in partnership with the union, UWUA, representing our frontline gas and electric workforce. We have identified the top 10 most diverse school districts in our service territory as the highest priority to deploy these important workshops. In 2022, we are on target to present to 2500-5000 students. The workshops cover basic safety for both gas and electric, along with hands-on interaction with the equipment and vehicles used by our crews.
- **DAPCEP** is a Detroit area pre-college engineering program designed to expose diverse students to STEM Careers. Every summer the Company sponsors a cohort of students.
- **Project SEARCH** focuses on high school students with differing abilities and provides work experience and mentoring to this unique group of students while they complete their senior year at our Headquarters.
- **Inside Track Webinars** This new popular webinar is focused on promoting energy careers to diverse job seekers. Held three times this year, over 1000 people joined in the one-hour session to learn about our career pathways, school partners, application processes, decoding our job postings, and increasing their employability at Consumers Energy.

b. Training and Education

- **Veteran's Gas Bootcamp:** In partnership with UWUA trade school, P4A, the Utility Military Assistance Program: Michigan Gas Boot Camp (UMAP-MI) openly recruits current Michigan National Guard members, Reservists and Honorably Discharged military veterans. The program is designed to provide the requisite skills and knowledge an individual will need for a successful career within the gas utility sector. Successful completers are employed with Consumers Energy as entry-level Gas Lines Construction Laborers. To date, Consumers Energy has employed 201 Veterans as a result of the Gas Bootcamp.
- **Energy Industry Fundamentals:** Through the Michigan Energy Workforce Development Consortium, we partner with Career Technical Education centers and high schools (Hartland, Boyne City, Oakland South and Oakland North, Holt, Jackson Public, Jackson Northwest, Western High school) to deliver the national certification course, *Energy Industry Fundamentals*. This course is also offered as a part of college energy programs at Lansing Community College, Jackson College, MIAT, and Henry Ford Community College. High School students can dually enroll to earn college credit. An online version at Jackson College is also available as of Fall 2020. We promote it as a precursor for many job roles and a primer for our college level school-to-work programs. Each year more than 250 students enroll in the course statewide.

- **Jackson College Energy Systems Program**: As the college located in our Headquarters' hometown of Jackson, Consumers Energy partners with **Jackson College** to provide education for multitude of job roles including gas delivery technicians, planners, and schedulers. Their two- and four-year degree programs in Energy Systems were developed in partnership with the Company and are continually updated to meet our needs. The high school energy programs and summer intern programs will serve as a natural pipeline of diverse students for the Jackson College programs. The Company will also be offering paid internships for Jackson College students.

c. Resources

- **Michigan Energy Workforce Development Consortium:** The Company works with other utilities and provides leadership for MEWDC. This organization is made up of more than 50 partners from education, government, workforce development, and community-based agencies to strategize, plan, and execute activities that increase the available diverse qualified workforce including: periodic workforce demand planning surveys, creating, and maintaining standards for CTE programs in energy, forming college partnerships, promoting energy career awareness, and engaging with diverse communities.
- **State Apprenticeship Expansion (SAE) Grant Funding:** Most recently MEWDC was awarded a $1.1 million grant ($134k coming to CE) to recruit and train more women, minorities, and veterans into skilled trade positions.
- **Going Pro Grant:** In addition, the Company receives between $400-500k per year in grant funding to support technical training for our operations, maintenance, and construction workforce through the State Going Pro grant program—ensuring that our new apprentices have access to high quality state of the art training.

d. Diversity, Equity, and Inclusion in the Talent Pipeline

- **Intern Recruiting:** Annually engages in over 50 on-campus recruiting and networking events connecting students to various internal business departments. Partner with various internal Intern Councils to identify workforce needs, schedule recruiting activities, screen, and select company interns. In 2020/21, the Company vetted over 5,000 qualified intern candidates to fill 142 positions.
- **Targeted Campus Organizations:** In support of the campus recruitment, the Company will deliberately partner with diverse student organizations in effort to ensure maximum exposure of our intern and career opportunities. Some of the most prominent student organization partners include: Society of Women's Engineers (SWE); National Society of Black Engineers (NSBE); Society of Asian Scientist and Engineers (SASE); and Society of Hispanic Professional Engineers (SHPE). In addition, the Company works directly with several on campus diversity programs or multi-cultural student support offices to ensure opportunities are reach the less prominent organizations.
- **Intern Experience:** During the summer internships, the Company leads several engagement opportunities with the interns to foster a positive experience. Annually, Consumers Energy hosts an intern luncheon experience designed to develop a deeper understanding of our business and build affinity. At the end of each internship, the Company gathers intern rating documents from supervisors to use in the vetting process for return internship or fulltime offers.

- **Professional Organizations:** In support of the core business needs and benchmarking studies, the Company continuously seek partnerships to improve our employee diversity. The goal is to infuse high quality diverse applicants into all our external job postings. These deliberate efforts include a paid partnership with Professional Diversity Network (PDN) to participate in six diverse organization career fairs in 2021 and post all of vacancies on over 30 partner network careers sites reaching over 500,000 diverse jobseekers. Also, the Company maintains an annual partnership with MI Talent Connect that reposts all our job vacancies on more than three hundred local diverse job boards.
- **Leverage Corporate Giving Relationships:** Routine collaboration with Corporate Giving allows the Outreach Team unique opportunities to connect with recipient organizations to support our workforce needs. A great example of this is our support for the MSU CoRE Program, which is dedicated to supporting first- and second-year Engineering students inspired to remain in the field. A great example of this is our support for the MSU CoRE Program, which is dedicated to supporting first- and second-year Engineering students inspired to remain in the field. This partnership provides a unique access to network, mentor, and support this student body that traditionally has a high attrition rate of female and minority students.
- **National Women in Construction (NAWIC) Relationship:** Over the past five years, the Company has maintained a strong working relationship with NAWIC to help promote our opportunities to their membership. Over the past two years, Consumers Energy has shared every external gas construction vacancy posting with NAWIC. This relationship with NAWIC has also provided several diverse supplier contract bids.
- **Targeted Career Fairs:** Annually, the Company supports more than two dozen career fair events focused on minorities, females, veterans, and individuals with disabilities. The Company partners with our Employee Resource Groups, People and Culture Business Consultants, and Talent Acquisition Team to support these external career fair events.
- **Virtual Engagement:** In 2019, the Company began using virtual career fair platforms to provide more opportunities to reach targeted audiences. This augmentation plan allowed the Company to seamlessly transition to full remote career fair and networking with targeted jobseekers in our current remote environment.
- **Career Bootcamps for Hiring Success:** The Company is creating a pipeline to become an employer of choice for underrepresented communities in high demand occupations. These bootcamps are designed to springboard you to a successful career. In partnership with trade schools and the Utility Military Assistance Program, our Michigan Gas Boot Camp (UMAP-MI) openly recruits current Michigan National Guard members, Reservists and Honorably Discharged military veterans. The program is designed to provide the requisite skills and knowledge an individual will need for a successful career within the gas utility sector. Successful completers are employed with Consumers Energy as entry-level Gas Lines Construction Laborers.

1. Diversity, Equity and Inclusion in the Entire Talent Life Cycle

To quantify this work, Consumers Energy has several DE&I Movement Stands that include multi-year goals in the areas of culture, talent, philanthropy, and supplier diversity. Our stands support our strategy, are aligned with our Executive DE&I Council, and represent measurable aspirations.

Consumers Energy's Culture Stand: "We work in our company and our communities to value people of all backgrounds."

Embedding DE&I into the Company's culture focuses on educating our co-workers and leaders, including companywide DE&I awareness training, and highlighting opportunities where they can contribute to create an inclusive environment.

- *DE&I Awareness Training*: In 2021, the Company launched a from-the-top learning model for our employees, starting with company leaders and achieved 100% unconscious bias training completion for anyone with a direct report. In 2022, we moved to all coworkers in our commitment to 100% completed DE&I awareness training. This is setting common expectations and norms about all things DE&I. By training all employees in core DE&I concepts—such as the roles unconscious bias plays in our personal and professional relationships and decision-making— and building a solid foundation that makes DE&I an integral part of the Company's work experience.
- *Employee Resource Groups:* The Company has 2,000+ co-workers, more than 20% of our workforce, engaged in our Employee Resource Groups where each embrace differences to improve working relationships and deliver better results for coworkers and customers. All eight ERGs are employee-led, raising new ideas that will lead to a greater sense of belonging by all. Recent ideas that evolved internal policies include: A world-class parental leave policy that expands to six months for birthing parents and four months for non-birthing. Similarly, expanding domestic partner benefits for all co-workers. This is not only designed to better protect LGBTQ employees and their dependents but also seniors and other unique scenarios where these benefits are essential. The Company also evolved our paid holiday policy, once capturing only major federal holidays but now includes Inclusive Holidays, chosen by the employee, such as Juneteenth, Hanukkah, or Ramadan.
- *DE&I Champion Program:* A program made up of half union employees and half exempt, their mission: Create safe spaces within any DE&I program and help bring core concepts to life at all organizational levels. The program works to advance belonging by leading grassroots communication efforts, sharing opportunities for involvement, identifying and addressing gaps, solving problems and providing continuous learning and development. Today they lead our companywide DE&I awareness training for all employees. Peer-to-peer conversations, especially within our union family, are a critical step in setting common expectations and norms for all while building a solid foundation that makes DE&I an integral part of our company.
- *Conversations About Race and Social Justice:* The Company invited all 8,500+ coworkers to companywide conversations through all-hands townhalls and offering safe, weekly DE&I & Well-Being Office Hours where any employee can seek 1:1 time. We enhance the experience by inviting external speakers, experts in the justice space, to grow our learning journey through unique perspectives. We're focused on inspiring difficult conversations, working through discomfort and embracing our differences to deliver better results for our company and our customers.
- *Well-Being Champions*: With the workforce pressures due to the COVID-19 pandemic, we implemented Well-Being Champions who lead well-being initiatives throughout the company by identifying and addressing needs of our co-workers and provide continuous opportunities to engage in well-being efforts throughout the organization and beyond (retirees and spouses). The goal is to

empower our employees to thrive in each pillar of well-being by creating a culture where the healthy choice becomes the valued and easy choice.

Our Talent Stand: We expect every future and current employee to have equitable opportunity to succeed

As one of Michigan's largest employers, the Company is building a world-class, inclusive workforce to be a better reflection of our community. Building a diverse, equitable, and inclusive workforce relies on the ability to attract and retain diverse talent. That attraction starts with a strategic talent sourcing strategy that focuses on recruiting in areas representative of all demographics, allowing us to build diverse, qualified candidate pools. Creating a diverse and inclusive workforce expands beyond strategic sourcing to the processes used for the employee lifecycle (e.g., hiring, promoting, developing, and succession planning).

- *100% Diverse Hiring Committees and Candidate Slates:* The Company expects every future and current co-worker to have an equitable opportunity to succeed. The practices include 100% diverse hiring committees and candidate slates for every position posted. Further, the hiring training includes the best hiring practices for our managers.
- *Summer Youth Energy Academies:* Within the communities where the Company's employees live and work, there are 300+ Talent Ambassadors inspiring K-12 students to become future co-workers—thus building our Talent Pipeline in the communities we serve for future generations. Our 6-week Summer Youth Academy provides participants exposure to energy careers while gaining pre-employment essential skills. The program will continue to expand with a focus placed on urban core cities with a high percentage of students from underrepresented populations.

Our Supplier Diversity Stand: We will double our spend with diverse suppliers, reaching first quartile by 2024

The Company continues maturing in diverse supplier programs by building a framework that enables high quality, long-term success. The Company knows a vibrant and diverse supplier network increases competition, strengthens innovation, and ultimately benefits our customers' pocketbooks. Together, Consumers Energy is a force of change and that's why the Company is committed to doubling its spend with diverse businesses by 2024.

- *Expanding our reach*: The Company in this to spark innovation and drive economic prosperity. That's why it actively engages with diverse-supplier organizations nationally and in Michigan. Together the Company connects, supports and develops minority-, women-, LGBTQ-, disability-, and veteran-owned suppliers. Diverse suppliers are encouraged to create a business profile on our "Become a Supplier" website. We share our values and prefer suppliers who hold similar commitments. This is good for our co-workers, good for our customers' bills and good for future generations. Our program will include an expanded diverse supplier network, validating certification of diverse vendors, and Enhanced Tier II reporting for suppliers of our suppliers.

Our Philanthropy Stand: Consumers Energy creates equitable, sustainable change to support social justice initiatives throughout Michigan and the communities we serve

The Company has been giving back to Michigan for decades, helping local communities grow and thrive through the Consumers Energy Foundation. As a force of change, we're committing $15 million by 2023 to create equitable, sustainable change in justice initiatives. Recently, the Company has contributed $2.6 million to diverse organizations specifically impacting communities of color.

- *Incubating People of Color Owned Businesses:* The Consumers Energy Foundation seeded the start of the New Community Transformation Fund (NCTF), a $25 million venture capital fund aimed at driving a more diverse economy in Grand Rapids, Mich. The group will invest between $250,000 to $500,000 in second-stage, people of color-owned companies involved in advanced manufacturing,

food and agribusiness, e-commerce and information technology, life sciences, and finance technology as well as legacy and transitioning succession businesses. One of the largest investments in the Foundation's history, the commitment to diversity demonstrates our unwavering belief that West Michigan's continued success must be collective and inclusive of everyone.

- *Supporting DE&I in Local Communities*: The Foundation recently invested $100,000 to support five community foundations across Michigan who are directly working with local organizations actively engaged in DE&I initiatives to expand grassroots opportunities. Community foundations are uniquely positioned to identify inequities that exist in their communities and direct funds to make the biggest impact. Our success is defined by driving measurable outcomes with our community partners. We maintain a focus on social justice, including Racial; Gender; Environmental; Veterans; LGBTQ+; Ability/Disability; Socioeconomic. Our commitment to equitable and sustainable change will strengthen the communities we serve, including investments in diverse businesses and in people with unique perspectives, strategies and spheres of influence. These relationships strengthen not just the Company but also the state, leaving Michigan better than we found it.

Our Movement Stand	2022 Measurement	2023	2028
Culture: The Company includes and values people of all backgrounds in the company and culture	+2 increase from 2021 score on DE&I Index	83	93
Talent: Every current and future co-worker has an equitable opportunity to succeed	Engineering roles at/above labor market availability: 49%	54%	79%
	Operational roles at/above labor market availability: 53%	58%	83%
Philanthropy: The Company creates equitable, sustainable change to support social justice initiatives throughout Michigan	$5 million	$15M	$40M
Supplier Diversity: The Company will double its spending with diverse suppliers to achieve 1st quartile	11.90%	16%	1st Quartile

- *Volunteering for Our Communities:* The Company's 8,500 employees mobilize into volunteer engines to deliver on our purpose for the people of Michigan—not just with dollars but with our people in our communities where we live, work, and play. Together, the Company can continue being a force of change – advocating for justice in our communities.

The Executive DE&I Council, chaired by the Company's CEO, is driving organizational change by tracking progress with measurable Action Plans, designed within the Movement Stands framework. The Council includes every channel represented by our Senior Vice Presidents and includes a measurable glidepath through 2028. The Council tracks measures for each DE&I Movement Stand. The following table has been previously and is annually presented and reviewed with the Board of Directors ("Board"). The Board actively engages and challenges progress, explores thinking, and ensures the appropriate resources are applied.

2. Company Brand

The Company makes intentional efforts to ensure that our customers, stockholders, current and future co-workers, and the energy industry are aware of our progress to embed DEI in everything Consumers Energy does. The Company strategically participates in employer branding opportunities by sharing its successes in social media, on the Company website, and participates in sponsorships and speaking engagements at conferences and events. It publishes the DE&I Annual Proxy Statement. Recognition of the Company's impact in 2021-2022 includes these awards:

- 2022 Forbes Best Employer for Women; fourth year in a row
- 2022 3BL Media 100 Best Corporate Citizens out of the Russell 1000 Index
- 2022 VETS Index 4-Star Award
- 2022 Ranked DiversityInc #10 Company for Philanthropy
- 2022 National Organization on Disability Leading Disability Employer
- 2022 Ranked DiversityInc #1 Top Utility Companies for Employee Resource Groups
- 2022 Scored Human Rights Campaign 90% on the Corporate Equality Index
- 2022 Newsweek America's Most Responsible Companies
- 2022 Ranked Forbes #2 Utility for Best Employers for Diversity
- 2021 Military Times Best for Vets: Employers List

Considering all these efforts, the Company is confident it will have the talented workforce necessary to execute this Plan successfully.

B. Process – Operating System Approach

The Company is committed to operational excellence. At Consumers Energy this means achieving a state of performance that enables the Company to deliver on its purpose. Through application of Lean principles (The CE Way), work management enhancements, and the Gas Safety Management System, the Company is transforming how it operates to improve performance, the customer experience, identify opportunities to increase efficiencies in the business, and minimize risks.

1. THE CE WAY

In 2016, Consumers Energy began its Lean journey, The CE Way, to provide the best value for customers through a culture of continuous improvement. This is the adaption of the Company's lessons learned in manufacturing and other industries applied to design, construction, and operations of utility assets to continuously improve safety, quality, cost, delivery, and morale.

Early in the journey, the Company created a large footprint across the organization by exposing employees Company-wide to the CE Way, while building a strong motivation to improve safety, quality, cost, delivery, and morale.

- In 2017, the Company launched the 4 Basic Plays (Visual Management, Operating Reviews, Problem Solving, and Standard Work) as a prioritized approach for leaders to begin implementing the CE Way. Since that time, the Company has added Waste Elimination to the Basic Play toolkit available to all employees.

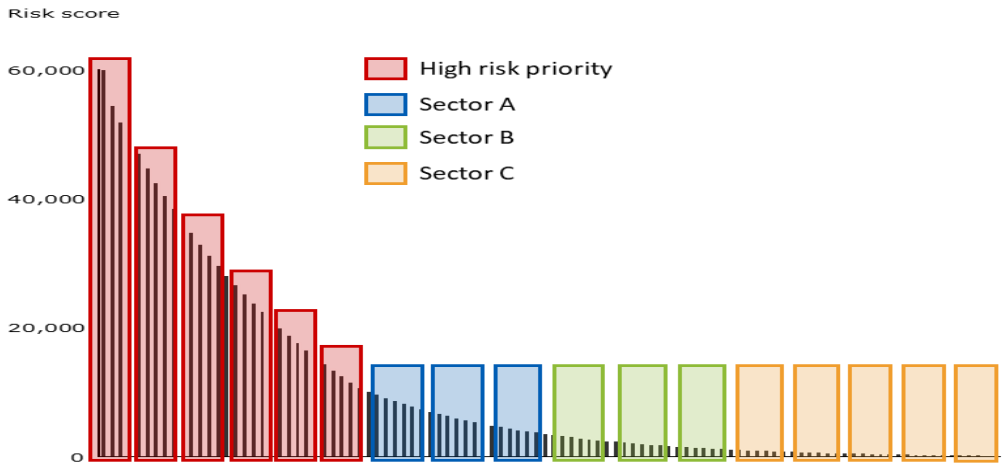
Through these basics, the Consumers Energy has established a strong capability for delivering value to customers and allowing the Company to sustain breakthrough performance. Consumers Energy's purpose of 'CMS Energy: World Class Performance Delivering Hometown Service' means ensuring the Company delivers safely, reliably, affordably, and with the highest quality. Examples of performance improvements can be seen across the organization because of the Company's Lean journey. The CE Way Basic Plays depend upon one another and are implemented together to achieve maximum effectiveness in delivering for customers.

2. WORK MANAGEMENT

As part of the overall operational excellence process, work management is a key to the successful execution of this plan. Part of transforming the workforce is within distribution remediation and that will include changing to a zone-based model.

As stated in the *Distribution Asset Plan* section, remediation projects can range in size from several hundred feet to a few miles. Many utilities use a grid-based model to complete projects one at a time, grouping areas of distribution mains and services together based on collective risk as shown below in Figure 52.

Figure 52: Illustrative View of a Grid-based Model



The grid approach creates economies of scale and provides multiple benefits:

- Fewer project locations — The historic approach resulted in a higher number of smaller projects compared to the grid approach plan to have a smaller number of larger projects.
- Real estate rights cost — Need for fewer number of project laydown yards to store materials and equipment.
- Equipment cost — Each project requires a minimum amount of equipment to perform the required work.
  - Bore machines are a good example. Typically, one or more bore machines is needed at each smaller project. But a larger grid project might only require two or three bore machines (while the project scope is several orders larger than this) and be able to use equipment more efficiently and cost effectively.

- Improved efficiency — The grid approach is focused on completing all vintage pipe and service work in an identified geographic area.
  - The historic approach has resulted in projects being completed for a section of high-risk pipe in one year and then returning to complete a nearby project only a few streets over a year or a few years later that had a lower risk.
  - In addition, the historic approach may result in prioritizing work for a Vintage Services project in a year and then have the EIRP Program come back to the same area a year or a few years later to work on the distribution main pipe.
- Increased productivity – The grid approach will reduce the amount of project mobilization and demobilization travel time and cost each year, allowing construction crews to use that time for productive project work.
- Improved coordination with local communities – Longer-term planning and communication on fewer and larger projects will improve coordination of local public works projects and plans. This allows the Company to explore cost savings opportunities with local municipal partners.
- Improved customer experience – The grid approach will focus on completing vintage materials replacements within a larger construction project as compared to the segment approach. This will minimize repeated road-user disruptions, reduce the number of project mobilization/demobilization occurrences in the neighborhood, and maintain personnel working within the project allowing them to keep an open dialogue with impacted customers sharing updates, issues and insights about the project.

3. GAS SAFETY MANAGEMENT SYSTEM (GSMS)

In support of Consumer Energy's focus on safety, the Company continues implementation of the GSMS to reduce the risks related to the operation of the gas system, and to ensure customer safety by adhering to an industry best practice shown below to achieve compliance requirements.

GSMS is the Company's approach to implementing API RP 1173. The implementation of API RP 1173 by natural gas operators is encouraged by the National Transportation Safety Board, PHMSA, and the US Congress. API RP 1173 includes 10 essential elements. To align with its business structure and needs in support of improving system safety, an additional element (Prioritization, Resources & Unit Cost) is included in GSMS to reflect our focus on maintaining customer affordability while making needed safety investments, and the essential elements of risk management and operational controls were subdivided. The elements of GSMS are referenced in Figure 53.

The implementation target was to achieve a maturity level 3 (which requires the Company to be fully implemented throughout the organization) by 2022, which has been achieved and now continuously growing in maturity in subsequent years, as shown in Figure 54. Self-assessment puts GSMS program maturity at 3.14.

The Company's policy for the GSMS states "Consumers Energy employees and contractors will comply with regulations and adhere to and continuously improve all Company natural gas policies and procedures to improve gas system safety for Michigan and our co-workers."

In alignment with the policy statement, a corrective action process, feedback system (ECAP), documentation, and records processes are essential to the implementation of the GSMS. The following sections highlight plans to support development and enhancement of these processes and systems.

Figure 53: Overview of Gas Safety Management System

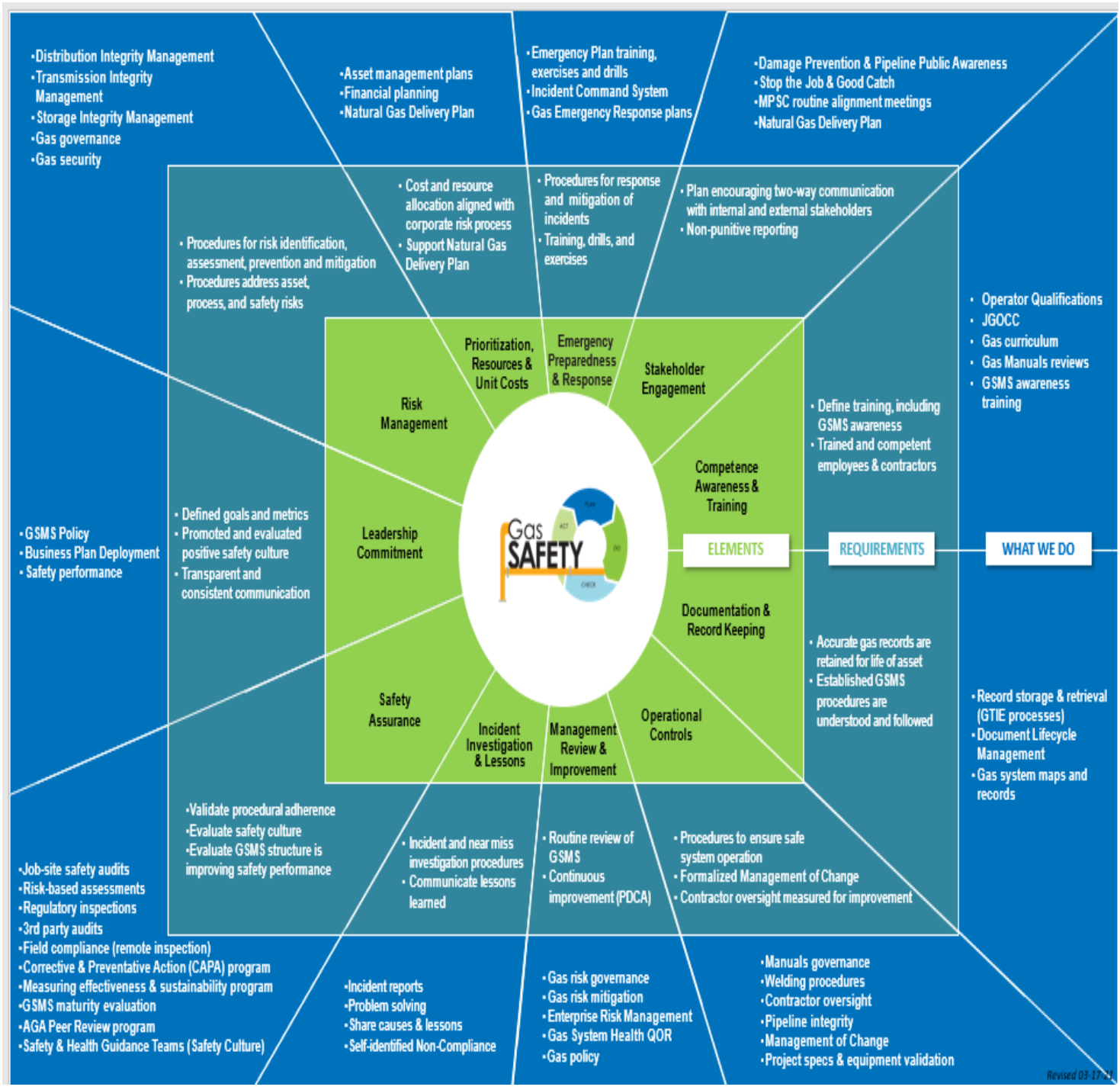
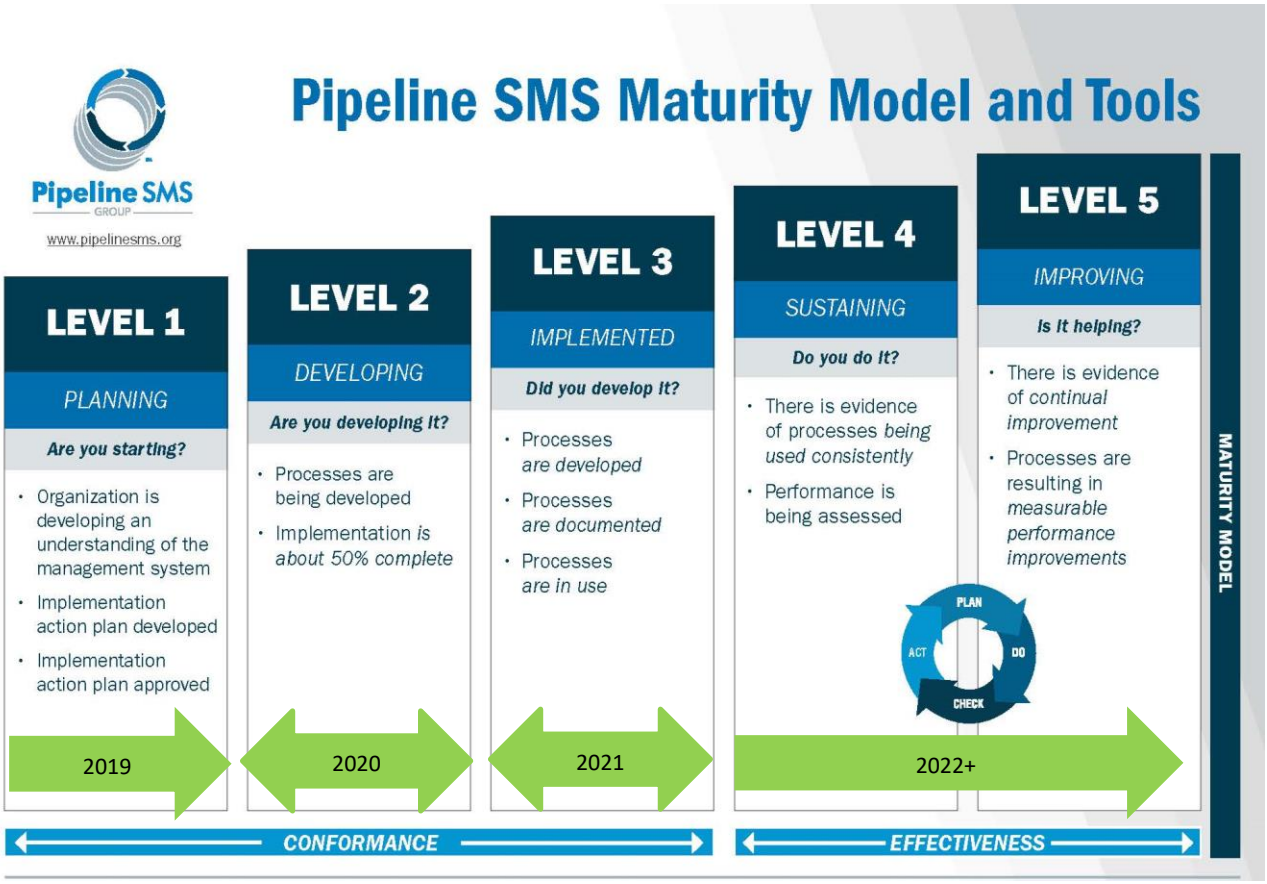


Figure 54: Pipeline SMS (i.e., GSMS) Maturity Model & Timeline



a. **Enterprise Corrective Action Program** ("ECAP")

The Corrective Action Program is a requirement for incident management within GSMS and as described by API RP 1173.

The scope of the ECAP initiative includes:

1. Creating an intake process for documenting issues as they are identified.
2. Setting up a standard taxonomy for issues and causes.
3. Organizing and retaining issue content data.
4. Performing risk-based evaluation of issues per established Quality Standards.
5. Implementing a process and/or tools for risk-based issue remediation.
6. Performing Statistical and Cognitive data queries and trending.
7. Performing other data analytics.
8. Creating a system of record for an audit trail while reducing the risk of human error.

This program will reduce risk to the gas system through the implementation of innovative sustainable solutions for gap closure.

b. Enterprise Contractor Oversight

Enterprise Contractor Oversight ("ECO") is a key initiative for the effective oversight of contracted work.

ECO provides a framework for governance, performance monitoring, and controls of contractor work across the entire Consumers Energy enterprise. The goals of the ECO are to:

- Design and implement a Center of Excellence ("CoE") covering all aspects of Contractor Oversight.
- Implement risk-based standardized contractor prequalification processes, procedures, and tracking metrics.
- Develop remote inspection capability allowing for oversight of all contractor operations.
- Create standardized contractor performance metrics paired with common contracts, in line with Consumers Energy's Safety Culture.

c. Sewer /Cross bore Program

Consumers Energy has become aware of the possibility that in the process of directional boring of gas lines, since the practice began in 1976, the Company or its contractors may have inadvertently bored through sewer laterals. Over time, this can cause sewers to clog, and when the sewer lines are cleared the gas lines could be damaged. This impingement is commonly referred to as a 'cross bore' and can pose major risks to customer safety.

Using historical data and sewer contractor knowledge, the Company in 2015 built a risk-based approach, as part of the Company's Distribution Integrity Management Program, to identify potential higher-risk areas for cross bores, such as schools, churches, hospitals, and other areas of regular high-volume customer gathering. The Company's legacy program addressed these high-risk areas by retroactively returning to these areas to perform sewer locates and eliminate any found cross bores. This legacy program was completed in 2021.

With the completion of the legacy program, the program shifted from areas of high-consequence to areas of high probability. The Company is currently developing a risk model of already identified and repaired cross bores, areas where sewers are shallow, and other key variables that will indicate high cross bore probability.

d. Operations Compliance Programs

Operational Compliance consists of two main focus areas, risk-based assessments and field compliance. Both focus areas use the ECAP six-phased approach to problem solving, management action plans, and effectiveness reviews to implement sustained improvements.

- A Risk Based Assessment is a programmatic evaluation of operational areas within the Company's gas operations governed by 49 CFR 191, 49 CFR 192, 49 CFR 199, and the applicable state-added rules in the Michigan Gas Safety Standards. Identification of these risks is necessary to create effective risk mitigation as well as prevention and correction of non-conformances through ECAP investigation, implementation, and verification activities.
- The Field Compliance Program provides in-person field oversight of operations, maintenance, and construction activities being performed by Union and contractor employees. The documented field compliance findings are trended and evaluated for recurrence, and repeated findings are considered for formal problem solving and risk mitigation.

e. Gas Documentation & Records

Effective documentation and accurate records reduce gas system risk by increasing accuracy, accessibility, and resource efficiency related to the content.

A multiple year effort is currently underway to ensure gas documentation, referred to as Gas Standard Work, is sufficient, usable, and meets the requirements of the CE Way Standard Work Basic Play. This effort will provide frontline workers with the standard work documentation they need to ensure work is done safely, efficiently, and in a way that demonstrates to regulators that we adhere to the Gas Code.

The Gas Technical Information Excellence (GTIE) program was developed to "ensure the gas technical records and information are accurate, complete, and accessible, making employees more efficient while increasing confidence in public safety." GTIE is aligned with the Company's Corporate Information Governance organization and adopted the Association of Records Managers and Administrators ("ARMA") *Generally Accepted Record Keeping Principles*, to define and execute enhanced governance of gas technical records and information.

The GTIE Program will continue implementation of standards, setting requirements that promote consistent activities across the entire gas organization, resulting in accurate, complete, and accessible technical records.

4. Gas Damage Prevention Strategy

The Company's vision for Damage Prevention is to provide World Class Performance in damage prevention through reducing and preventing excavation damages to the gas distribution system in support of employee and public safety.

Damages are caused by home/business owners or excavators digging around Consumers Energy gas distribution assets. The primary causes of damages are due to:

- Insufficient excavation practices (failure to hand dig, failure to maintain marks, improper backfilling).
- Insufficient one call practices (failure to call MISS DIG, working after ticket expiration).
- Insufficient locating practices (mismarked facilities, record errors).

Consumers Energy's goal is to achieve 1st quartile ranking by 2030. Strategies to achieve the goal include creating, stabilizing, and continuously improving critical programs that support both the homeowner and excavating community in alignment with industry best practices.

The Company is also planning to engage in discussions with repeat third-party damagers and collaborate with regulatory stakeholders, to continue to improve in this area. In addition, the Company is also part of the Gold Shovel Program.

Key considerations in the strategy are focused on behavioral change, including a combination of trust, relationships, and accountability.

5. LOST AND UNACCOUNTED FOR GAS

a. Overview of Lost and Unaccounted for Gas

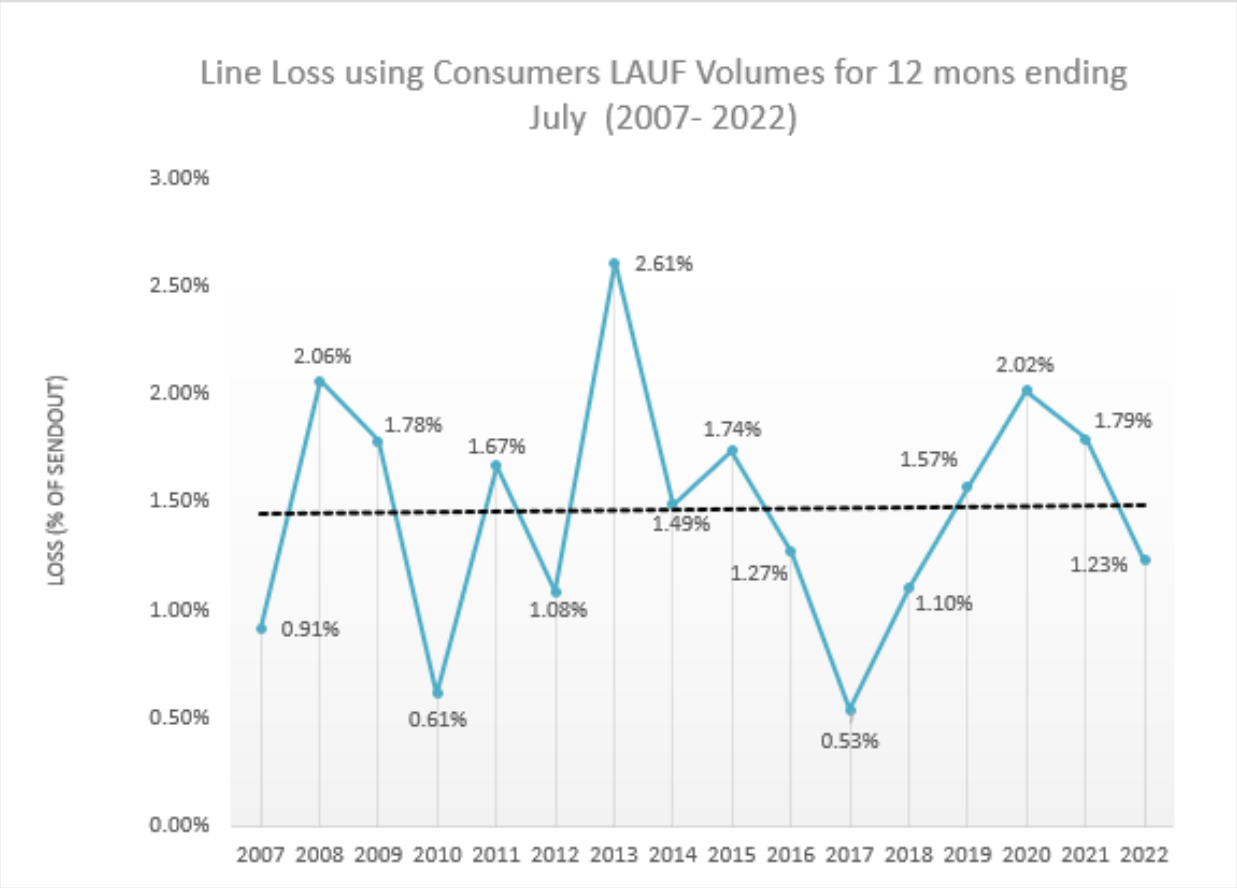
Lost and Unaccounted for ("LAUF") Gas is the difference between the total measured transmission and distribution pipeline system gas volumes received less gas volumes delivered.

A 'loss' occurs whenever the measured receipts are greater than the deliveries of the pipeline system. Conversely, a 'gain' occurs whenever the measured deliveries are greater than the measured receipts. Factors that contribute to gas losses and gains are described in section b.

LAUF = (Total Measured Input Volumes - Total Measured Output Volumes)

The Company calculates LAUF annually, based on 12 months ending July 31. This is the percentage used for reporting purposes. There is a natural variability in the yearly data due to factors such as weather and load distribution. As shown in the chart in Figure 55, the overall trend shows an average loss of 1.48%. Through general rate cases the Company recovers LAUF expenses based on a five-year average of line losses, based upon current cost of gas.

Figure 55: LAUF Historical Reporting



b. **Factors Contributing to Gas Loss**

There are many factors that can contribute to gas losses or gains. The most common factors are related to equipment, measurement accuracy, theft, and leaks.

- Equipment issues can be incorrect sizing, condition, and location of meters and meter components.
- Incorrect calibration of meters and/or transmitters, data interface, and communication errors between systems can also cause inaccuracies.
- Other factors are inaccurate estimates of lost gas during venting of gas or when damages to the system occur, and stolen gas.

c. Plan for LAUF Monitoring and Control Improvements

1. Smart Energy and Gas AMR

With the completion of the AMI and Gas AMR projects, the Company will be able to incorporate the use of monthly calendar reads for the calculation of delivered gas to sales customers, reducing the impact of cycle billed reads. This will mitigate the unbilled volumes that are inherent in the lag between meter reads and customer billing.

2. Gas Quality and Measurement Improvement Projects

Pressure, temperature, and gas quality are the contributors to accurate measurement calculations. To increase measurement accuracy for volume, heat content, specific gravity, pressure, and temperature effects, the Company plans to replace 230 orifice meters, which range in age from 50 to 65 years old, using highly accurate ultrasonic meters ("USM") and install 20 additional gas chromatographs across the state over the next 15 years.

3. Increase Utilization of Flow-Cal Enterprise Gas Automation Software

Gas system segmentation within the Flow-Cal system includes installation of boundary meters to enable system segmentation and tracking of LAUF by zones (segments). Further refinement into zones results in improved LAUF tracking and issue identification.

4. Infrastructure Improvements

The age and materials of the distribution system affects LAUF. Natural deteriorations in vintage materials causes corrosion and cracking in piping which results in leaks across the system. Replacement of vintage materials and other aged assets should reduce gas loss over time.

C. Technology – Digital Approach

Digital capabilities are essential to optimizing compression and storage assets, modernizing the distribution and transmission systems, incorporating predictive and condition-based maintenance, transforming work management, and ensuring physical and cybersecurity of assets.

Consumers Energy's pragmatic digital approach is evolving to support:

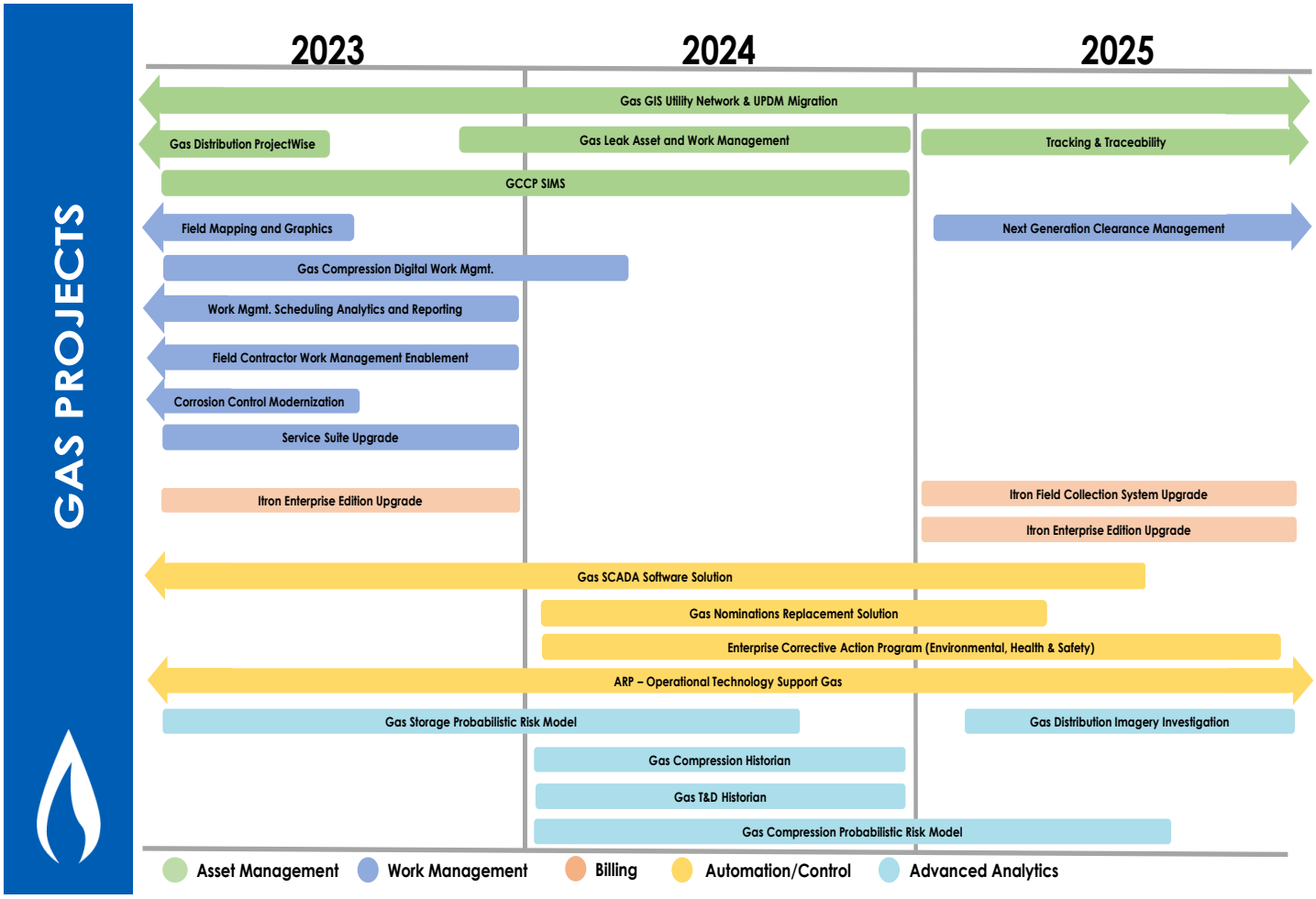
- Faster delivery with new practices such as adopting agile frameworks.
- 'Democratization' of digital skills and expectations.
- A move to cloud solutions where and when appropriate.
- Data as an asset and deployment of larger-scale analytics.
- Deployment of a consistent asset management system/framework.
- Deployment of integrated control systems for system automation.
- Continuous operational improvements through automation.
- A commitment to ensure digital investments do not introduce unnecessary risk to the Company or its customers, and to protect sensitive data and critical infrastructure from cyber threats.
- Evaluating current strategic platforms to ensure they are fully leveraged/optimized, and implementing enhancements as needed to provide new functionality for emergent business and customer value.

- Evaluating new platforms that can further enhance the Company's capabilities. This is in alignment with API RP 1173, "*11.2 – Management shall also periodically evaluate new technology that may enhance pipeline safety.*"

1. INVESTMENTS IN DIGITAL CAPABILITIES

The Plan includes digital investments in the following areas: asset management, work management, system automation and control, security and privacy, and advanced analytics. An overview of digital projects over the next few years is shown below in Figure 56.

Figure 56: Overview of Consumers Energy Digital Projects



a. Asset management investments include the ability to store, manage, and track Company gas assets in a consistent manner to ensure visibility and transparency as part of asset life cycle management and predictive maintenance practices (see *Advanced Analytics* below).

- Projects include the transformation of the enterprise gas GIS system to the new industry standard Utility Pipeline Data Model, and implementation of the Utility Network extension to merge the transmission and distribution into one data model.

  This will allow simpler analysis of TOD assets, enforce a higher level of data integrity, develop geospatial insight on a more granular asset level, and more accurately define how each part of a utility system is connected.

In driving to a single source for the geospatial location of Company gas assets, Consumers Energy has begun migration of gas service records into GIS.

Completing this effort will create a single source for distribution asset location, simplify processes, reduce opportunities for inconsistencies in data sources, enhance the Company's ability to interrogate and improve the data, and increase Public Safety.

- Extending the implementation of ProjectWise for Gas Distribution assets will facilitate a management of change process for gas engineering design and gas system configuration changes—increasing public and employee safety and regulatory compliance with complete and accurate records that are easily accessible and searchable.
- The Company is implementing Advanced Methane Detection using Picarro technology, that could further help prioritize and plan for the accelerated pace of vintage material remediation along with implementing risk-based leak surveys.

In conjunction with risk modeling and prioritization for pipeline and service replacement, the use of more advanced technology is being considered as a potential replacement for conventional leak surveys.

- This will be achieved in a systematic manner with a multi-month trial and validation phase, with consideration of the volume of leaks expected in comparison to conventional methods and the subsequent remediations.

Data is the foundation for predictive maintenance. The Company will require live digitized records and performance of all assets to enable predictive calculations and a potential future state of machine learning.

- The Company must digitize current maintenance records into a centralized database and electronically log maintenance activities to uncover correlations between asset health and driving factors.
- Additional functionality and analytics are needed from the Company's foundational information systems, including more reliable and advanced SCADA and SCADA Historian systems. These are necessary to streamline data access and to allow for more timely and accessible operational analytics that will enable better asset management, troubleshooting, and support.

b. **Work management** and field service management solutions provide electronic capabilities for work forecasting, resource and work planning, work scheduling, dispatch, field execution and closure, tracking performance and work trends, and reacting/responding to emergencies.

The technologies provide more accurate and timely information for field and office employees.

- Advanced fleet telematics will enable and enhance the visibility of crew and work location, create opportunities to improve crew and work dispatching.
- Modern technology tools are also required for work groups that still use paper forms, including the Gas Measurement, Regulation, and Pipeline & Storage and Gas Construction. Enabling contractors with an electronic work management system also supports improved accuracy and timeliness of work. Fully digitizing the work management experience also supports improved customer service by providing real-time work status.
- Improved field mapping and graphics functionality enables better visibility of maps and drawings in the field including the ability for field redlines/edits to ensure records are accurate.
- Advanced planning and scheduling work management features will lead to efficient work assignment to field employees and other resources for improved customer service.

- The Company will continue to enhance its current foundational work management systems in support of related business improvements. Periodic maintenance of technology assets is key for supportability in the field. Application currency for critical systems ensures that applications can perform in emergency and field scenarios.

c. **SCADA** is comprised of software and hardware components used to monitor, analyze, and control real-time data from field devices on the gas system. Field data from measuring devices (sensors, valves, meters, etc.) is collected using a Remote Terminal Unit ("RTU") and then relayed to Gas Control where software is used to display for operators to analyze and interact with.

- **Gas Control Software**

  The current gas SCADA software solution, called Citect, was originally implemented in 2000.

  – While the solution has been maintained since its implementation, the Company's gas system has outgrown the current capabilities. As the solution ages, increased effort is required to address obsolete application and database software architecture, and enhancements to the system are limited.

  – To address the capability gaps, custom interim fixes and integrations have been developed where each requires maintenance and support. This environment adds complexity and cost to solution upgrades and troubleshooting issues.

  – The current gas SCADA solution will limit the ability to invest in digital solutions for increased system health monitoring and preventative maintenance capabilities due to the inherent complexity to integrate these future capabilities.

  – The investment in a more advanced gas SCADA software system will enable:

    a. Integration with GIS for system control reliability
    b. Gas system visibility and transparency
    c. Deployment of RCVs integrated with the gas SCADA system
    d. The future ability to control and perform remote shut-off to preserve safety and reliability of the gas system

  Replacement of the gas SCADA Citect software is planned to be completed in 2024.

- **Remote Terminal Unit (RTU) Solution**

  The current RTU solution, called SixNet, was completely implemented by 2006.

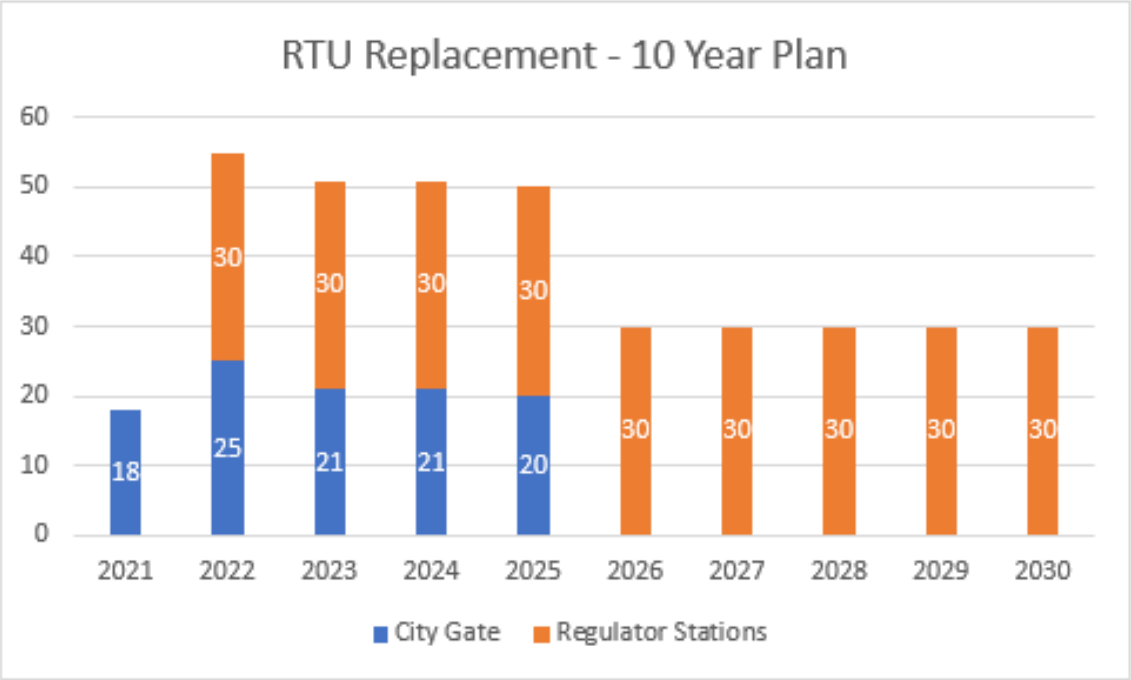
  The SixNet hardware and software required to program and operate the RTUs are no longer being updated or supported by the original equipment manufacturer ("OEM").

  – New RTU models and associated hardware produced by the OEM is not backward compatible with the software/hardware configurations currently running on all Consumers Energy Gas RTUs.

  – The current SCADA architecture needs to be updated to ensure the long-term viability of the monitoring and control functions necessary for the safe operation of Consumers Energy's pipeline system.

  – The plan is to replace the existing SixNet RTU platform with a new platform with the plan shown in Figure 57.

Figure 57: 10 Year RTU Replacement Plan



d. **Security and privacy** investments secure key Company assets, including physical locations with card access.

Transitioning from a lock-and-key system at the Company's city gates to card access will centralize access control and enhance security. The system is capable of both single-factor authentication (card only) and two-factor authentication (card and code).

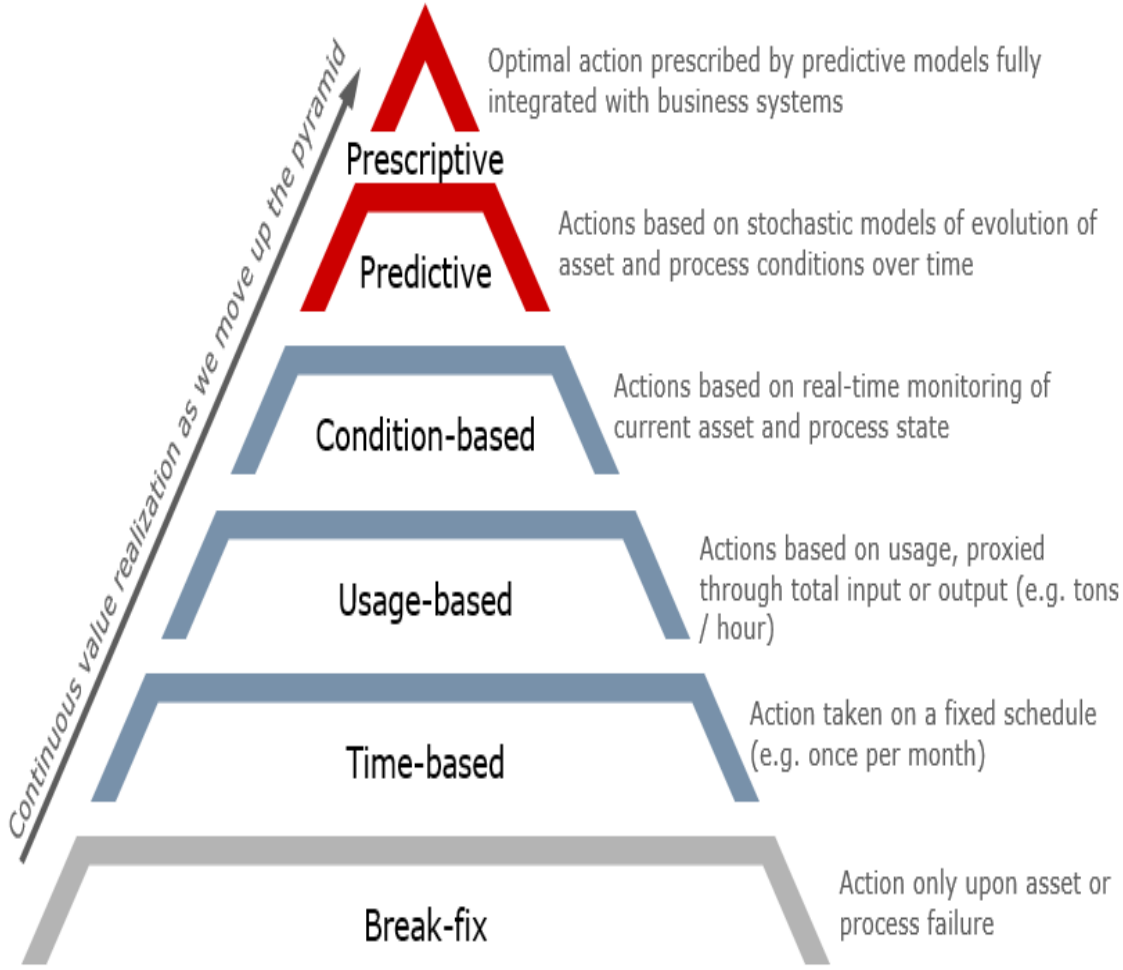
- Currently the Company deploys two-factor authentication in only the most sensitive physical areas (generally North American Electric Reliability Corporation ("NERC")/Critical Infrastructure Protection ("CIP") medium assets). The Company will evaluate two-factor authentication for gas facilities over time, as security and regulatory requirements mature.
- Card access management is a single, centralized system and process for the Company. All employees receive basic access to major buildings with specialized access granted through a workflow approval process. Access is monitored through the Company's 24 x 7 Security Command Center. Processes are in place to deactivate badges immediately upon notification of separation from the Company and automatically when not used for specific periods of time.
- Modernizing and standardizing the gas SCADA network at the Company's gas compressor stations and controls rooms to mitigate cyber security vulnerabilities and allow the Company to fully comply with API requirements to provide a secure gas system that meets Customer needs.
- Continued implementation of security infrastructure to enable more visibility and protection of critical infrastructure, including but not limited to, perimeter fencing, security cameras, and two-way audio.

e. **Advanced analytics** investments include data collection, standardization, and analytical model frameworks.

The Company will transition from its existing indexed risk model with probabilistic risk models as described above in Risk Management.

- Consumers Energy plans to apply advanced statistical and predictive modeling tools and techniques for deriving insights from gas system data. Such projects will enable damage prevention predictive analytics and customer-level load profiling and predictive models with propensity ranking for future gas DR programs.
- Integrating operational gas system data to a consolidated data repository will strengthen operational reporting and analytical capabilities. For example, customer value modeling efforts revealed the need to also invest in a repeatable capability for rapid system configuration modeling to run scenarios as future supply states and customer demand evolve.
- The Company's current maintenance practices vary among assets. Compressor units currently use a mix of usage-based and time-based maintenance for large parts. This means parts are replaced based on throughput or time since last replacement. Select smaller parts use a break-fix approach. The plan is to move maintenance practices toward predictive or prescriptive levels. Figure 58 illustrates such an approach.

Figure 58: Maintenance Practices Pyramid



2. FOUNDATIONAL TECHNOLOGY INVESTMENTS

Supporting digital capabilities for gas are foundational investments that create the technology platforms, tools, processes, and frameworks that enable business outcomes through project delivery.

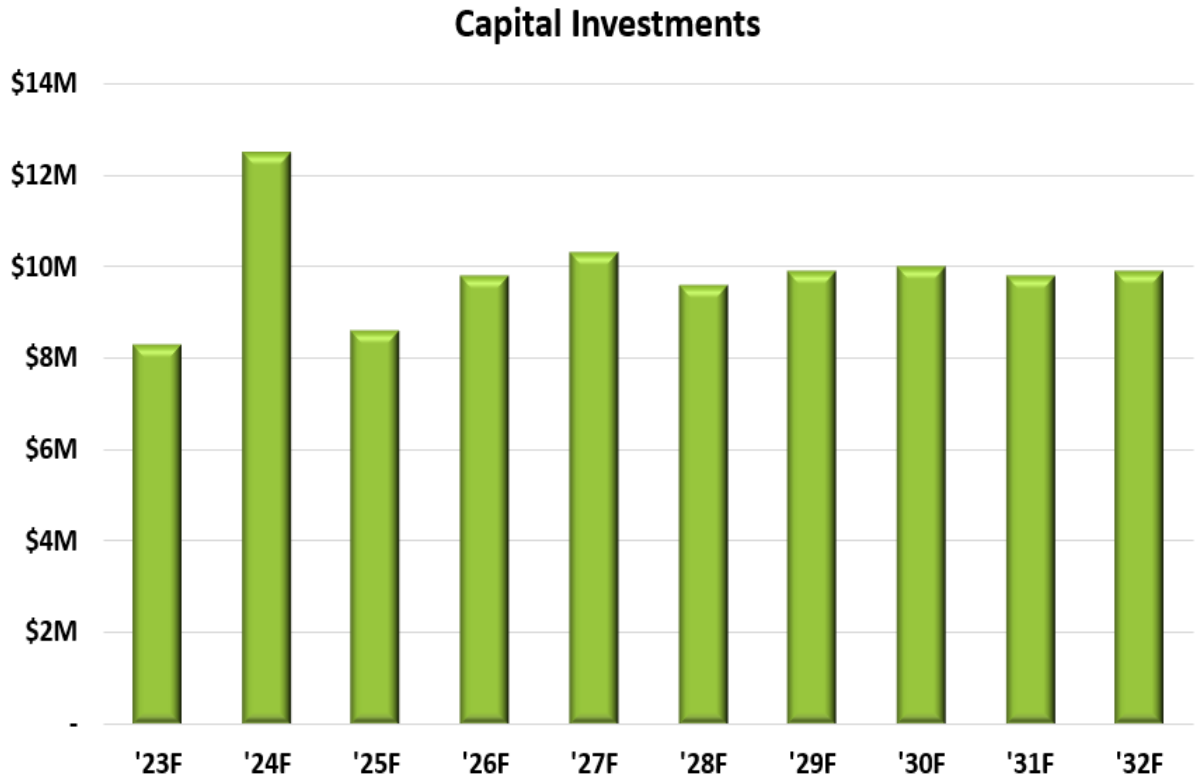
The investments are organized by capabilities as follows:

- Data and analytics – Accurately manage and collect data, integrate it seamlessly across systems and applications, and create insights to inform and enable business outcomes and decisions.
- Data management and governance – Manage data as an asset through data life cycle process (create, update, and delete) for master data management.
- Data integration (Application Programming Interface Fabric) – Integrate data across platforms, systems and applications with a re-usable framework to increase speed of delivery for new integrations, and to avoid costs associated with point-to-point integrations.
- Work automation with artificial intelligence – Automate routine, repetitive tasks through software to improve efficiency and productivity. This includes low-code/no-code application platforms that enable employees across the Company to build simple applications to automate their business processes.
- Cloud platform enablement – Manage scalable solutions, platforms, and technical infrastructure remotely over the Internet to flex capacity with Company needs and demands. Consumers Energy has already been using cloud solutions by adopting Software as a Service ("SaaS") and Platform as a Service ("PaaS") offerings.
  - EWN Services Operator Qualifications for tracking and renewals of employee's qualifications, ARCOS solution for employee schedules and callout, ESRI's ArcGIS Online for creation of focused mapping and analysis solutions, ServiceNow, Office 365, and SAP SuccessFactors are examples of SaaS solutions that have been implemented; and
  - Azure DevOps is an example of a PaaS solution used by developers to manage their software development lifecycle.
- Use of Cloud technologies to leverage artificial intelligence and machine learning at-scale – Integrate data and run advanced analytics at scale using leading machine learning and artificial intelligence frameworks.
  - As an example, in Electric, the Company is beginning to use Infrastructure as a Service ("IaaS"), along with machine learning, to train an analytics model that will help improve Estimated Time of Restoration ("ETR").
- Electronic content management – Manage enterprise content/data consistently to enable digital document management for retention, compliance, and privacy.
- IT Infrastructure and Communications Technology – This technology is critical to successful operation of business applications, providing a strong backbone required for supporting 24 x 7 Operations. Consumers Energy plans to continue investment in best-in-class infrastructure and communications to support Operations.
  - Infrastructure technologies are the backbone networks for running business applications and are planned to be kept up to date for performance and security of modern applications. The technology is key to manage data, voice and multimedia communications through a reliable and redundant network infrastructure with robust frameworks to protect physical and cybersecurity assets.

- Support for multiple networking communication options for field operations and back-office personnel, including updates for truck connectivity, virtual private networking, mobile phone connections, and others.
- Communication and collaboration technology like Microsoft Office365 provide additional channels for supporting field operations.
- Field communication via 800 MHz radio provides dedicated mission critical connectivity between dispatch and field operations. "The Company recently migrated to the Michigan Public Safety Communications System to improve coverage and reduce costs.

Figure 59 shows forecasted capital investments for this digital implementation into the gas system and will support many gas projects and programs.

Figure 59: Digital (IT) Capital Investment Plan



Equally as important as new digital investments in technology as an integral element of the Plan, is the ability to properly maintain technology assets after implementation.

Prudent technology asset management and replacement programs, system monitoring, timely upgrades, and continuous system patching to mitigate cyberthreats are necessary Information Technology ("IT") O&M expenditures required to sustain business operations and provide the experiences customers expect.

NOTE: More information on Digital, including a corresponding financial summary, is available in the Company's *Digital Three-Year Plan*.

3. RISK MANAGEMENT

To manage system risk, the Company uses risk models.

Currently, the Company uses multiple indexed risk models for the different asset areas, which are used throughout the gas utility industry. These models have changing risk factor weightings on an annual basis that affect project planning and resource requirements.

- The Company is moving to an upgraded version of the transmission indexed model that will rely on a more consistent definition of risk.
- But as part of the transformation, the Company is also going to use an upgraded probabilistic risk evaluation tool—and leverage it for learnings in transmission prior to potentially using this same type of new risk model for the other assets (i.e., storage, compression, and distribution).

The industry is shifting from relative index risk models toward probabilistic risk models. That's why the Company is planning to transition from the current transmission indexed model to a probabilistic model.

PHMSA defines probabilistic as a model with inputs that are quantities or probability distributions, with outputs that can be expressed as probability distributions. Model logic attempts to adhere to laws of probability.

Figure 61 contrasts an indexed model to a probabilistic model and shows why a probabilistic model is favorable to an indexed model for complex gas systems.

Figure 61: Contrast of Potential Risk Model Upgrades

	Upgraded Indexed Model *(as of 2021)*	New Probabilistic Model
Description	• Output is a unit-less index score • Based on 8 threat categories informed by 100+ underlying variables • Produces single risk score that has standard risk definition (i.e. no longer has changing factor weights	• Output can be expressed as probability • Outputs incorporate probability distributions • Inputs as many high-quality data factors as possible but self solves to simplify and remove poor quality variables
Benefits	• Reduced variance compared to current indexed model (omits changing weighting factors) • Consistent definition of risk (i.e. consistent factor weightings) • Expanded set of underlying inputs	• Industry-leading and easy to interpret • Reduced variance compared to current indexed model (omits changing weighting factors) • Enables easier business case development through simpler risk-$ tradeoffs • Allow for more informed, data-driven decisions • Would enable comparison across any assets that also use probabilistic model
Disadvantages	• Score is difficult to interpret and therefore does not allow for instant business case calculations • Difficult to compare magnitude of risk between various asset classes / risk models • Still subjective	• Learning curve for both industry & organization • Sizeable investment required • Perception of increased complexity • Need to completely overhaul existing system • Lose ability to compare against past risk results
Delivery Implications	• Need to continue using existing model until 2021 • Need to better understand exactly how it works & if additional data collection is needed • Need to develop methodology to incorporate into business cases and compare results to system-wide priorities	• Need to design, develop and test extensively • Will need an interim plan between launch of new model and existing model • Need to develop best practices on how frequently to run and how often we can allow our plans to change because of the model • Requires organization-wide training on interpretation of risk results and how to use in business case calculations

Based on the model contrast above, the Company plans to evolve to a probabilistic risk model. The approach was to start with the transmission system in 2021, and then migrate to other assets over time.

VI. Initiatives

A. Gas System Decarbonization

Consumers Energy is implementing industry-leading plans to reduce greenhouse gas emissions created by its natural gas operations. This includes modernizing its natural gas system to achieve net zero methane emissions from its operations by 2030. In addition, the Company is also looking beyond emissions in its system and operations to protect the planet. A deliberate, clean energy transition of the gas system can help the environment—while continuing to safely deliver the energy customers need in a cold-weather climate, like Michigan.

Therefore, Consumers Energy is continuing to lead Michigan's clean energy transformation by looking beyond its own operations to help customers and suppliers reduce their greenhouse gas emissions, especially those generated from natural gas sources. The Company is building on previous goals and announced an additional clean goal in 2022 to achieve net zero greenhouse gas emissions from the entire natural gas production and delivery system, including customers and suppliers, by 2050.

As a next step on our path to net zero by 2050, the Company will work with customers to reduce their emissions in 2030 by 20 percent.

Pursuing this new goal supports Michigan's MI Healthy Climate Plan to achieve net zero carbon emissions by 2050, including an interim State target of reducing emissions from space heating 17% by 2030. Additionally, Federal Executive Order ("EO") 14008 of January 27, 2021, commits the United States to a broad action plan addressing climate change. This EO directs federal agencies to prioritize projects that reduce emissions of toxic substances and greenhouse gases from existing and abandoned infrastructure, and to coordinate investments to achieve substantial reductions of methane emissions from the oil and gas sector as quickly as possible.

The U.S. Environmental protection Agency (EPA) tracks greenhouse gas emissions in three categories:

- **Scope 1**: Direct emissions from sources that are owned or controlled. At our Company, these are emissions produced in the process of generating and supplying energy for customers, such as carbon emissions from burning methane and also fugitive methane emissions from our natural gas delivery system. The Company's goal to reduce Scope 1 emissions is "methane net zero by 2030."
- **Scope 2**: Indirect emissions from sources that are owned or controlled. These emissions may arise from the energy we use at our facilities and comprise only a fraction of the emissions linked to our company.
- **Scope 3**: Emissions are from sources not owned or directly controlled but related to our activities. These include all emissions traced to natural gas we purchase and activities by customers and suppliers, primarily from end uses like burning natural gas to heat homes and businesses. The Company's goal to reduce Scope 3 emissions is "net zero carbon emissions by 2050."

1. METHANE NET-ZERO GOAL

Consumers Energy recognizes the role methane plays as a greenhouse gas emission, and that methane's impact as a greenhouse gas is notably more significant than that of carbon dioxide, with a short-term global warming potential that is approximately 100 times greater. This means that removing methane early in our decarbonization journey has an even greater benefit to the environment. Even over longer time horizons, methane's global warming potential remains 25 times that of carbon dioxide. Methane emissions across the Company's system are being identified and quantified, in an effort to reduce and eliminate their contribution to our Scope 1 emission footprint. Since 2012, Consumers Energy has already reduced its methane emissions from its natural gas delivery system by approximately 15%. In 2019, Consumers Energy committed to achieving an 80% reduction in methane emissions as part of our effort to reach Net Zero methane by 2030.

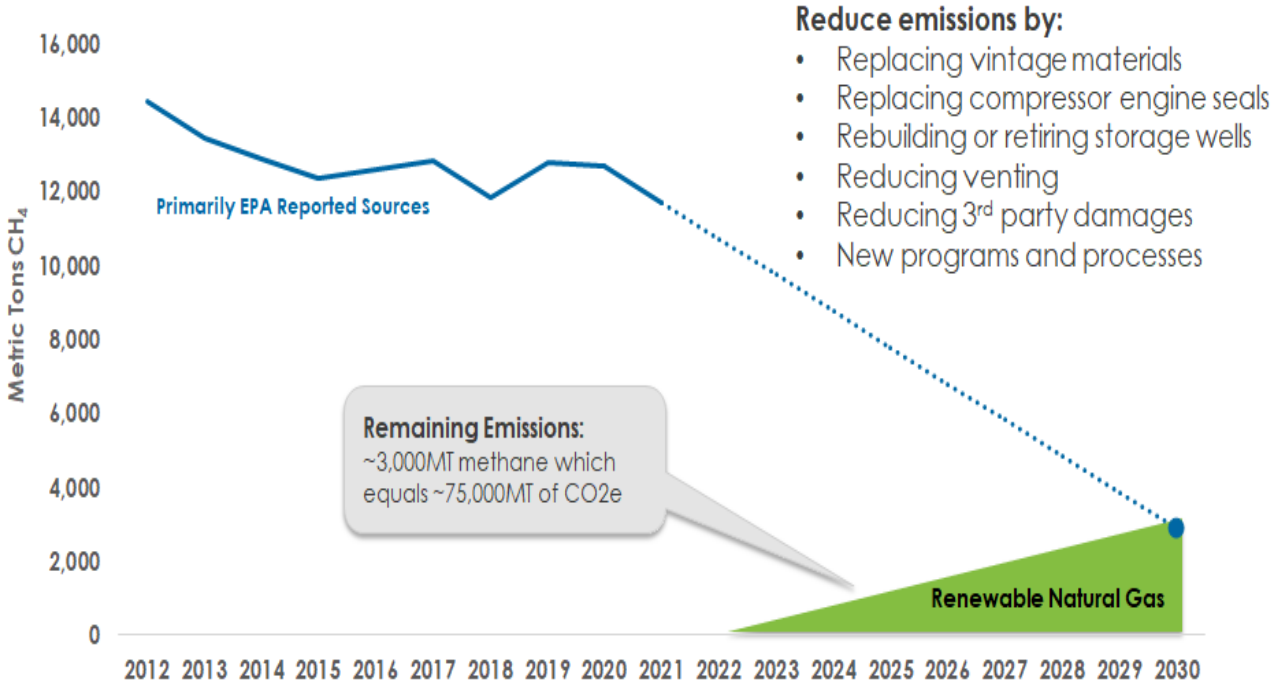
The methane net-zero plan seeks an 80% reduction of methane emissions by 2030 through the following near-term measures:

- Distribution main leaks: replacing vintage pipe (cast iron and unprotected steel).
- Distribution services leaks: replacing vintage pipe (copper and bare steel).
- Storage: Wellhead component leaks (plug and abandon program).
- Compression blowdown vent emissions: reducing natural gas venting frequency/duration.
- Transmission blowdown emissions: increase utilization of temporary compression to reduce quantity of natural gas being vented.

As shown below in Figure 62, procurement of RNG is expected to cover the remaining 20% methane emissions to achieve net zero for the delivery system. This 20% portion is equivalent to approximately 75,000 tons of CO2e. RNG supply may be pursued prior to 2030, to secure appropriate and limited supply. See *Renewable Natural Gas* below for further discussion.

Based on initial assumptions in 2018, by achieving net-zero methane emissions for the natural gas system, the Company will reduce methane emissions by more than 10,000 metric tons—that's the equivalent of removing about 55,000 vehicles from the road per year or preserving more than 300,000 acres of forest.

Figure 62: Net Zero Methane Goal: Emission Reduction and Renewable Natural Gas Offset



In 2020, Consumers Energy's annual methane (CH_4) emissions from known sources were 14,384 metric tons. In 2021, Consumers Energy sought a reduction in methane emissions of 422 metric tons and achieved 1297 metric tons in reductions. The total reduction from baseline achieved to date is estimated to be 2,988 metric tons, resulting in estimated annual emissions of 11, 396 metric tons.

2. NET ZERO CARBON EMISSIONS GOAL BY 2050

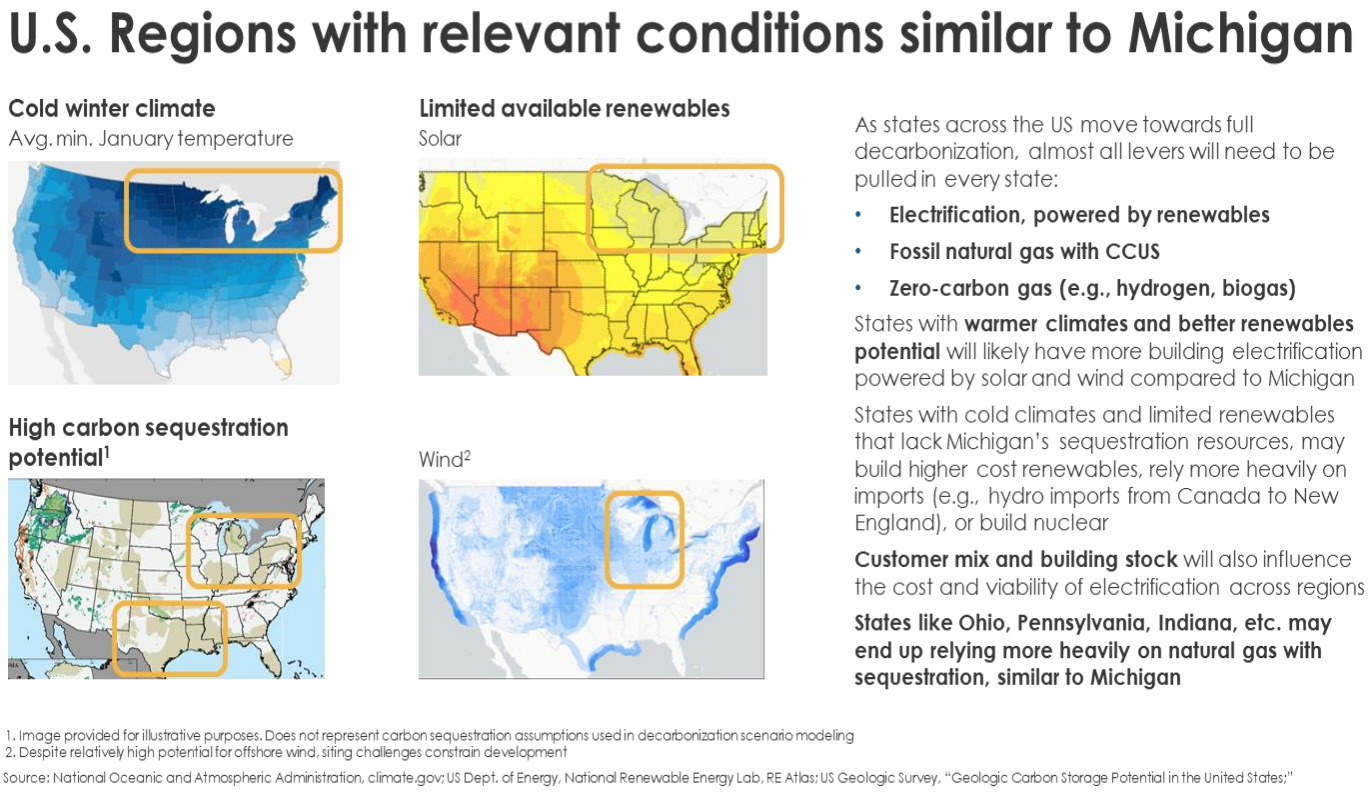
In March 2022, Consumers Energy committed to net zero emissions from sources not owned or directly controlled but related to our activities. These include all emissions traced to natural gas purchases and activities by customers and suppliers, like those associated with burning natural gas to heat homes and businesses.

Reaching 'net zero' will require Consumers Energy to balance many diverse emission reduction opportunities with safe, reliable, and affordable energy delivery. It will also require working partnerships with stakeholders across the state to ensure a decarbonized gas system can continue to meet the needs of customers, communities, and businesses.

In 2021, Consumers Energy worked with industry leading consultants to better understand the most affordable and resilient State-wide economy decarbonization plan that achieves net zero carbon emissions by 2050. This analysis incorporates both the Company's electric and gas utilities with an 'energy agnostic' approach. It was determined that limiting the scope of analysis to the Consumers Energy service territory would improperly exclude constraining factors like electric vehicle demand on the grid and would not take advantage of geographic and logistical efficiencies throughout the State.

Therefore, the analysis assessed the United States approach and differences as shown in Figure 63 below, and then was performed on a state-wide basis.

Figure 63: U.S. Decarbonization Potential by Region

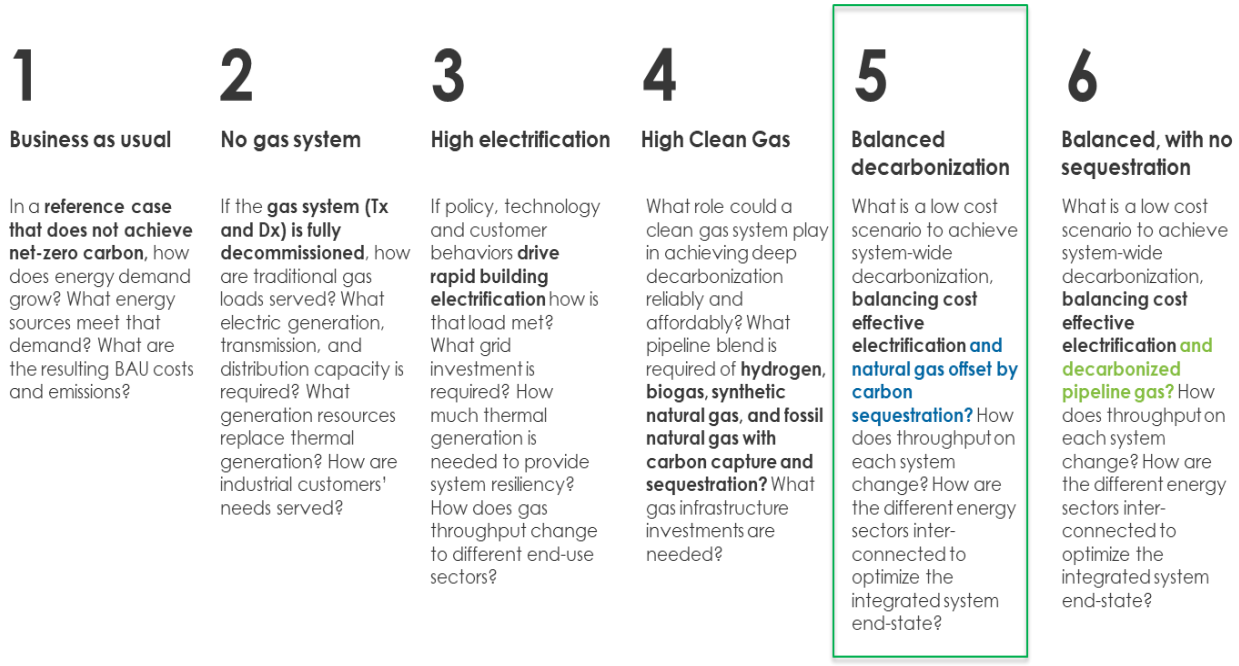


The modelling analysis looked for the most cost-effective energy supply to meet the energy demand of the State, including full electrification of the passenger vehicle sector, while simultaneously achieving net zero by 2050.

The analysis was completed for six different scenarios, shown below in Figure 64.

- **The business-as-usual** scenario is used as a reference point and assumes no progress in energy decarbonization.
- The **no gas system** scenario was assessed to understand the cost of meeting energy demand, in the absence of the gas system, meaning all current uses of gas, including industrial processes and electric generation would require alternative energy supplies like hydrogen or electrification. This scenario also demonstrates the value the current gas system provides to the state's overall decarbonization costs.
- **The high electrification** scenario assumes all end uses are electrified except for natural gas electric generators, meaning the majority of the compression and transmission system would remain, while the majority of the gas distribution system would be retired.

Figure 64: Decarbonization Scenarios



The key conclusion from modelling was that a **balanced combination of multiple technologies is the most cost-effective means of achieving economy-wide decarbonization by 2050**. The diversity in a balanced combination of multiple technologies not only increases resiliency, but also increases optionality across the system, lowering risk of not achieving carbon neutrality.

In all scenarios, electric load increases due to transportation and some space heating electrification. As coal plants are retired, gas generation with carbon capture grows to meet increasing load.

Renewables are an increasingly important part of Michigan's energy supply, but resources are limited, and long duration energy storage will be needed. Decarbonized natural gas generation via RNG, hydrogen and/or carbon capture show near-term economic pathways to investigate further.

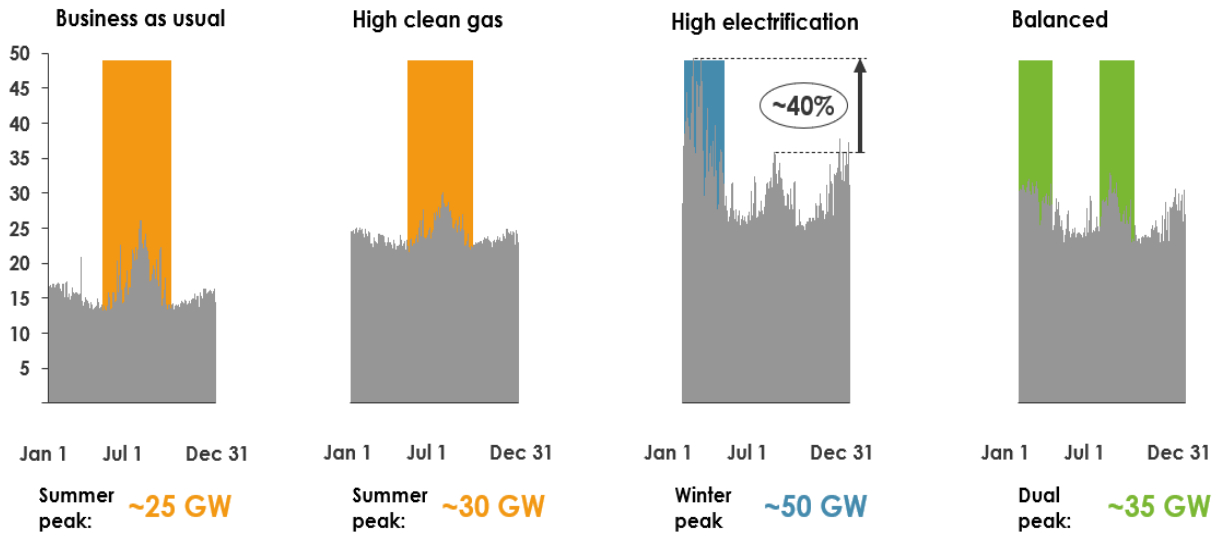
Additional conclusions as follows:

- The gas distribution system enables cost effective, reliable hybrid home heating in Michigan winters.
- The gas transmission system is needed to supply natural gas to electric generators.
- Carbon sequestration is needed to cost effectively achieve deep decarbonization, specifically to support electric generation, and synthetic gas and hydrogen production.
- Clean fuels such as RNG and hydrogen provide system resiliency, diversification, and energy for hard to electrify end uses.
- Electrification potential was constrained by costs associated with additional transmission and generation infrastructure necessary to meet demand, in a winter peaking electric system.

As shown below in Figure 65, analysis indicates that in a highly electrified decarbonized future scenario, building electrification can drive winter peaks as high as 40% higher than summer peaks. In this scenario, the most economic form of clean electric base load generation to support building electrification would come from natural gas generators fitted with carbon capture.

Hybridized electric + gas space heating, as represented within the 'balanced scenario' can mitigate a peak shift to winter, reducing the need for a massive investment in electric generation and transmission by ~$20-25B compared to a high electrification scenario. Additionally, a dual gas + electric system could provide more resiliency than one that is fully electric.

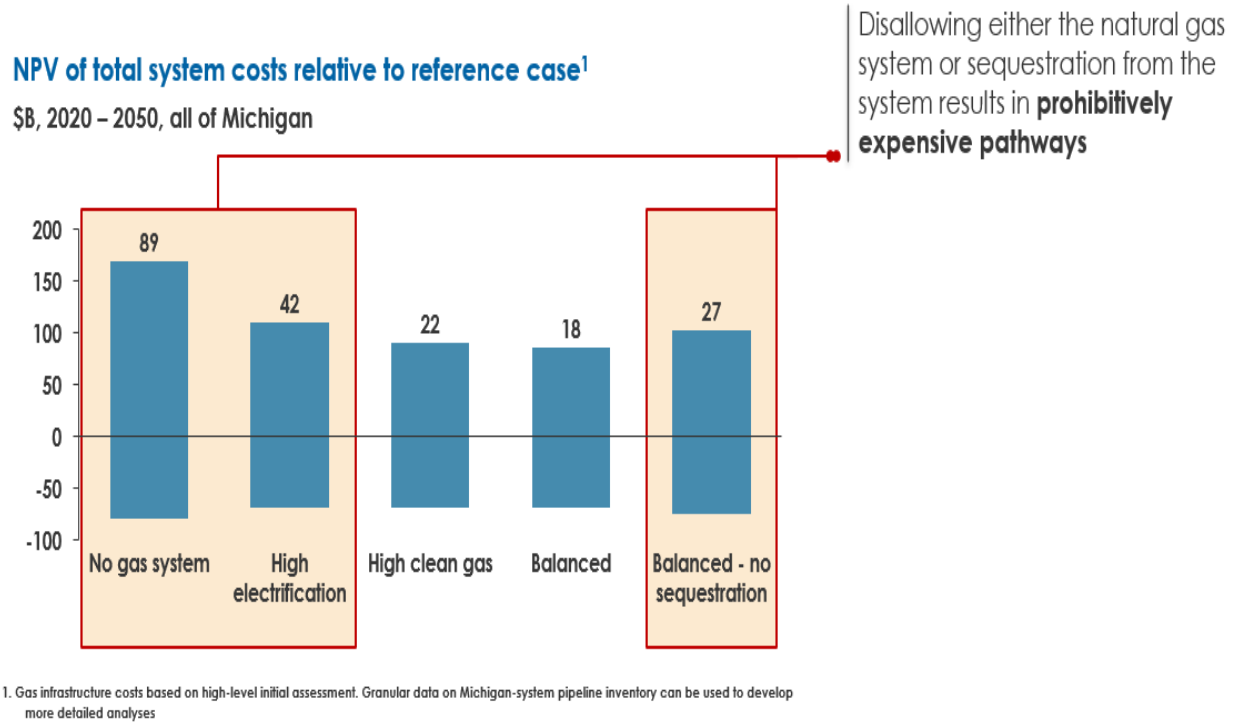
Figure 65: Potential Electric Peak Load Impacts by Scenario



Additionally, ~20% less electric generation capacity is required in the 'balanced scenario' than in a high electrification scenario, which helps mitigate cost increases.

Total energy system costs include all costs associated with energy in Michigan, including feedstock and commodities; electricity generation, storage, and fuel production technologies; energy delivery infrastructure; carbon capture and sequestration; demand-side technologies (e.g., appliances and vehicles, EE investments, etc.). In each decarbonization scenario, there is a societal cost impact to Michigan as shown below in Figure 66, with the 'balanced scenario' being the lowest societal cost pathway to meet carbon neutrality by 2050.

Figure 66: Potential Cost Impacts to Michigan by Scenario

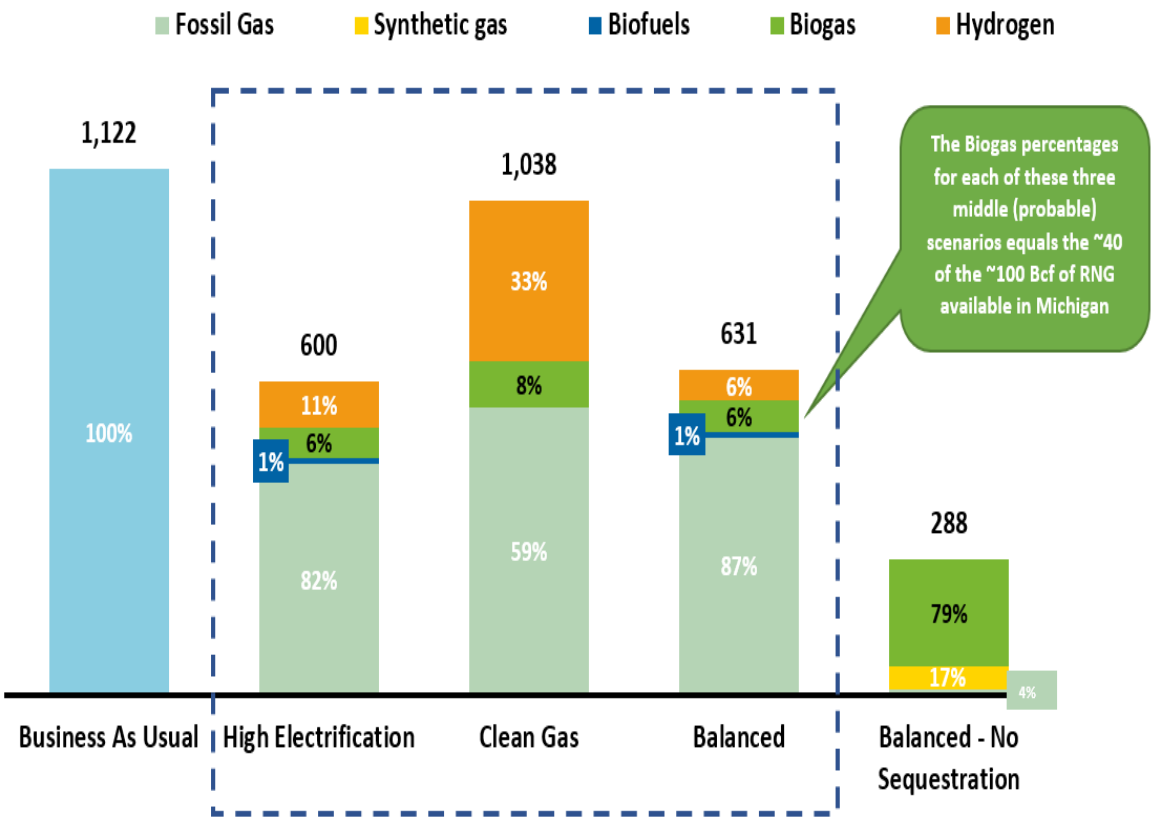


As shown in Figure 67 on the following page, RNG ("biogas") is seen as a foundational technology that best prepares the Company for any likely decarbonized future scenario including high electrification, high clean gas, and a balanced approach. This is because RNG is cost effective in reducing carbon, mature technology, and requires no incremental investment in the existing infrastructure.

While technologies like electrification and carbon capture play a role in a decarbonized future, analysis shows the balanced combination of multiple technologies such as energy waste reduction (EWR), RNG, carbon capture, hydrogen, and electrification will all be needed to cost effectively meet the State's 2050 net zero goal.

None of these pathways alone are viable to achieving the State's 2050 net zero ambitions—using RNG opportunities that are available today is more cost-effective than other approaches and provides the State with a solid foundation for meeting our shared environmental goals over time.

Figure 67: Potential Michigan Gas Pipeline Composition in 2050 by Scenario

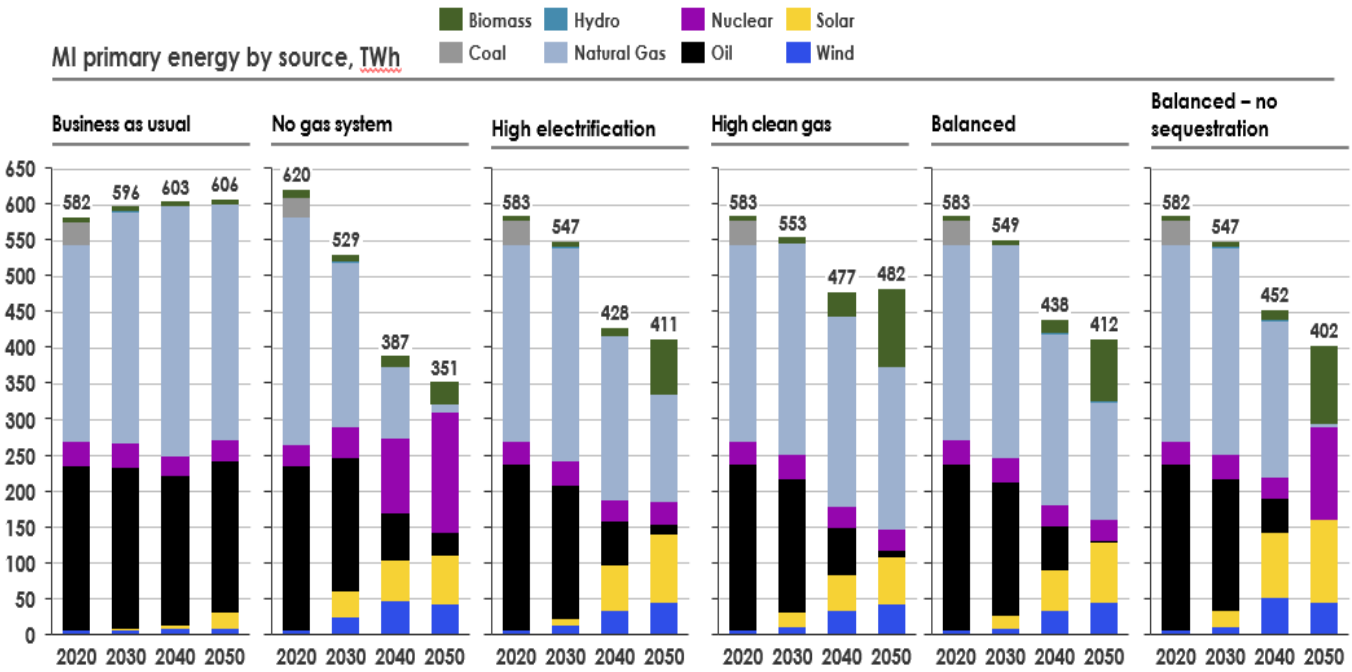


In all likely scenarios (high electrification, high clean gas, balanced), modeling shows natural gas generation as the least-cost, carbon neutral energy supply able to meet demand.

In the absence of a gas system or carbon-neutral natural gas generation, new nuclear generation would be necessary to support demand by 2050 as shown in Figure 68 on the next page.

NOTE: This analysis is Michigan-wide and does not necessarily reflect the Company's expected energy supply.

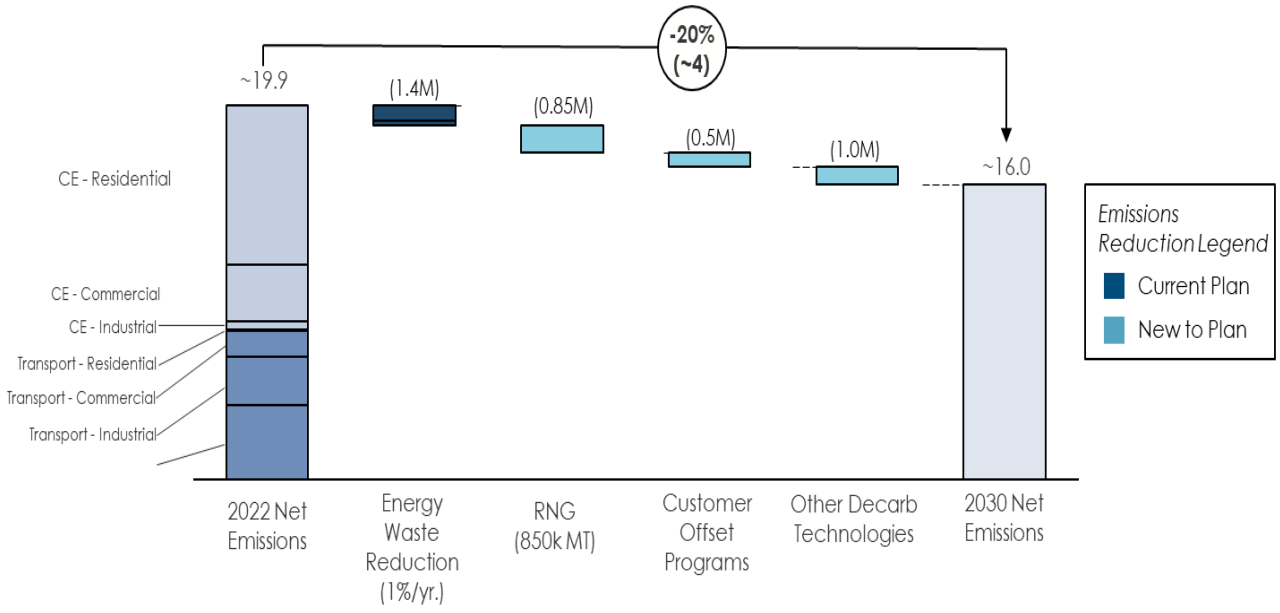
Figure 68: Potential Primary Energy Sources by Decarbonization Scenario



Overall, to support Michigan's decarbonization goal and meet carbon neutrality by 2050, Consumers Energy has set an interim goal to work with our customers to help them achieve a 20% reduction in Scope 3 emissions by 2030.

The plan to achieve this reduction is shown below in Figure 69, which illustrates that EWR, RNG, carbon offsets, and new emerging decarbonization technologies are all necessary pathways to contribute to achieving this 20% reduction by 2030, as part of the overall glidepath to the 2050 net zero goal.

Figure 69: Potential Gas Customer Decarbonization Pathways to Achieve 20% Reduction to 2030



All these potential decarbonization pathways are shown as follows:

a. MI CLEAN AIR VOLUNTARY CARBON OFFSET PROGRAM

In February 2022, the MI Clean Air Program was approved to provide a voluntary offering for customers to offset the emissions tied to natural gas use. A carbon offset reduces emissions of greenhouse gases made in a separate location. In other words, a reduction in emissions are made in one location to compensate for emissions in a different location, effectively negating the effects of the remaining emission, when applied at the same scale Accordingly, this Program will provide customers the option to offset the carbon impact of the conventional natural gas used at their location.

This Program focuses on forestry-based carbon offsets in Michigan. The Company will supply offsets from an in-state forestry project located in the upper peninsula. Limiting the volume of deforestation through this project promotes clean air, preserves wildlife habitats, and clean carbon storage.

b. RENEWABLE NATURAL GAS (RNG)

RNG is pipeline quality gas that is low-carbon or carbon-negative and can be used in existing pipelines and end uses. RNG is created by capturing methane from the decomposition of organic matter through anaerobic digestion. This methane would otherwise be vented into the atmosphere. This captured gas is known as **biogas,** and must be further conditioned to meet pipeline quality specifications necessary for pipeline injection and customer end use.

Biogas is generated in existing waste handling operations, involving various 'feedstocks,' including but not limited to, the following:

- food waste
- landfill gas
- animal manure
- forest residue
- agricultural residue
- wastewater treatment solids

Although the Company is open to all RNG feedstocks**, manure-based feedstocks are of particular interest** because of their demonstrated ability to produce a carbon negative fuel supply, driven by capture of methane from waste

Landfill gas is currently the most common and largest supply of RNG, primarily because landfill gas is already collected and flared as part of normal operations, making it easier to direct to new RNG systems. Landfill sites, in many cases are already using waste gas to support energy systems, driven by historical incentives in the renewable electricity markets. Despite its availability, its contribution to carbon reduction is limited due to regulations that require landfills to flare methane, resulting in carbon dioxide emissions. Directing these emissions to RNG results in a one-for-one offset for the fuel that will eventually be combusted downstream. For this reason, the Company sees other feedstocks as more environmentally economic for customers.

Unlike intermittent renewable electricity, e.g., wind and solar, **RNG feedstocks and waste gas are consistently available and can be converted into renewable energy on demand**, making it a valuable renewable energy source. RNG can also support other environmental goals, including reduced nutrient run-off and improved water quality, organic waste management and diversion, groundwater protection, and displacement of fossil fuels.

In 2021, Consumers Energy entered into an agreement with Michigan-based, Swisslane Farms, a dairy farm in Alto, Michigan, to produce RNG from their manure. Annual production is estimated at 56,000 MMBtu, abating approximately 17,000 tons of carbon dioxide equivalents annually. This project is currently scheduled to be in construction in 2023.

Consumers Energy continues to seek opportunities with farms to help bring clean fuel to the State of Michigan. Any farm can potentially contribute to Consumers' natural gas supply as Renewable Natural Gas. Consumers Energy sees RNG as an opportunity to reduce emissions and improve the environment in Michigan, while supporting local farms.

c. ENERGY WASTE REDUCTION

Energy Waste Reduction (i.e., Energy Efficiency): Providing customers with the power to reduce energy waste, and lower bills and emissions through a variety of energy efficiency and demand response programs. Since 2009, Consumers Energy has helped customers save approximately $4 billion and prevented the emission of more than 21 million tons of carbon dioxide.

d. EMERGING TECHNOLOGIES

Emerging technologies: Potential solutions include using hydrogen to produce energy, capturing and sequestering carbon emissions from natural gas combustion, and using hybrid natural gas and electric heat pump systems to heat homes and businesses.

Hydrogen has the greatest energy-to-weight ratio of any fuel due to its lack of carbon-based elements. Additionally, hydrogen is an ideal fuel when it comes to emissions as it contains no carbon or sulfur when combusted. Modelling results show hydrogen is most optimally used as a replacement fuel for high heat end use processes that are difficult to electrify.

Hydrogen is the most abundant element in the universe, making up approximately 75% of the mass of all visible matter in stars and galaxies. Hydrogen is also the simplest of all elements. A hydrogen atom is visualized as a central nucleus with a single orbiting electron. In fact, the radius of the electron's orbit, is approximately 100,000 times as large as the radius of the nucleus. For this reason, it is clear (including C0, C02 or Sox) when combusted.

Currently, most forms of industrial scale hydrogen are derived through a process known as *steam methane reforming*. Despite its hydrogen generation, carbon dioxide is emitted through the process.

Electrolysis is a technology that uses electric energy to break apart the water molecule into hydrogen and oxygen, leaving no emissions. When powered by a renewable energy source, such as hydro, wind or solar, electrolysis produces a truly carbon-neutral form of energy.

It is important to note that hydrogen and natural gas are *not* completely interchangeable as a usable fuel at existing pressures and flow rates. However, given advantages tied to dispatch, storage, and carbon neutrality, hydrogen is being assessed by the energy industry to determine its potential as a clean energy pathway for the future natural gas system.

Hydrogen's zero carbon footprint along with its energy content characteristics make it an important pathway that targets hard to abate high heat processes such as industrial drying, compression, and long-haul transport. Specifically, the Company's initial focus on Hydrogen will be for the industrial customer segment, and particularly assisting large industrial customers in evaluating hydrogen's role in their decarbonization journey.

3. REFERENCES

1. *Properties of Hydrogen*, 2001. College of the Desert.
2. *Renewable natural gas*. Retrieved from https://www.enbridgegas.com/sustainability/renewable-natural-gas

B. Gas Demand Response (DR)

As part of the Settlement Agreement in Case No. U-20650, the Company launched a residential and Small Medium Business (SMB) DR Pilot during the winter of 2020/2021 and the winter of 2021/2022. A Commercial & Industrial (C&I) pilot was originally scheduled to be executed at the same time, but was delayed until the winter of 2021/2022.

The pilots, organized by customer sector, will allow for a voluntary tool that can be called upon to balance available system capacity and customer load requirements—ultimately reducing peak demands in support of providing system resilience.

For the residential and SMB pilots, the test objective was to create an experimental design that ensured comparable treatment and control groups to accurately assess Gas DR impacts including:

- Voluntary customer response by measuring the demand reduction obtained by using smart thermostats and interruptible rate as load control.
- Evaluate customers' receptiveness (participation and satisfaction levels) to the offering to determine total market potential.

The results of the pilot are documented in evaluation reports, specifically (1) *the Smart Thermostat Winter Pilot Program Evaluation Report*, 2021 Program Year, dated August 27, 2021, and (2) the *Smart Thermostat Winter Pilot Program Evaluation Report,* 2022 Program Year, dated October 5, 2022.

During 2021 and 2022, the pilot implemented a 'Bring Your Own Device' ("BYOD") smart thermostat approach for residential and SMB customers—modeled after electric DR programs currently offered to customers and described below.

- The first phase of the Residential pilot ran during the winter of 2020/2021 after enrolling 5,647 customers (with an original target of 3,000 customers) who have a gas furnace and a Wi-Fi enabled smart thermostat. During the winter of 2021/2022, enrollments in the pilot had expanded to 14,295 customers. The program used a cloud-based software deployed through the customer's Wi-Fi thermostat to reduce the heating load during DR events.
- For the SMB pilot program, the Company offered a BYOD Gas DR pilot similar to the residential BYOD pilot described above. Customers had their usage adjusted through control of their compatible Wi-Fi enabled thermostat. The Company enrolled 424 business customers (with an original target of 500 business customers) to participate in this pilot during the winter of 2020/2021. During the winter of 2021/2022, enrollments in the SMB pilot had expanded to 558.
- Ten Gas DR events were successfully dispatched for Residential and SMB customers during the months of January and February 2021. Load shift did occur during peak times. In total, residential customers delivered an average hourly load shift of 36 Mcf during the Company system peak day DR event hours and SMB customers delivered 5 Mcf.
- Ten additional Gas DR events were dispatched between November 2021 to March 2022. The pilot shifted customer consumption on the peak day demand response event hours, resulting in an average demand reduction of 172.5 Mcf per hour during the January 26, 2022, event.
- To continue evaluating the possible benefits of scaling this pilot into a commercialized program, an extension of the pilot was requested for the 2022/2023 and 2023/2024 winter seasons in the 2021 Gas Rate Case. However, based on the Company's experience with the Gas DR pilot program, the Company determined the resilience and/or reliability benefits of an ongoing Gas DR program cannot be cost-effectively realized. This conclusion recognizes that natural gas emergencies are a rare occurrence, and public appeals for voluntary conservation is a relatively low-cost alternative to smart thermostat device

demand response. As a result, the Company has removed its request for ongoing pilot funding in our Gas Rate Case No. U-21148 and is discontinuing the pilot.

- The large C&I pilot ran for one winter season with 5 events called between January 2022 and February 2022. There were 12 total customers enrolled to provide net reductions of natural gas during events in exchange for being incentivized through a contract-based rate. The total nominated natural gas reductions for these customers was 1,014 MCF. Participation in individual events varied with one facility opting out of all 5 events and others did not participate in multiple events due to economic reasons and the need for equipment testing/recertification.

C. Energy Waste Reduction (EWR)

Natural Gas EWR programs play a role in decarbonizing the gas system; reducing the amount of energy consumed reduces Scope 3 methane emissions. Consumers Energy filed its 2022-2025 EWR Plan Filing in August of 2021 and it was settled on March 17, 2022. In developing the portfolio of EWR programs from 2022 through 2025, Consumers Energy looked for ways to meet its 1% natural gas corporate savings goals by building on the success of its existing EWR programs, refining them to optimize energy savings opportunities, while also expanding opportunities to capture new sources of energy savings.

Consumers Energy built the EWR portfolio by compiling existing program measures into a comprehensive list. To identify eligible electric and natural gas measures to apply energy savings, Consumers Energy uses the Michigan Energy Measures Database (MEMD), developed in conjunction with MPSC staff and other energy stakeholders specifically for the Michigan market. Consumers Energy iteratively adjusted participation and incentive levels as needed to balance the plan and arrive at a reasonable mix of cost-effective programs that meet its goals.

Taken together, the portfolio of EWR programs outlined in this Plan continue Consumers Energy's history of offering a diverse portfolio of cost-effective, flexible, and inclusive program choices, incentive options, and educational opportunities for every customer class. Consumers Energy's program offerings are summarized in Table 9.

Table 9: 2022–2025 Program Summary

Program Name	Markets Served	Program Offerings
Residential EWR Portfolio		
Appliance Recycling	All residential electric customers	• Incentive and environmentally responsible, free pick up of older, inefficient refrigerators, freezers, and small appliances
Energy Dashboard	All residential customers	• Web-based platform that provides customers with information about their energy use and tips to manage their consumption and save energy
ENERGY STAR Appliances	All residential customers	• Prescriptive rebates and upstream incentives for qualifying ENERGY STAR–certified appliances purchased through a Consumers Energy retail partner
ENERGY STAR Lighting	All Consumers Energy customers	• Upstream incentives for qualifying high-efficiency LED lighting measures purchased through a Consumers Energy retail partner
Home Energy Analysis	Residential customers in in single-family homes and in duel fuel and electric-only territories	• Walk-through or virtual home inspection and installation of free energy-saving measures • Customized report with energy-saving tips and recommendations • Walk-through or virtual home inspection specifically targeting electric energy-saving opportunities for customers in Consumers Energy's electric-only territory and installation of free, electric energy-saving measures

Program Name	Markets Served	Program Offerings
Home Energy Report	Residential customers in single-family homes	• Personalized household reports, sent by mail, and email with individual energy usage tips and program recommendations
Home Performance with ENERGY STAR	Residential customers in single-family homes	• Comprehensive home assessments performed by Building Performance Institute (BPI)-certified contractor • Diagnostic testing and visual inspection for energy-efficiency upgrades and health and safety issues • Comprehensive final report that uses energy modeling software to inform customers of available energy savings, upgrade costs, and payback associated with recommended improvements
HVAC and Water Heating	Residential customers in single-family homes	• Prescriptive rebates for customers and midstream rebates for equipment distributors for the purchase and installation of high-efficiency heating, cooling, and hot water technologies • Support to HVAC contractors, including account management representation, training, educational materials, and marketing collateral • Web-based Find a contractor tool
Income-Qualified Energy Assistance	Residential low-income customers in single-family homes	• Free walk-through or virtual home inspection/assessment with direct install measures tailored to customer's fuel type (dual fuel, natural gas-only or electric-only) • Home weatherization assistance, installation of energy-efficient measures, and education about how to conserve energy and manage utility costs • Focus on installation of premium measures • Collaboration with community partners to provide maximum and coordinated benefit to income-qualified customers
Income-Qualified Multifamily	Residential low-income customers in multifamily housing	• Direct, no-cost installation of energy-saving devices in individual tenant units and common areas • Educational materials explaining the program's energy and money saving benefits • Prescriptive and custom incentives (offered at a higher rate than those in the Market-Rate Multi-family program) for property owners to install energy-saving equipment in individual units and common areas
Insulation and Windows	All residential customers	• Financial incentives for qualified energy-saving windows and home insulation
Marketplace	All residential customers	• Instant rebates for customers who purchase qualifying products through Consumers Energy's online store
Market-Rate Multifamily	Residential & commercial multifamily property owners	• Turnkey services for residents to reduce energy use in their living units through the direct installation of energy-saving devices at no cost to the property owners or tenants • Educational materials explaining the program's energy and money saving benefits • Prescriptive and custom incentives for property owners to install energy-saving equipment in individual units and common areas
Residential Agriculture	Agriculture customers	• Incentives for energy-saving measures in retrofit and major renovation projects
New Home Construction	Residential builders	• Incentives for builders who construct new homes to ENERGY STAR standards or achieve a minimum Home Energy Rating System (HERS) score • Builder training on high performance building practices and how to promote the value of energy-efficient homes

Program Name	Markets Served	Program Offerings
Think! Energy	Early elementary to high school students and community groups	• In-class or virtual EWR presentations and educational content for teachers and community groups • Free energy-saving take-home kit including low-cost energy-efficiency measures and educational content
Business EWR Portfolio		
Comprehensive Business Solutions (Custom, Prescriptive, Segment Offerings, and New Construction)	All business customers	• Rebates ranging from 20% to 40% of the incremental cost of high-efficiency electric and natural gas equipment • Analysis, performance-based incentives, and technical assistance for large commercial and industrial customers who install high-efficiency equipment or process improvements not covered in the prescriptive program • Segment offerings for business customers including information on energy use and assistance with identifying EWR opportunities, ENERGY STAR benchmarking, building assessments, gap analysis, and audits—also supports a holistic approach by consolidating measures employed in multiple business segments and initiatives, including Agriculture, Network Lighting Controls, ENERGY STAR programs, Industrial Energy programs, New Construction, and Smart Buildings
Small Business Solutions	Small business customers	• On-site energy assessments with limited direct installation measures and a report of the measures installed, product recommendations, and tips on how to save more energy • Installation of free measures including showerheads, faucet aerators, pre-rinse sprayers, pipe wrap, programmable and smart thermostats, and LEDs • Installation of common lighting and refrigeration measures by participating trade allies • Self-service, online marketplace that provides instant incentives for the purchase of qualifying energy-efficient products

The table below outlines natural gas savings targets.

Table 10: Natural Gas Investments and Savings Compared to Targets

	2022	2023	2024	2025
Planned Investment, Natural Gas Programs	$78,258,379	$80,645,504	$80,932,953	$82,151,451
Annual Natural Gas Savings, Statutory Target (Mcf)	2,130,572	2,134,854	2,135,387	2,137,368
Annual Natural Gas Savings, Statutory Target	%0.75	0.75%	0.75%	0.75%
Annual Natural Gas Savings, Planned (Mcf)	3,184,658	3,228,854	3,252,414	3,313,370
Annual Natural Gas Savings, Planned (%)	1.1%	1.1%	1.1%	1.2%

The EWR Plan aims to:

- Exceed statutory savings targets and meet the increased resource acquisition goals tied to Company IRP commitments. Continue to support long-term market transformation.
- Contribute to the Company's *Clean Energy Plan* goals to end coal use for electricity generation, reduce carbon emissions 60% from 2005 levels, and meet customer needs with 35% clean energy resources.

- Offer a diverse, cost-effective portfolio of programs that provide participation opportunities for all customers.
- Foster equity by:
    1. Significantly increasing the investment in EWR opportunities for low-income and hard-to-reach populations.
    2. Analyzing historic program participation to identify delivery gaps related to limited program access or other barriers among disadvantaged communities.
    3. Working collaboratively with stakeholders and evaluators to develop opportunities to collect and analyze customer demographic data to enable strategic marketing to and recruitment of diverse populations to its EWR programs.
    4. Actively working to increase its supplier diversity with a goal to double diverse supplier spending between 2019 and 2025.
    5. Continuing to work with EWR collaboratives and work groups such as the MPSC Energy Affordability and Accessibility and EWR Low Income work groups to identify gaps, priorities, and recommendations for increasing EWR opportunities among diverse communities.
- Realize opportunities through coordination with other providers of EWR services (such as DTE Energy).
- Provide programs that create customer value and engender high satisfaction.
- Facilitate adoption of next generation technologies and EWR services through a robust focus on research and development.
- Expand EWR infrastructure, contribute to Michigan's economic growth, and increase supplier diversity through engagement, training, and collaboration with EWR equipment dealers, contractors and trade allies, non-governmental organizations, industry groups, and other program partners.
- Inform and educate customers to use energy more efficiently, using easy-to-access support and messaging that emphasizes comprehensive and deep energy savings.

The resulting Plan is a mix of proven EWR programs that have been successful in Michigan and elsewhere. Consumers Energy's *2022–2025 EWR Plan* builds on past success, but acknowledges and accounts for a changing market, new opportunities, increased savings goals, and the Company commitment to a triple bottom line of people, planet, and prosperity.

VII. Financial Summary

A. Benefits of the Integrated System Plan

One of the most significant benefits of this integrated system plan is that Consumers Energy will continue to plan and allocate capital using a holistic view of the entire gas system to prioritize projects between asset classes, and the Company continues to analyze and communicate the trade-offs between the system's many potential needs and projects.

The four objectives of the Plan (i.e., safe, reliable, affordable, and clean) are used to guide and prioritize future investment decisions. The Company allocates capital based on the most pressing needs of the system and in accordance with these objectives, enabling success in the 10-year outcomes.

B. Financial Profile

The integrated system plan bases funding decisions about capital projects to fund and the timing on entire system need.

By continuing to forecast the work over a rolling 10-year period, the Company can predictably plan and communicate investment spend in various portfolios over a longer time, while providing the agility necessary to modify future plans based on potential internal and external changes over time. Overall, the total future capital spend will be approximately $12.3 billion from 2023 to 2032, at an annual capital investment spend of approximately $1.2 billion per year, enabling more predictability in the budget planning process, as seen in Figure 70.

This level of capital investment is consistent with recent past years with new potential investments for RNG and other possible decarbonization technologies to evolve the system in the future. The capital forecast will help achieve the safe, reliable, and clean objectives by enabling predictable customer bills while striving for competitive pricing with future gas commodity projections to support the affordability objective.

Figure 70: 2023 – 2032 Capital Plan

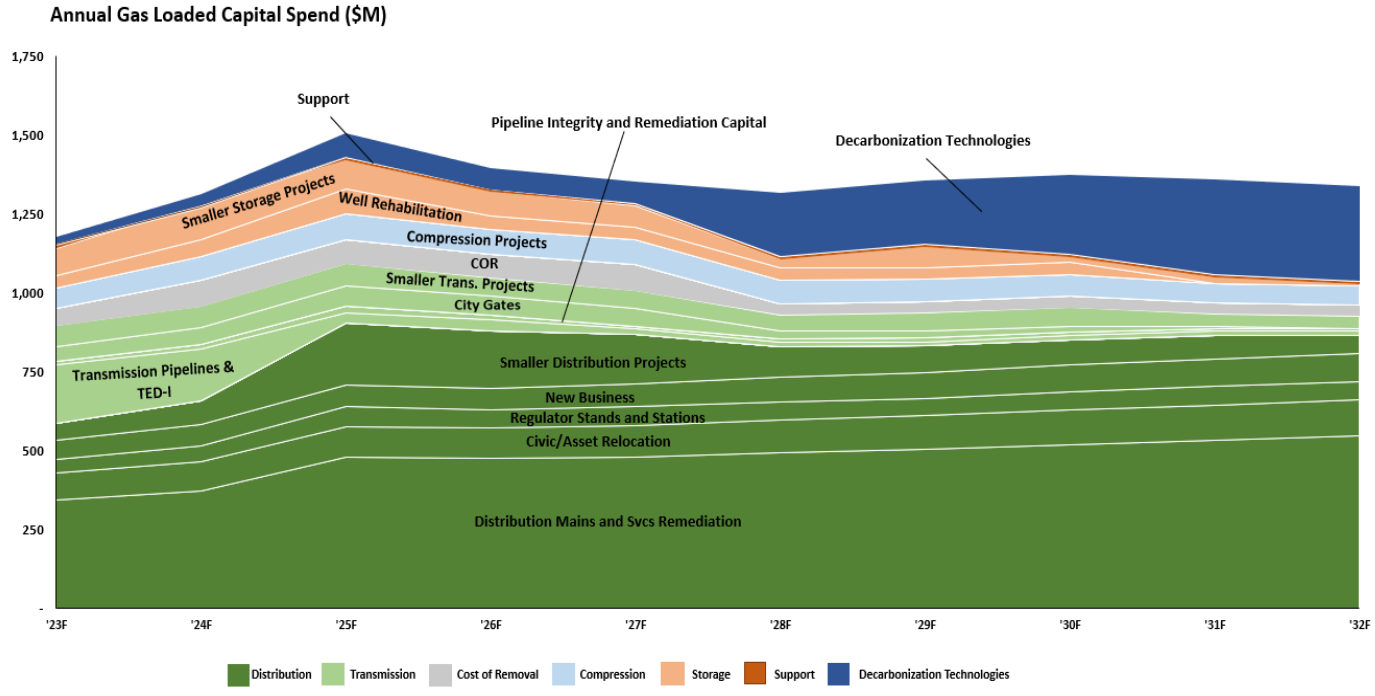


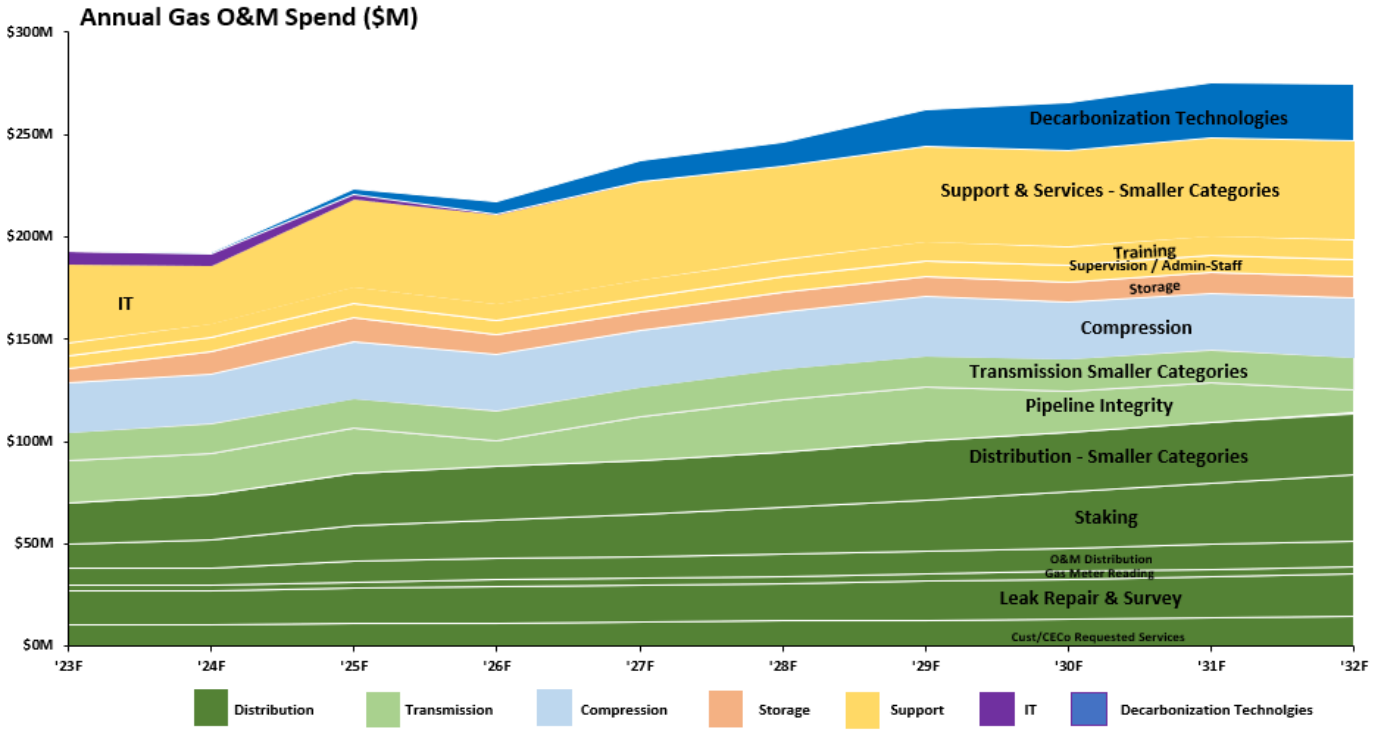
Figure 71 shows that this capital investment will also result in an increase of O&M cost over the next five years with the O&M directly for these areas showing an increasing trend as it pertains to the gas asset O&M allocations.

This additional cost is necessary as part of the capital investment in decarbonization projects along with the additional cost for compression assets to reach predictive maintenance levels, and the increase in pipeline and integrity work. It is expected that the capital investments in the distribution assets area will support the cost of leak repair and survey but will remain steady and/or increase due to the continued aging of the system.

- Given the criticality of maintaining and securing technology assets after technology implementation, if a gap exists in the IT or other O&M available, the Company will prioritize operational support of its current technology assets over investing in new capabilities.
- Having the appropriate levels of IT and other O&M funding is an absolute pre-requisite for the Company to execute the necessary and prudent capital expenditures needed to achieve the desired outcomes identified in the Plan.

The Company's IT O&M projections are calculated based on a comprehensive analysis of known and forecasted expenditures—providing an accurate and reasonable projection of future year IT O&M requirements.

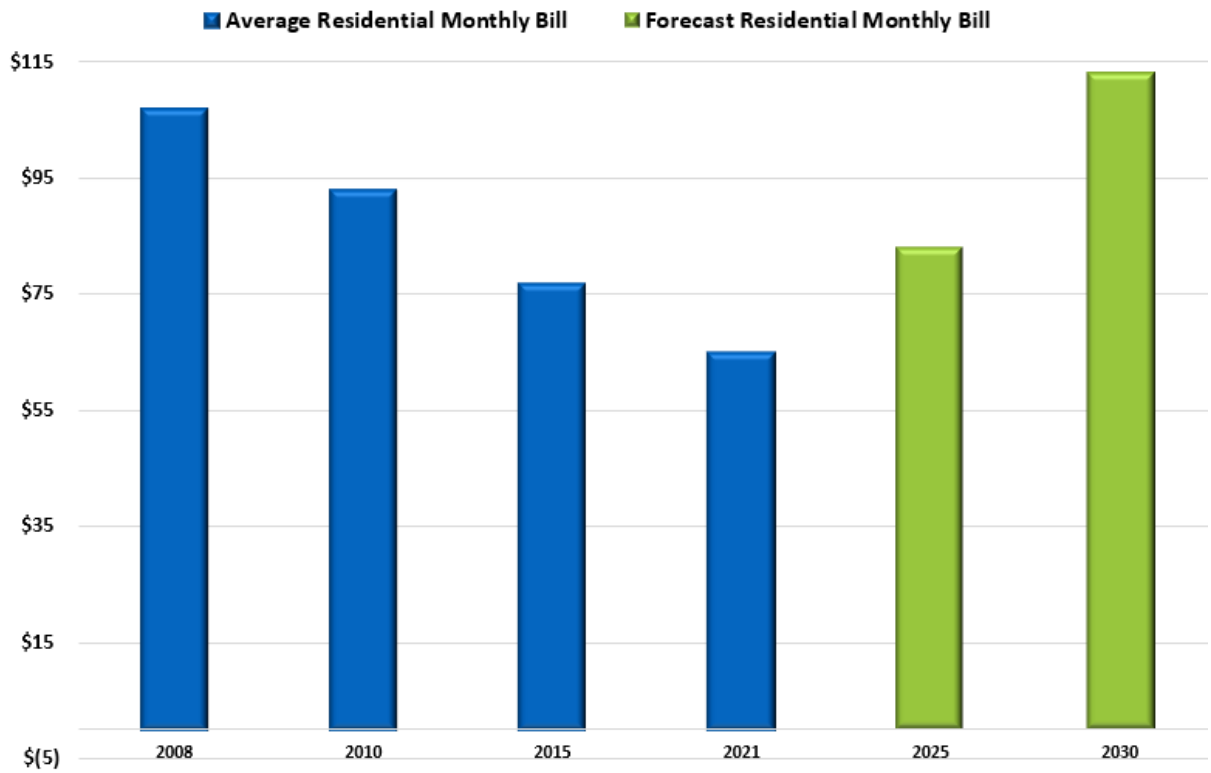
Figure 71: 2023 – 2032 O&M Plan



As provided previously in the Plan, Figure 71 and Figure 72 below shows that the average monthly bill has decreased significantly at over 5% per year over the last decade.

Figure 72 shows the history in blue and the forecast in green for the average monthly residential bill per year that was in the previous version of this Plan.

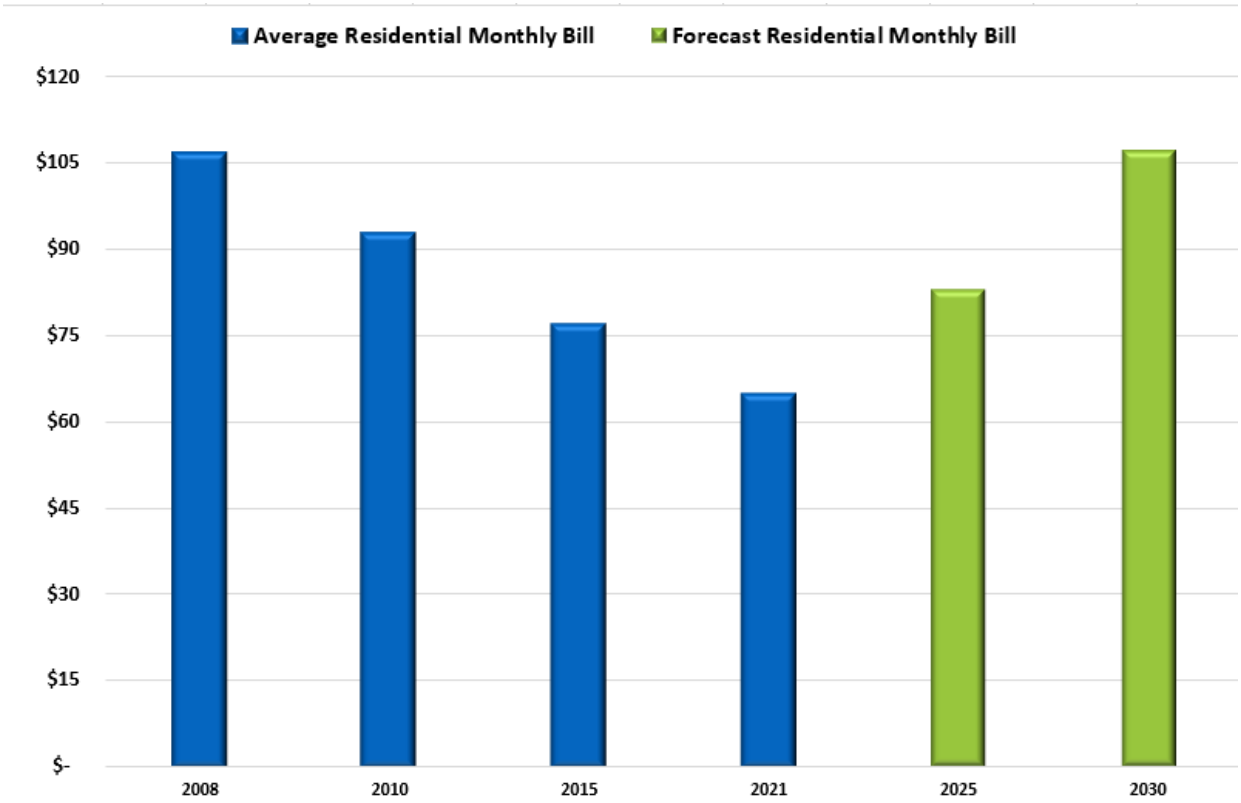
Figure 72: Average Residential Customer Bill History and Previous NGDP Forecast



As mentioned earlier and shown in Figure 72 above and Figure 73 on the next page, the average monthly bill decreased significantly at more than 5% per year through 2021, reflecting the Company's gas supply strategy and system capital investments to maximize the value in lower gas commodity costs during this period. Over the same period, the Company increased capital investment spending by approximately 15% per year to the benefit of all customers.

Despite recent gas commodity increases, Figure 73 has been updated with a new forecast showing a reduction in its 2030 bill projections. This re-forecasted bill growth rate will be an approximate compounded annual growth rate of approximately 5% each year through 2030 and comparable to the bill amount to that of 2008. However, even if the average bill increases to a 2008 historical value by 2030, the average forecasted bill decreases from 2008 to 2030 in real dollars when considering inflation rates from 2008 to 2030, which helps maintain affordability for customers now and in the future. Consumers Energy recognizes that historical data isn't always relevant to our customers, however, it does show the Company's commitment to be at, or below, inflation over the years and works diligently to maintain value and affordability to its customers.

Figure 73: Average Residential Customer Bill History and Updated Forecast



Going forward, the Company will continue to coordinate commodity costs with the long-term infrastructure investment requirements needed for a safe, reliable, and clean gas system while maintaining affordable and predictable customer bills. The Company will also continue to measure customer satisfaction and ensure the predictability of the capital work spend plan to help reduce the volatility of customers' bills over time.

VIII. Closing

Consumers Energy has developed this 10-year Plan for the gas delivery system to ensure Michigan has a safe, reliable, affordable, and clean natural gas supply.

The Natural Gas Delivery Plan enables stakeholders to have confidence in the Company's commitments to:

- Enhance **safety** by prioritizing and lowering system risk throughout the gas delivery system.
- Deliver **reliable** supply to customers with prudent contingency planning.
- Provide **affordability** to customers through stable, competitive, and predictable energy value.
- Create a **cleaner** gas delivery system that reduces greenhouse gas emissions.

The Plan reflects a thorough analysis of the system, the natural gas commodity market, trends and practices across the industry, and regulatory and customer trends.

Consumers Energy routinely reviews the validity of the inputs and assumptions that led to the updating of this Plan, and will adjust in the future as appropriate, and continue to share the Company's vision with stakeholders across Michigan.

Appendix A

As a regulated gas utility company, Consumers Energy must adhere to many different state and federal compliance requirements.

To illustrate this requirement for the work described in the Plan, the following is a high-level, but not fully inclusive, list of requirements and industry standards or practices as an example:

- Code of Federal Regulations
  - 49 CFR Part 191 - Transportation of Natural and other Gas by Pipeline; Reports
  - 49 CFR Part 192 - Transportation of Natural and other Gas by Pipeline; Minimum Federal Safety Standards
  - 49 CFR Part 199 - Drug & Alcohol Testing
- Michigan Gas Safety Standards
- Michigan Technical Standards for Gas Service
- American Petroleum Institute
  - Standard 1164 – *Pipeline Control Systems Cybersecurity*
  - Recommended Practice 1171 - *Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs*
  - Recommended Practice 1173 – *Pipeline Safety Management Systems*