2015 Gas Integrated Resource Plan

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Chapter 1 – Executive Summary

The Gas Integrated Resource Plan (GIRP) is a long-term plan used to guide natural gas resource acquisition needed to meet customer demands through 2025, taking into account existing resources, the distribution system, electric generation, and efficiencies. The GIRP specifically will identify when deficiencies occur and the potential resources that could be built or acquired to meet the deficiencies. The GIRP employs rigorous technical analysis to ensure safe, reliable and cost effective natural gas supply. The goal is to evaluate all resource requirements in order to economically determine the natural gas supply and delivery options for the forecasted annual, peak-day and peak-hour demands. Colorado Springs Utilities recognizes there are other factors that must be considered besides cost within the context of resource planning, including a high level assessment of risks, as well as environmental, and regulatory issues associated with each potential resource option.

Through a multi-discipline project team, the GIRP identified and established objectives to guide Colorado Springs Utilities toward cost effective results in order to meet the forecasted load of its customers as follows:

- Assure safe, reliable and cost effective natural gas service through documented and audited processes.
- Thoughtful application of several planning alternatives that result in resource options that meet safe, reliable and cost effective delivery of natural gas to ratepayers in the next ten years.
- Adherence to the Utilities Board Governance, Executive Limitation 11 - Enterprise Risk Management policy. Prudent planning compatible with specific direction recognized in Utilities Board Governance, Executive Limitation 13 - Infrastructure policy, as well as best industry practices.

Integrated Resource Planning Process

The 2015 GIRP was developed during a year-long process evaluating a wide range of planning assumptions in order to determine potential resource options based on the GIRP objectives. The integrated resource planning process explored the social, regulatory and market landscapes Colorado Springs Utilities must operate within to provide natural gas to the customers of Colorado Springs. The process included identifying future demand and supply resource conditions in order to recommend actions needed over the next ten years to meet the forecasted demands.

Due to regulatory uncertainty, increasing delivery capacity and supply requirements, as well as fluctuating natural gas market prices, the GIRP team examined key assumptions and historical trends, exploring how they might impact the delivery of safe, reliable and cost effective natural gas based on forecasted loads. Extensive analysis and modeling was performed to understand the various conditions the organization must respond to in order to meet the forecasted loads over a ten year period.

The GIRP comprehensive planning cycle is every three years. However, key planning attributes are reviewed annually to identify needed actions. These attributes may include significant changes to or uncertainty in load forecasts, unplanned availability or unavailability of distribution or upstream gas assets, new federal or local regulations, or other major regional or operational issues.

The purpose of a comprehensive three year planning cycle along with an annual review is to ensure that system and regional resources with long lead times are being developed when needed as cost effectively as possible. Figure 1.1 indicates the key parts of that process.

Gas Integrated Resource Planning Process					
Demand Forecasts	**Supply-Side Resource Options**	**Distribution Options**	**Demand-Side Resource Options**	**Analysis and Risk Assessment**	**Recommendation and Action Plan**
Population Growth Use-per-Customer	Commodity Gas Supplies	Load Modeling and Forecasting	Energy Efficiency/ Peak Load Management Program	Alternatives and Outcomes	Adopted Planning Criteria
Efficiency Standards	Transportation, Storage, Propane-Air Plant	Stress Testing	Interruptible Customers	Timing and Cost	Demand/Supply Balance Options
Peak-Day Forecasts Peak-Hour Forecasts	Supply Balance: Daily/Hourly Demand	Design Day and Peak-Hour Forecasting		Integration with EIRP	Further Studies

Figure 1.1: Gas Integrated Resource Planning Process
The figure above shows the major steps in the Gas Integrated Resource Planning process sequentially from left to right across the top. Under each major step is a high-level look at some of the considerations made for that particular step. Each of these steps is explored indivually in the following chapters.

The three primary purposes in meeting the GIRP objectives are:

Supply: Obtain natural gas supplies, transportation capacity and storage capacity sufficient to meet distribution system demand.

Delivery: Ensure the natural gas distribution system adequately provides reliable natural gas to end-users based on a peak-hour design day.

End Use: Consider the full economic spectrum of consumers from industrial, power generation, residential, commercial, and other uses, including transport and interruptible customers.

Demand Forecasts

The GIRP process developed three primary types of demand forecasts; annual, peak-day and peak-hour. Annual demand forecasts are used for preparing revenue budgets and developing long-term natural gas procurement plans. Peak-day and peak-hour demand forecasts are critical for determining the adequacy of existing gas supply resources, or the timing for new resource acquisitions and capital investments required to meet customers' needs during a peak demand. Statistically, these conditions will occur once every 20 to 30 years and typically last no more than 3 consecutive days.

Demand forecasts focus on two primary drivers, residential natural gas usage and non-residential usage. The non-residential base in Colorado Springs is relatively small compared to other cities of similar size, therefore Colorado Springs Utilities natural gas usage is predominately driven by weather sensitive heating loads. Since there is substantial weather volatility in the Colorado Springs Utilities service area, forecasting daily and hourly demands is a challenging process. Demand forecasts include wind speed in addition to average temperature as fundamental demand-influencing factors. GIRP team members analyzed weather data dating back to 1946, and determined a one-in-twenty-five year occurrence to be a -13 °F average daily temperature. The 2015 GIRP weather planning criteria is tabulated in Table 1.1.

Table 1.1: Weather Planning Criteria
Weather data used for peak day and peak hour demand forecasts. Note: Heating Degree Days is defined as a base of 65° F minus the average daily temperature.

CSU Weather Planning Criteria					
Time Period	**Metric Used**	**Temperature (Degrees F)**	**Heating-Degree-Days**	**Wind Speed (mph)**	**Wind Chill (Degrees F)**
Daily	24-Hour Average	-13 .0°	78.0	15.0 mph	-36.0°
Hourly	Minimum Temperature	-25.0 °	N/A	15.0 mph	-46.9°

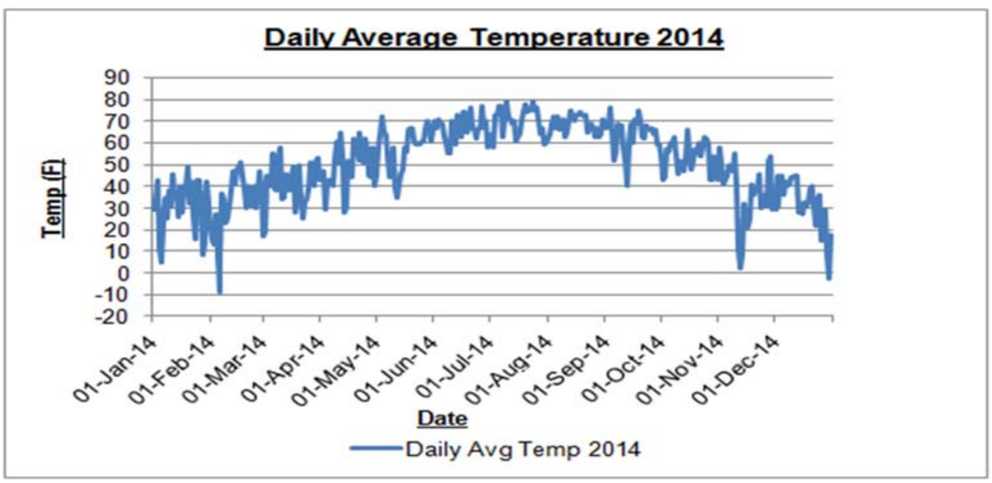


Figure 1.2: Daily Average Temperature 2014
Graph illustrates the day-to-day fluctuation in weather in the Colorado Springs area. Note that wind conditions are not shown or accounted for in this figure.

In addition to average temperature and wind speed, Colorado Springs Utilities' approach to demand forecasting recognizes two additional drivers, customer growth and demand response of existing residential, commercial and industrial customers. Factors that influence new demand include population, employment trends, traffic area zones (TAZ) based on the Pikes Peak Area Council of Governments planning information, construction trends, and new use development (e.g. natural gas vehicles). Demand response recognizes customers adjust consumption in response to price and modify their demand through conservation measures such as, installing insulation, weather stripping, energy efficient windows, replacement of existing appliances with higher efficiency appliances, and behavioral adjustments such as, lowering thermostat settings. Over the past two decades the demand response has resulted in the annual use per residential customer declining by approximately 25%.

One of the key results of the 2011 GIRP was a revision in forecast methodology that better correlated forecasts with an actual peak-day and peak-hour event. The improvements included: widening the data set with hourly load data, including wind effects, and switching to a use per customer approach to determine daily peak loads for temperatures less than 45° F. The methodology for forecasting peak-hour load was defined as the peak-day load multiplied by a historical peak-hour factor of 5.3%. For the 2015 GIRP, this revised methodology was validated and used in the peak hour forecast.

The annual, peak-day and peak-hour forecasts of natural gas customer requirements into the future are the starting point for ensuring Colorado Springs Utilities is able to safely, economically and reliably meet customer demand going forward. The Ten-Year Peak Demand Forecast is shown in Table 1.2.

Table 1.2: Peak Demand 2015-2016 Heating Season

Ten-Year Peak Demand Forecast Scenario [Mscf @ 14.73 psia]		
Winter	**Daily Peak Demand (Dth/Day)**	**Hourly Peak Demand (Dth/Hour)**
2015-2016	291,357	15,442
2016-2017	295,611	15,667
2017-2018	300,310	15,916
2018-2019	305,442	16,188
2019-2020	310,507	16,457
2020-2021	315,400	16,716
2021-2022	320,295	16,976
2022-2023	325,225	17,237
2023-2024	330,215	17,501
2024-2025	335,256	17,769

Current Resources

Our gas supplies originate from the rich Rocky Mountain supply basins (see Figure 1.3). Transportation services are purchased from the Colorado Interstate Gas Company (CIG). The gas is distributed to our customers by us through the extensive CSU distribution system (see Figure 1.4).

Colorado Springs Utilities has a diversified portfolio of natural gas supply resources that includes contracts to purchase natural gas from several different supply basins with various terms, as well as multiple contracts for pipeline transportation and storage services. The diversity enables flexibility based on supply sources, and leverages firm capacity rights on the Colorado Interstate Gas Company (CIG) pipeline system for supply delivery to the Colorado Springs Utilities City Gate stations. As part of the portfolio management process potential supply resource additions, incremental pipeline transportation, storage options, distribution capacity enhancements and Propane Air Plant (PA Plant) expansions are evaluated to manage a cost effective portfolio that results in the reliable delivery of supply when needed.

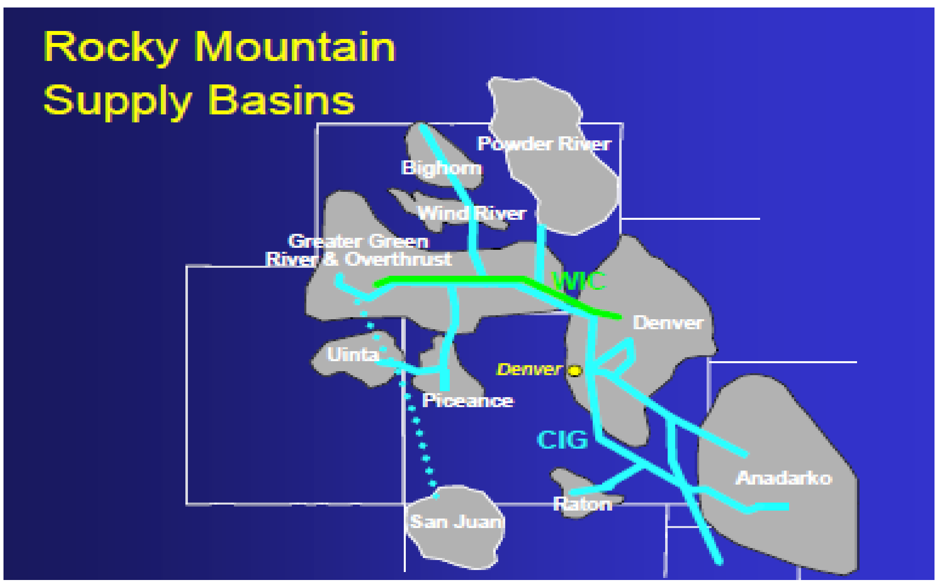


Figure 1.3: Rocky Mountain Supply Basins
The Rockies supply region encompasses about 28 separate supply basins. The major supply basins in the Front Range include the Green River, Wind River, Powder River, Uinta, Piceance, and the Denver-Julesburg ("DJ") all of which deliver gas directly into Colorado Interstate Gas.

The goal is tailoring a diversified firm transportation and storage services portfolio with contracts of varying terms and conditions to provide flexibility in meeting the changing load demands of our customers. In order to meet customer load demands, contracted quantities needs to be equal or greater than the forecasted firm peak demand volumes.

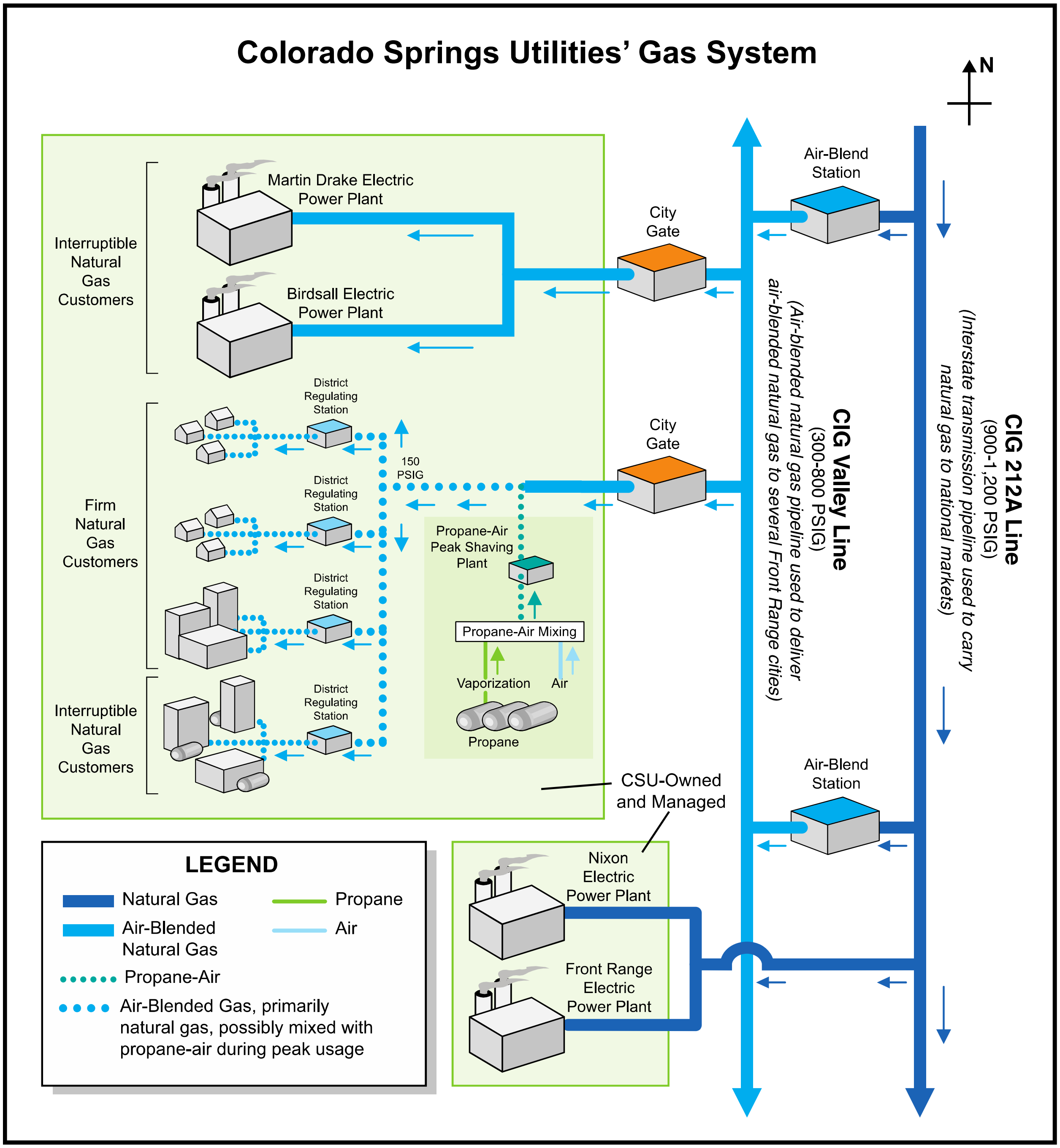


Figure 1.4: Colorado Springs Utilities' Gas System

This figure provides a look at Colorado Springs Utilities distribution system. The CIG Valley Line delivers air-blended gas, which serves the unique need of high altitude areas. For peak shaving Colorado Springs Utilities supplements the gas supply using a propane-air plant. Additionally Colorado Springs Utilities has several interruptible customers, such as power plants and industrial customers, which can be shed during high consumption periods. Refer to *Chapter 3 – Natural Gas System Overview* for more in-depth discussion of the delivery system.

Peak Day and Peak Hour Demand

Figures 1.5 and 1.6 illustrate the expected demand, current resource mix, and forecasted demand deficiencies for the *daily* and *hourly* peak demand projections, respectively.

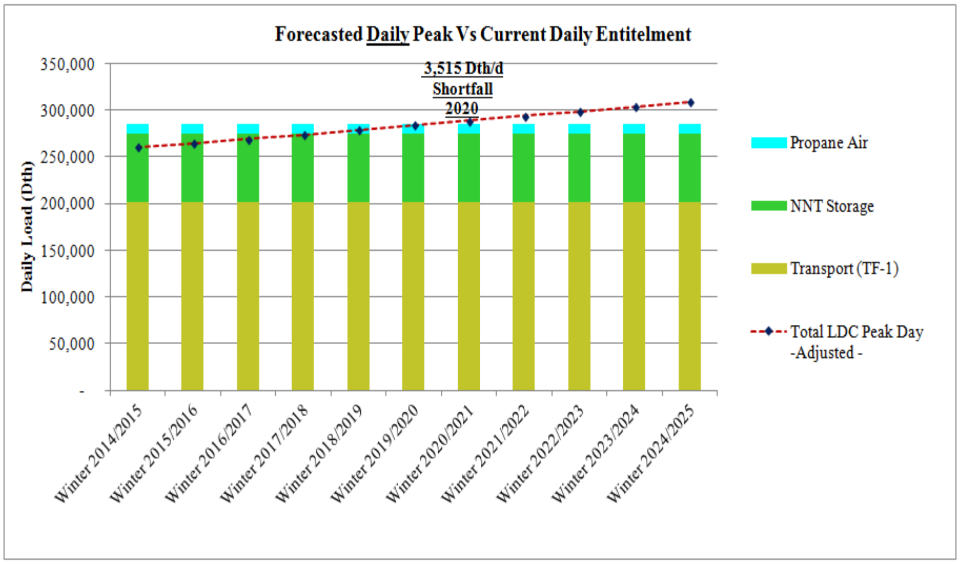


Figure 1.5: Winter Forecasted Daily Peak Load vs. Current Daily Supply
Comparison of forecasted daily peak with current supply resources at CSU. Note that "Total LDC Peak Day – Adjusted" is less than 26,746 Mscf for interruptible and G4T customers that CSU is not obligated to supply at all times.

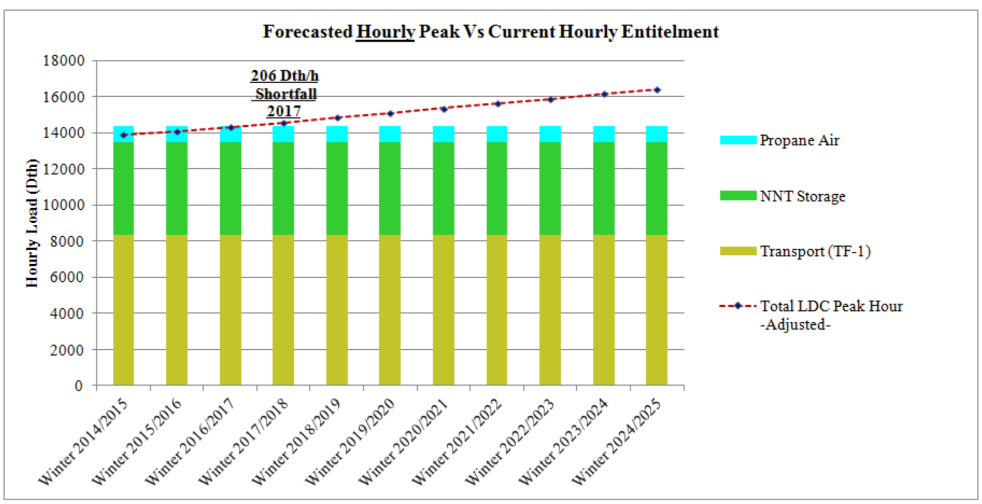


Figure 1.6: Winter Forecasted Hourly Peak Load vs. Current Hourly Supply
Comparison of forecasted hourly peak with current supply resources at CSU. Note that "Total LDC Peak Hour – Adjusted" is less than 1,357 Mscf for interruptible and G4T customers that CSU is not obligated to supply at all times.

The 2014 peak-*day* demand forecast indicates the existing upstream supply resources, including Colorado Springs Utilities' Propane Air Plant capacity, will become deficient in the 2020-2021 heating season. The peak-hourly demand deficiency occurs even earlier in the 2017-2018 heating season. Since the pipeline system serving Colorado Springs is currently at capacity, new capacity expansions will require installation of new infrastructure which may take two to three years to accomplish depending on obtaining construction permits and regulatory approvals.

Options explored to cover the expected shortage in supply capacity included:

- Increasing pipeline demand capacity from CIG, available in blocks of 15,000 Dth/day or larger but at considerably higher costs than current supplies,
- Expanding send-out capacity of the existing Propane-air plant,
- Construction of a new Propane-air or Liquefied Natural Gas plant providing new CIG owned capacity.
- Explore ways to reduce both peak hour and peak day demand on the system.

Distribution System Infrastructure

Distribution system network modeling facilitates the understanding of existing operational conditions as well as planning for future expansion within the Colorado Springs Utilities service territory. This allows the organization to effectively deliver peak-hour load requirements from the City Gate stations to each individual customer within the service territory. The Gas Planning and Design Section (GPD) identifies areas of concern within the natural gas infrastructure, evaluates alternative solutions, and develops corrective action plans. Identifying potential system performance issues provides Springs Utilities the opportunity to incorporate corrective action into normal maintenance or replacement projects. This proactive approach avoids costly "reactive" methods and creates value for our customers.

GPD performed numerous iterations to verify the conditions for the Distribution System Delivery Constraints demand scenario. Breaking point stress tests were modeled for power plants, gate stations and military bases. No deficiencies were identified in meeting the future peak-day and peak-hour requirements for the next ten years.

Identified Industry Impacts

As a part of the GIRP process, industry impacts were identified.

Economic Recovery - The recent economic downturn has been dramatic and has had an impact on near-term trends in economic activity. The impact on natural gas demand, infrastructure developments, commodity prices, credit terms and procurement practices of this unsettled economic environment presents many forecasting challenges. Effects of the economic recovery on customer natural gas usage is unclear, therefore gas usage will be continually monitored.

Power sector environmental regulations - The EPA is expected to enact several key regulations in the coming decade—pertaining to air emissions intake—that will affect the U.S. electric power sector, particularly the fleet of coal-fired power plants. In order to comply with those new regulations; existing coal-fired plants may need extensive environmental control retrofits if they are to remain in operation. Because natural gas often is the marginal fuel for electricity generation, low natural gas prices make it more likely that older coal-fired plants will be retired.

Action Plan

The recommended GIRP action plan outlines activities identified by the GIRP core team, with advice from management and public participation, for development and inclusion prior to the next regularly scheduled GIRP review process cycle, which is tentatively planned for 2018. The purpose of these actionable items is to position Colorado Springs Utilities to provide the best cost/risk resource portfolio and to support and improve GIRP planning. Key actionable items identified for further detailed analysis include:

- Restore the historic Propane Air Plant and increase its capacity rating through targeted maintenance and equipment upgrades, to provide an additional 500 Mscf / hour (12,000 Mscf / day) of supply capacity.
- Construct an additional Propane Air Plant to provide 1,000 Mscf / hour (24,000 Mscf / day) of capacity above and beyond that of current Propane Air Plant.
- Initiate a new Demand Side Management (DSM) study to examine the ability of the existing conservation measures to create sustainable reductions in natural gas demand.

Conclusion

Based on current projections, the customer demand for natural gas in the Colorado Springs Utilities coverage area will exceed current supplies starting in the 2017-2018 heating season. Despite decreasing use per customer natural gas demand is expected to increase slightly over the next ten years due largely to the growing population of El Paso County and therefore growing customer base. The 2015 GIRP evaluated resource options needed to meet annual, peak day and peak hour customer demands forecasted through 2025. The plan takes into account existing resources, the distribution system, electric generation, and efficiencies to produce a set of potential resource options that are tailored for the specific Colorado Springs Utility requirements in specific time frames going forward.

Chapter 2 – Introduction to Our Organization

The City of Colorado Springs, Colorado is a home rule municipal corporation with a population of approximately 439,886, located in the south central Front Range of Colorado. The economy of the City and the surrounding area is based substantially on employment attributable to service industries, retail businesses, construction industries, military installations, the high technology industry and tourism.

Colorado Springs Utilities (the "Utilities"), created by the home rule charter of the City (the "Charter") consists of a water system (the "Water System"), an electric light and power system (the "Electric System"), a gas system (the "Gas System"), a wastewater system (the "Wastewater system"), a streetlight system (the "Streetlight System"), and other systems designated in accordance with the Charter (collectively, the "System"). The Utilities is wholly owned by the City and constitutes an enterprise under certain Colorado Constitution and Charter provisions. The Utilities operates primarily through several functional divisions responsible for planning, financing, constructing, operating, and customer service responsibilities associated with the delivery of electric, gas, water, wastewater and streetlight services.

The service areas for some or all of the System include the City, Manitou Springs and many of the suburban residential areas surrounding the City. The military installations of Fort Carson Army Base ("Fort Carson"), Peterson Air Force Base ("Peterson") and the United States Air Force Academy (the "Academy") receive water and electric service, and gas supply and transportation from the System, and Peterson also receives wastewater treatment service from the System.

The Natural Gas Service

Colorado Springs Utilities operates a local distribution system supplying natural gas to approximately 195,832 customers in about a 500 square mile service area. A total of approximately 24.55 billion standard cubic feet (14.73 psia) were delivered in 2014. In addition to the City of Colorado Springs, the service area includes Manitou Springs, the Academy, and the northerly portion of Fort Carson and unincorporated portions of El Paso County. For illustration customer and systems statistics for 2014 are presented in Table 2.1.

Table 2.1: 2014 Service Area Statistics

Number of Customers	195,832
Miles of Gas Distribution Lines	2,454 miles
Peak-Day Demand	266,786 mcf @ 14.73 psia
Peak-Hour Demand	11,376 mcf @14.73 psia
Annual Demand	24.59 bcf @ 14.73 psia

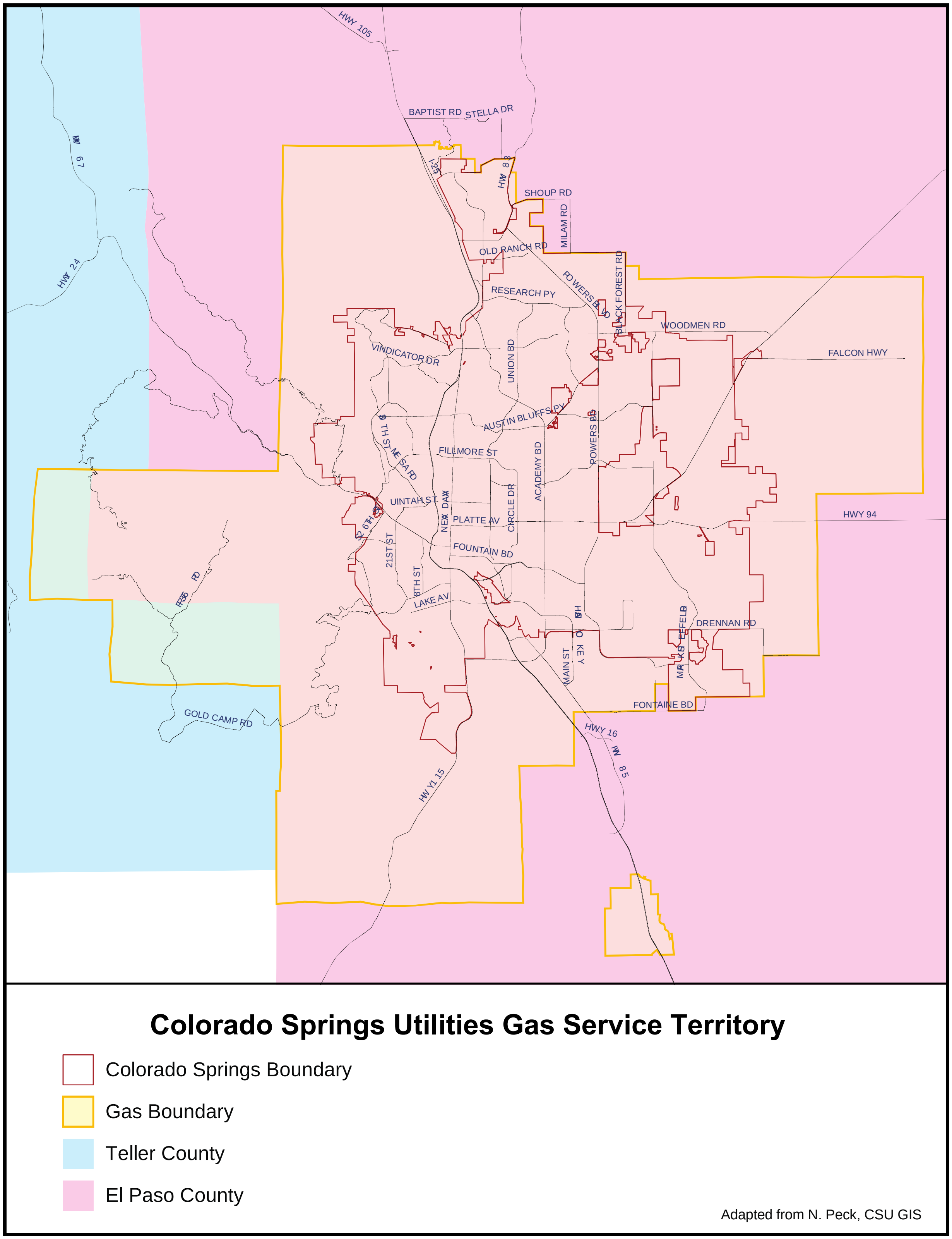


Figure 2.1: Colorado Springs Utilities' Gas Service Territory

The Gas System's customer base continues to grow at approximately the same growth rate as the population in the greater Colorado Springs area; customer growth rate is forecasted at 1.1% for 2015. Natural gas continues to be the preferred fuel for space and water heating for residential and commercial customers; approximately 7% of residences and business are not natural gas customers.

While the Gas System is subject to federal and state environmental regulations, Colorado Springs Utilities does not anticipate the incurrence of extraordinary costs for its compliance with such regulations. The Gas System facilities consist of approximately 2,454 miles of natural gas pipe mains and approximately 195,832 service lines. The Utilities undertakes improvements to maintain the Gas System and provide capacity for increased customer demand.

The Gas System purchases gas under contracts with a variety of gas suppliers including nationwide marketing companies as well as national and regional production companies. Colorado Interstate Gas Company, an interstate gas pipeline of the Kinder Morgan Corporation (CIG) transports the purchased natural gas supplies to the Gas System's distribution facilities pursuant to various firm, interruptible and "no notice" transportation agreements. Supplementing the purchased gas is a propane-air plant (peak-shaving facility) and contract storage services, including the Young Storage Field, of which the Utilities' is a 5% owner.

The city of Colorado Springs is located within the Front Range natural gas supply region and as a result has access to an abundance of supply. In fact, most of the region's natural gas supplies are exported since regional supply far exceeds regional demand. Denver Julesburg (DJ) is one the most growing production basins in Rockies, combined with reversal of flow in Rockies Express (REX) will change the supply dynamics regionally. An additional benefit to this collocation is historically lower gas cost relative to most of the U.S. With respect to pipeline and storage delivery capacity to the City, the Gas Integrated Resource Plan has identified the need for a modest amount of additional hourly capacity in the near term. Over the long term normal City growth will require the acquisition of additional delivery assets. There are several options for expansion of the existing delivery portfolio and the most cost effective solutions are being evaluated. Colorado Springs Utilities currently has term gas supply contracts ranging from three months to 27 years and has never encountered a problem obtaining sufficient supplies in the past 40 years, nor are any problems anticipated for the future.

Natural Gas Customers

Colorado Springs Utilities provides natural gas based on residential, commercial, industrial, and contract (military and Utilities generation) classifications. In addition, some customers have contracted for an alternative source of gas supply and have requested Colorado Springs Utilities to transport such gas, these customers are referred to by their rate class of G4T. Figure 2.2 illustrates the breakdown of natural gas use in 2014 for each rate class.

For most of the rate classes, Colorado Springs Utilities is obligated to deliver whatever volume is needed by the customer under firm delivery requirements. Over half of our customers are residential, nearly one third are commercial, four are military and relatively few are industrial customers. To date, we have twenty two customers on our transportation rate class (G4T).

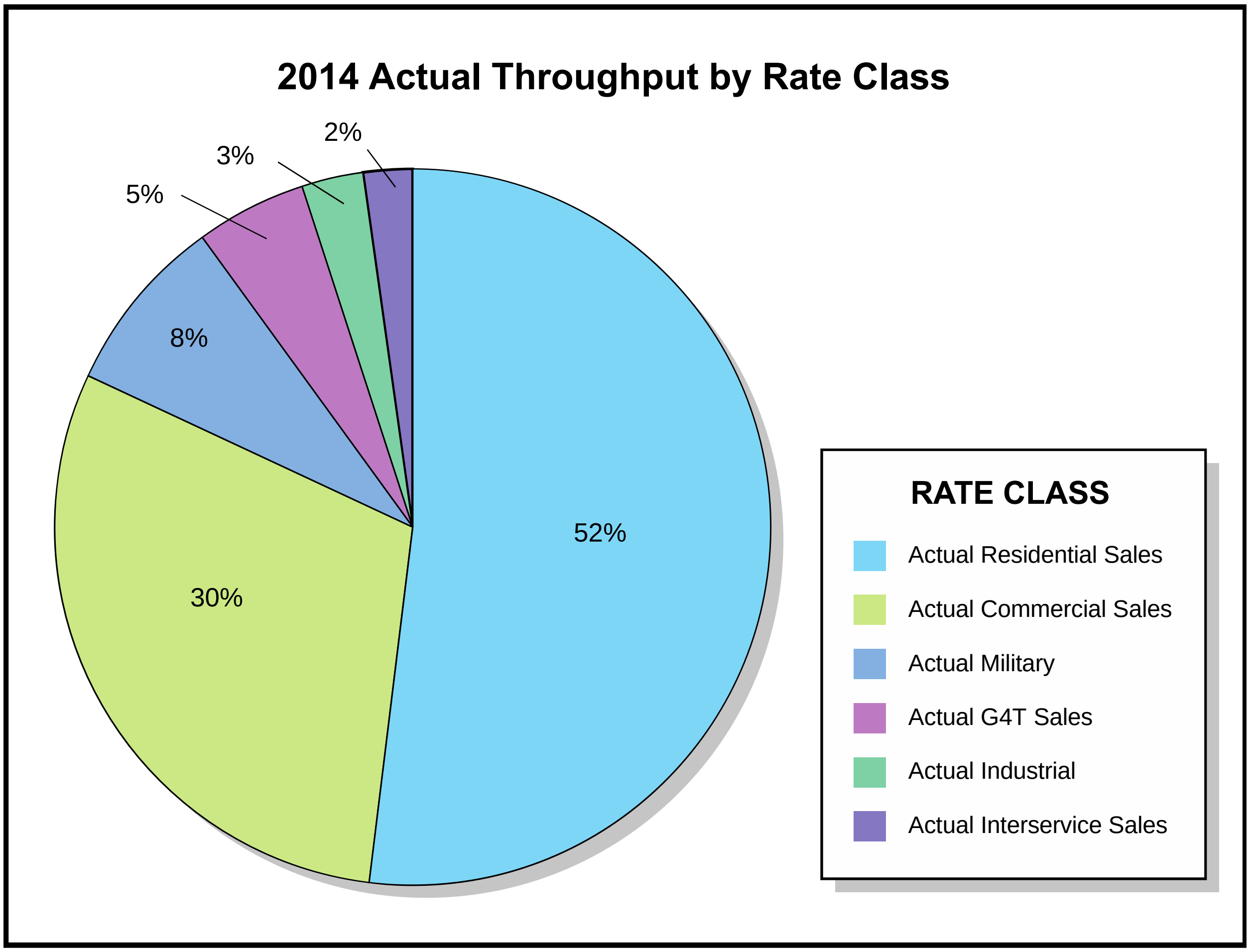


Figure 2.2: 2014 Natural Gas Throughput by Rate Class
Breakdown of natural gas customers in 2014 by customer type. Annually, over half of the natural gas load in the Colorado Springs are is for residential use.

Natural gas demand is seasonal, (especially for residential customers) and driven by temperature sensitive heating loads particularly for residential customers. Industrial demand, which is typically not weather sensitive, has minimal seasonality. **Figure 2.3** Illustrates the seasonality of CSU total system load.

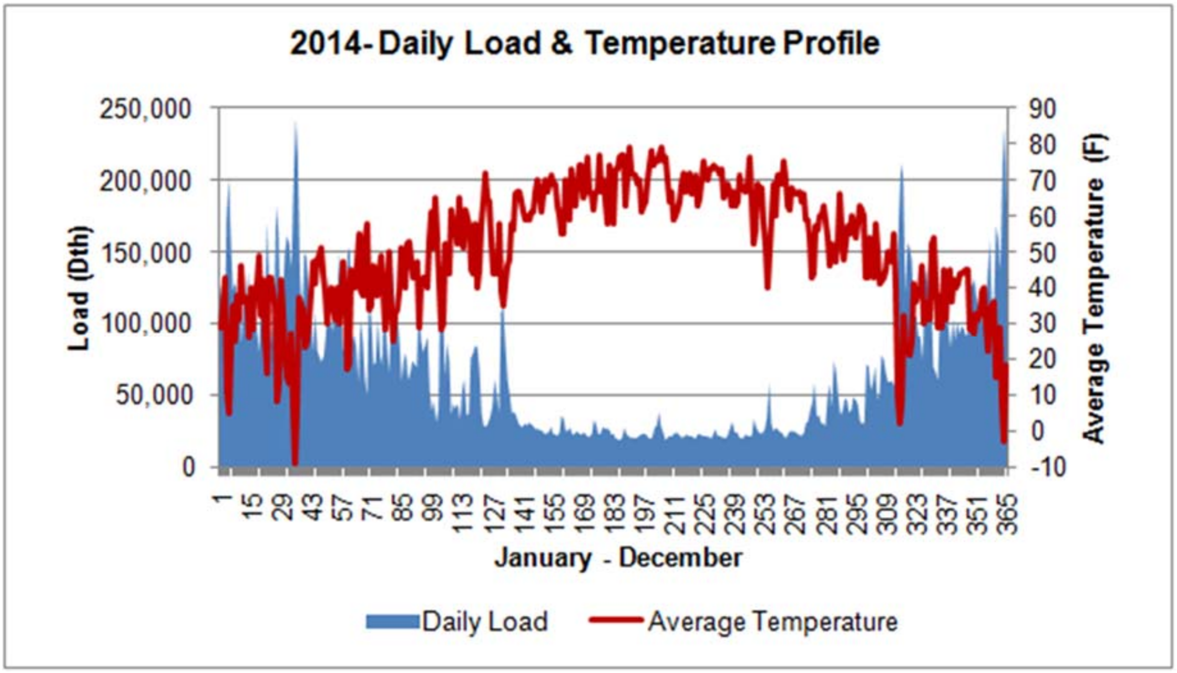


Figure 2.3: Daily Profile of Natural Gas Usage vs. Temperature
Figure overlays temperature with load to demonstrate the inverse correlation of temperature to natural gas usage (meaning higher loads correlate with colder temperatures).

Natural Gas Rates

The following table sets forth rates as they relate to residential and commercial services provided by the Gas System. As noted in the table, Colorado Springs Utilities levies a gas cost adjustment to pass through to its customers changes in costs of gas from its suppliers. As with the electric cost adjustment, the gas cost adjustment calculation considers the forecasted cost of gas and is subject to revision as often as monthly, depending on market volatility.

Gas Rates (Effective January 1, 2015)
Residential Service:
The bills are the sum of:
Supply Charges -- Per 100 cubic feet $0.6034
Access and Facilities Charges -- Per day $0.3930
-- Per 100 cubic feet $0.1645

Gas Cost Adjustment -- Per 100 cubic feet .... $(0.1265)

Commercial Service:
The bills are the sum of:
Supply Charges -- Per 100 cubic feet $0.6034
Access and Facilities Charges -- Per Day.. $0.7860
-- Per 100 cubic feet $0.1480
Gas Cost Adjustment -- Per 100 cubic feet .... $(0.1265)

The ten largest customers of the Gas System during 2014, ranked by sales volume in Mscf, represented approximately 3,440,808 Mscf, or 12.1% of sales (excluding interdepartmental and miscellaneous sales), and approximately $15,886,791 or 8.4% of revenues during that period (excluding interdepartmental and miscellaneous revenues).

Planning Environment

Colorado Springs Utilities' effort to manage the development of the current Gas Integrated Resource Plan began in November 2013. The effort thoroughly vetted the processes and plans for each functional area, such as Demand Forecast, Distribution Planning, Supply Side Resources, and Demand Side Management, to ensure our customers are provided with long-term safe, reliable and cost effective natural gas service. The GIRP evaluates, identifies and plans for the acquisition or capital investment of existing and future resources to meet peak-day and peak-hour supply and delivery requirements over a ten year planning horizon. Based on the potential resources identified, detailed studies will be performed to choose the best alternative for meeting the forecasted demand.

The GIRP will be reviewed annually, based on the triggers below, to ensure immediate actions are responded to as determined by the GIRP objectives:

- 5% increase in forecasted demand
- Regulatory requirements not originally anticipated
- Unplanned availability or unavailability of distribution or upstream gas assets
- Major regional or operational issues

The comprehensive annual analysis ensures that the customers of Colorado Springs Utilities are provided with a safe, reliable and cost effective supply of gas for years to come.

Chapter 3 - Natural Gas System Overview

The U.S. natural gas system is complex and dynamic. New supplies are found in areas with little infrastructure. Meanwhile, demographic and regulatory changes shape trends in natural gas consumption. This chapter looks at the business and physical infrastructure that gets natural gas from production at the wellhead to the consumer, discusses the system used by Colorado Springs Utilities, and describes CSU's customer demographics.

The gas industry's physical infrastructure is generally segmented into three areas: production and processing, transmission, and distribution. It is rare for any business in the natural gas industry to be involved in all aspects of the natural gas physical infrastructure. Although there are many kinds of business organizations operating in the natural gas industry, the industry business structure is likewise generally segmented into exploration/production/processing, transmission, and distribution. Colorado Springs Utilities operates in the distribution segment. The U.S. Department of Transportation (DOT) Code of Federal Regulations (CFR), federal environmental regulations, and other industry codes adopted by local jurisdictions regulate all industry segments, primarily for safety.

Natural Gas Exploration, Production and Processing

At the beginning of the natural gas system are companies involved in the exploration and production of raw natural gas. Exploration companies find the gas beneath the earth's surface in various types of formations. Production companies remove the gas from the ground for use.

From the wellhead, the gas is gathered in small diameter pipelines that carry it to processing plants. The processing plants separate the raw natural gas from liquids such as ethane, propane, butane and higher hydrocarbons, and from other contaminates such as CO_2 and sulfur compounds. The propane and other hydrocarbons are separated into individual components and sent to their respective liquid markets. What remains is "dry" natural gas – pipeline quality methane suitable for commercial and residential use.

Figure 3.1: Natural gas wellhead

The core business model of exploration and production companies is to develop gas supplies, and to process that gas to pipeline quality specifications for sale to marketers, local distribution companies, and industrial end-users.

Exploration, production, and gas marketing companies are predominantly investor-owned and operate on a free market basis. The wellhead operations and processing plants are regulated primarily by state oil and gas organizations, along with Federal environmental regulations and local jurisdictional requirements.

Natural Gas Transmission

From the processing plant, the dry natural gas is compressed and enters into large diameter interstate and intrastate pipelines that are owned and operated by transmission – or pipeline – companies. In the transmission pipelines, the gas combines with other similar natural gas streams and is transported under high pressure to and from storage fields and distribution gate stations. As the gas moves through this transmission system, its pressure falls, so the gas must be periodically recompressed at various "compressor stations" along the way. The compressor stations are also used to help balance daily supply and demand issues by increasing the pressure beyond what is required and packing extra gas into the system for later use in a technique known as line pack.

Underground storage facilities, consisting of natural or man-made formations into which natural gas can be injected and withdrawn, are often located at strategic points along the pipeline to act as buffers in the transmission system, and help balance longer term supply and demand requirements.

Transmission businesses typically own and operate interstate/intrastate pipelines, compressor stations, storage fields, and in some cases peak shaving facilities – low-inventory, high-output facilities that provide supplemental gas at times of extreme load (e.g., peak) demand.

The core business model of gas transmission companies is to receive gas volumes into their pipeline system for delivery to other pipelines, marketers, and end-use industrial customers. Transmission companies operate as a "common carrier," making their pipelines available to any supplier, marketer, or other authorized organization.

Interstate pipeline rates and operating practices are regulated by the Federal Energy Regulatory Commission (FERC), and by law operate under open access requirements. Rate structures and rates-of-return on investment are regulated by FERC in public rate cases.

Transmission companies are typically owned and operated by investor-owned companies. Interstate pipeline companies may own and operate marketing organizations (referred to as marketing affiliates) but must operate the marketing affiliate separate and distinct from the pipeline business and cannot share market and supply information that is not publically available.

Natural Gas Distribution

The transmission system ultimately delivers the gas to local distribution companies (LDC), who in turn deliver the gas to homes, businesses and other natural gas consumers within a specific region.

When the gas reaches a load center, the local distribution company takes custody of the gas that they have purchased. The delivery point is known as a city gate, and the piping after the city gate is referred to as distribution piping. At this point, the gas is reduced in pressure, and its flow and energy content measured. The gas is then distributed via smaller diameter pipeline systems to the end-use customers.

Peak shaving facilities help local distribution companies manage periods of high demand. Two common types of peak shaving are liquefied natural gas (LNG) and propane-air (propane mixed with air). In both cases, the gas is stored in liquid form. When needed to meet extra demand levels, the liquid is vaporized back into a gas and is injected into the distribution system to supplement the gas supply. Before injection, the propane undergoes the additional step of being mixed with air.

Colorado Springs Utilities is a local distribution company. The storage fields and peak shaving plants provide operating flexibility for meeting dynamic and extreme load demands, as well as for optimizing the cost benefit of infrastructure investments. Except for peak shaving facilities, the various gas systems of the LDC operate on a continuous basis to meet customer needs, and all systems are designed and operated to meet widely varying load demands driven by weather conditions, industrial needs, and consumer needs.

LDCs own and operate the distribution pipelines – and in some cases intrastate transmission pipelines, storage facilities and peak shaving facilities. The core business model of a local distribution company is to provide safe, reliable, and cost effective natural gas service to their customer base. LDCs operate in certificated service territories usually determined by state government regulatory agencies. They are owned and operated by investor-owned companies, municipalities, or utility districts created under state, county or other governmental charters. Investor-owned and government-chartered LDC's serving geographic areas generally operate under franchise agreements with governmental entities (states, cities, towns, municipalities). Rates and service levels are regulated by public utility commissions (PUC), chartered commissions, city councils, or other regulatory bodies.

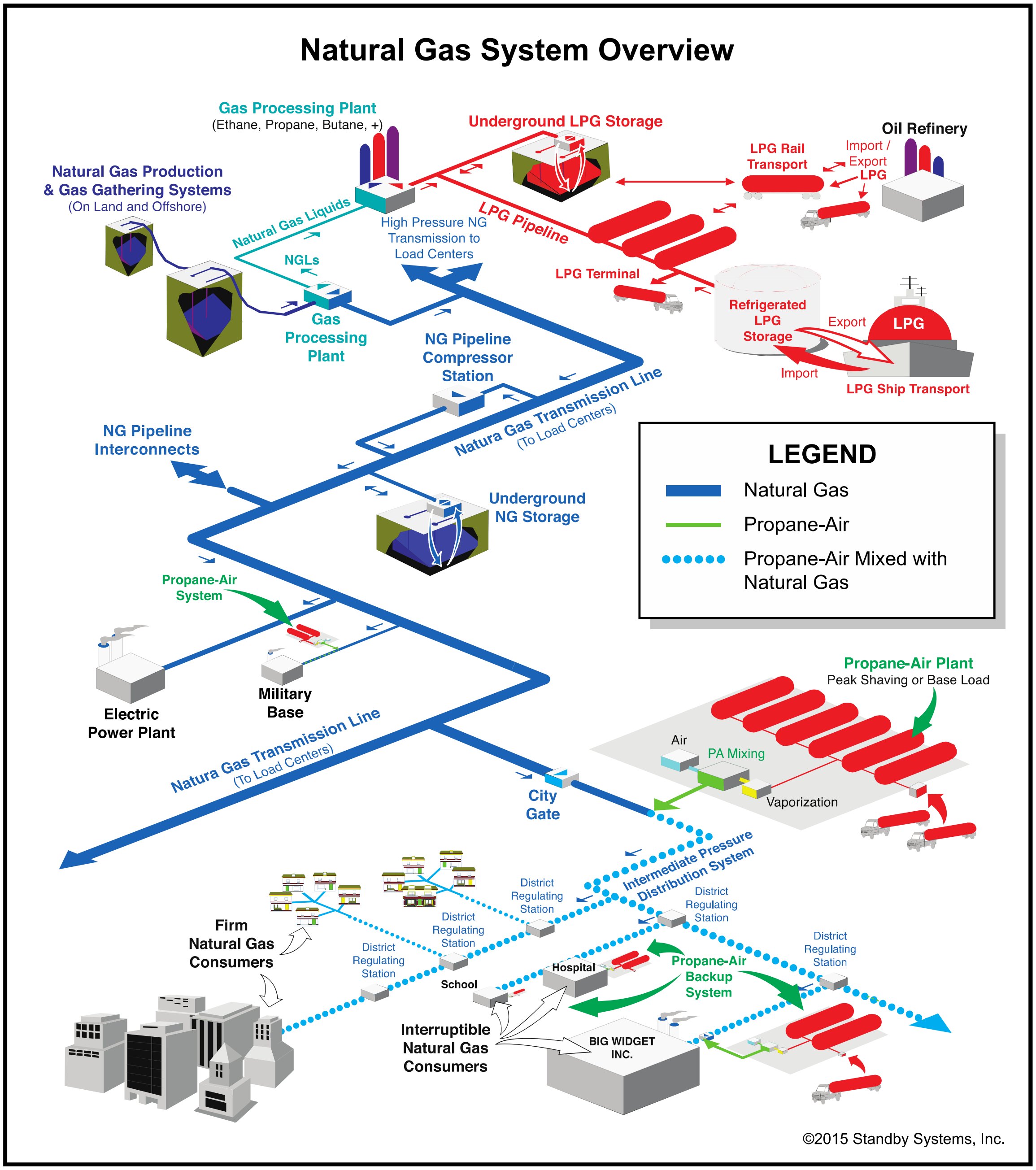


Figure 3.2: Natural Gas System Overview
Typical natural gas infrastructure. The top of the figure shows natural gas production and processing, where undesired particles are removed from the gas, and where the gas is purified to acceptable and usable grade. From there, the gas enters the transmission pipeline. The lower portion of this figure shows the roles performed by the local distribution company, as it delivery the gas to customers such as residential and industrial consumers.

Colorado Springs Utilities' Gas System

As a local distribution company, Colorado Springs Utilities acquires natural gas through various suppliers and has multiple contracts with Colorado Interstate Gas (CIG), a transmission pipeline company, to transport those supplies to five city gate stations for the Colorado Springs Utilities service territory. Colorado Springs Utilities also makes use of an underground natural gas storage reservoir to help balance supply with gas demand. Additionally the utility owns a propane-air system, which is used to supplement gas supply during extreme peak use periods.

One aspect of the gas industry that is unique to the Front Range of the Rocky Mountain region is gas quality management. At high altitudes, where oxygen levels in the air are low, undiluted natural gas is too rich to burn in standard gas appliances, resulting carbon monoxide emission problems. To ensure proper and safe combustion in end-use appliances in homes and businesses that use the Colorado Springs Utilities' distribution system, an extra step must be taken to manage the gas. The energy content and input factor of the gas must be adjusted by injecting air or nitrogen into the gas stream, effectively diluting the gas slightly to ensure proper burn and safe operation.

To address this unique and very important issue, the pipeline company, Colorado Interstate Gas, has air-blend stations on their interstate pipeline system, and air-blends the natural gas for Colorado Springs Utilities. At various points along CIG's transmission system, CIG's air-blend stations reduce the energy content of the natural gas through the addition of small amounts of air to allow for proper combustion in standard appliances. This air-blended gas flows in an additional air-blended pipeline that generally runs parallel to the interstate transmission line, and serves multiple high altitude communities including Colorado Springs. CIG is responsible for this high-pressure air-blended pipeline as well as for the air-blending stations.

Colorado Springs' five city gate stations serve as delivery points for the air-blended gas to enter into CSU's gas distribution system at a pressure of 150 psig. Distribution lines move the gas from the gate stations, located on the eastern side of the service territory, to the western borders of the city. Along the way, the pressure is further reduced at district regulating stations that maintain "street" gas pressure in various communities.

Finally for managing peak natural gas demands, Colorado Springs Utilities uses its propane-air peak shaving plant. Propane-air plants store propane in tanks at ambient temperature. During periods of high demand for natural gas, the propane is removed from the tanks, vaporized to a gaseous state and blended with air to produce a propane-air mixture that is compatible with the flowing natural gas. Adding propane-air at times of high demand is a common way that utilities manage natural gas demand. The propane-air plant in Colorado Springs is located adjacent its North city gate station.

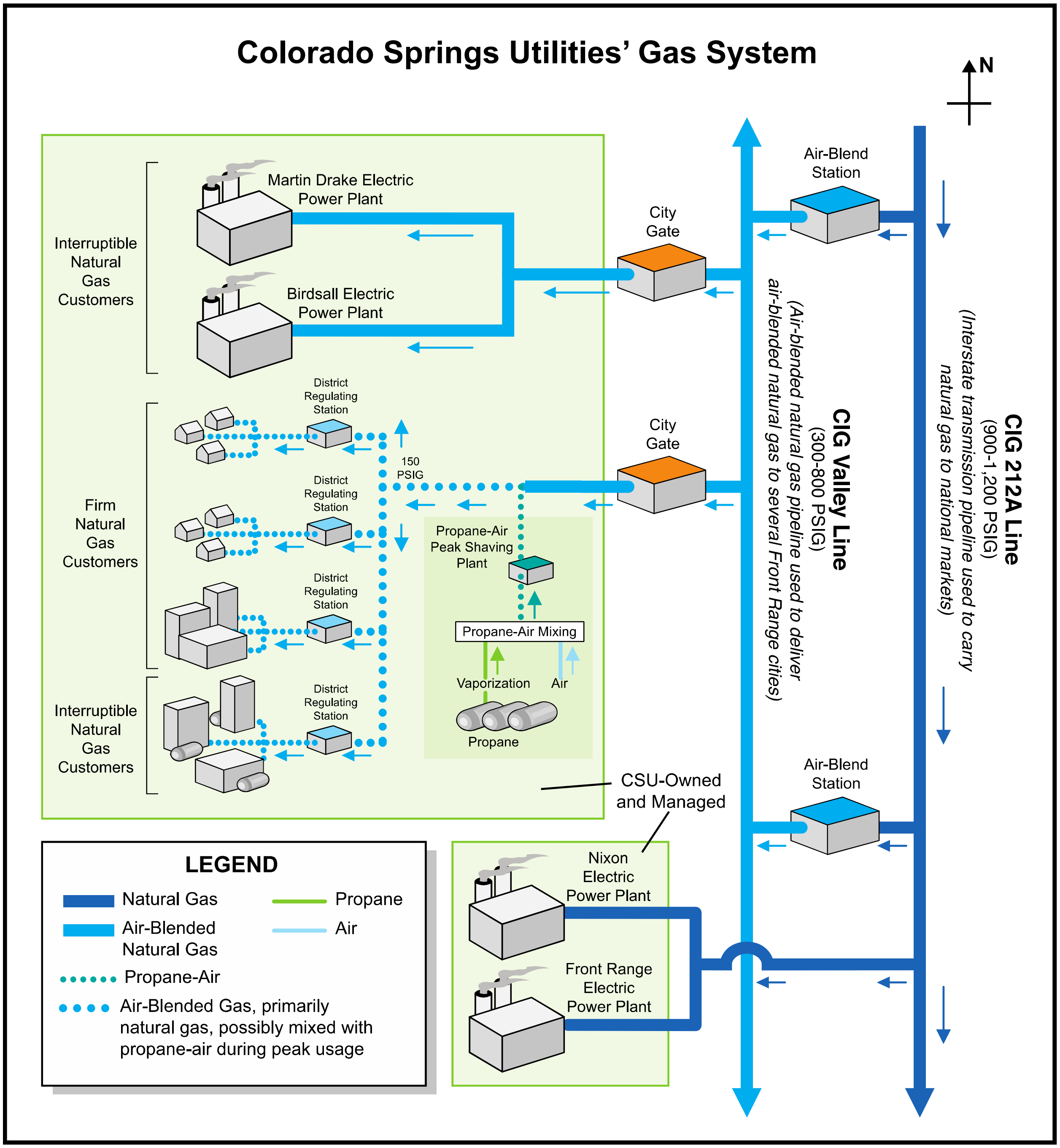


Figure 3.3: Colorado Springs Utilities' Gas System
Another look at Colorado Springs Utilities distribution system. The CIG Valley Line delivers air-blended gas, which serves the unique need of high altitude areas. For peak shaving, or managing extreme load demand, Colorado Springs Utilities supplements the gas supply using a propane-air plant. Additionally Colorado Springs Utilities has several interruptible customers, such as power plants and industrial customers.

Colorado Springs Utilities' Customers

Colorado Springs Utilities supplies natural gas to over 195,832 customers, delivering 24.55 billion standard cubic feet in 2014. The service is based on residential, commercial, industrial, and contract (military and electricity generation) classifications. Additionally, Colorado Springs Utilities provides G4T service to eligible customers who have contracted for an alternative source of gas supply and have requested Colorado Springs Utilities to transport such alternative gas for the customer's account.

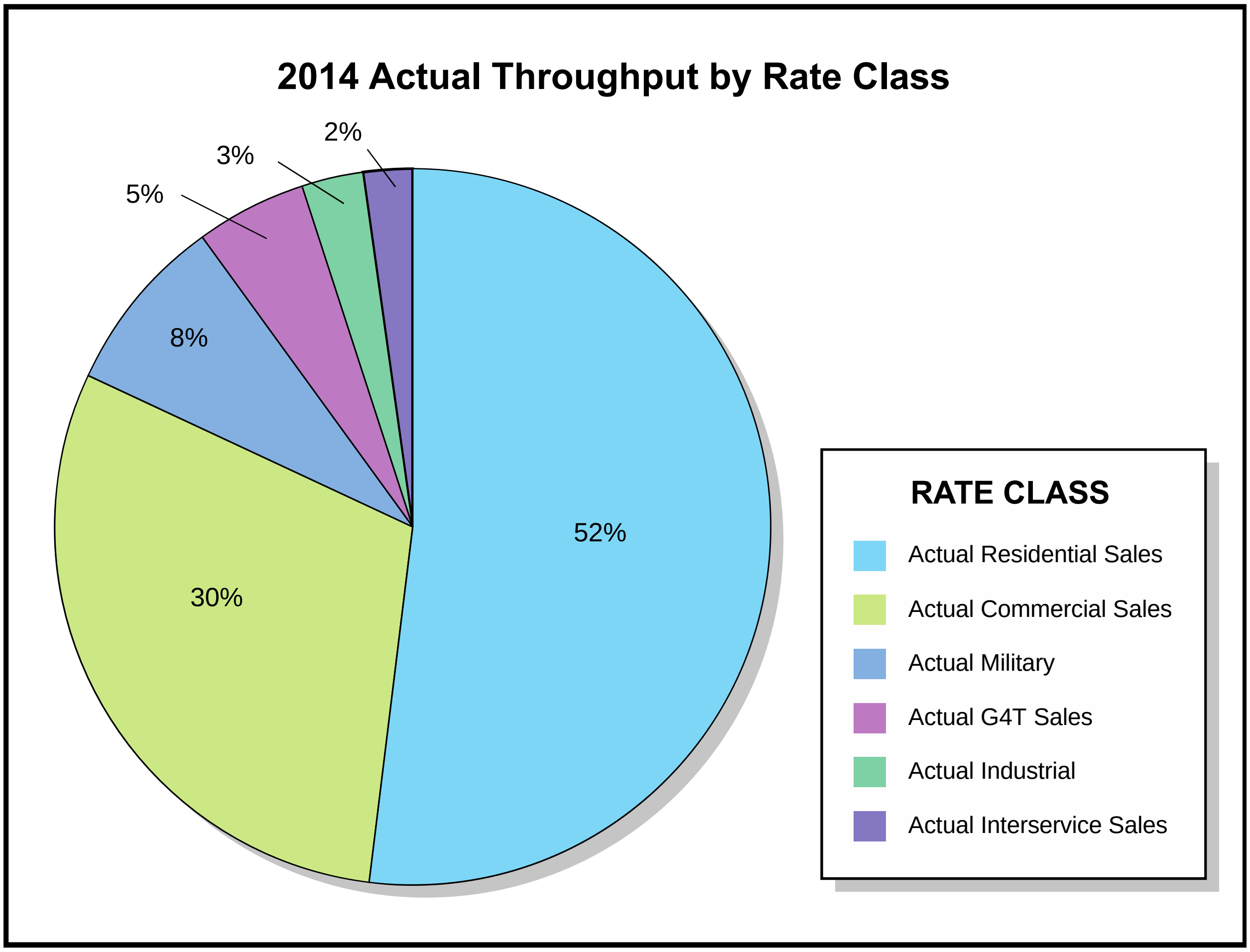


Figure 3.4: 2014 Natural Gas Throughput by Rate Class
Breakdown of natural gas customers in 2014 by customer type. Annually, over half of the natural gas load in the Colorado Springs are is for residential use.

Natural gas demand is seasonal, particularly for residential customers, and is driven by temperature-sensitive heating loads. Industrial demand, which is typically not weather-sensitive, has minimal seasonality. Over half of the natural gas consumed is by residential customers, nearly a third by commercial, and the remaining fifth by military, transport, industrial and interdepartmental (electricity generation). Due to cold winters and the relatively large portion of residential customers, gas demand is significantly higher in winter months.

Colorado Springs Utilities also supplies gas to four electric generating plants. Two of the plants – Nixon and Front Range – are located 20 miles south of Colorado Springs and have independent, not-air-blended natural gas supplies transported under Colorado Interstate Gas mainline transportation contracts.

The other two plants, Birdsall and Martin Drake, are located within Colorado Springs city limits and receive air-blended natural gas services just like any other commercial or residential gas customer on the gas distribution system. The supply to the Birdsall and Martin Drake plants is interruptible, meaning that gas supply to the plants can be curtailed during periods of high usage on the distribution system.

Transmission and distribution pipelines are limited as to how much gas can flow at any one time. Furthermore, utilities or other pipeline users, are only contracted for a specific amount of guaranteed capacity (firm delivery). Interruptible customers are one way for distribution companies, including Colorado Springs Utilities, to manage the finite capacity on the pipelines. In addition to the electric power plants, other large commercial and industrial customers also operate under interruptible supply contracts, which offer a lower cost of gas in return for switching from gas to an alternative fuel supply during periods of increased demand.

For most customers, Colorado Springs Utilities is obligated to deliver whatever volume is needed by the customer under firm delivery requirements. In other words CSU is required to ensure that gas is available to these customers at all times. Limitations due to pipeline restrictions are not acceptable and must be balanced with supply resources such as storage, peak shaving facilities or contract for additional capacity on the pipeline if capacity is available. Providing reliable natural gas supply to our customers is a core business objective of Colorado Springs Utilities.

Chapter 4 – Demand Forecast

The Customers of Colorado Springs Utilities rely on natural gas for both residential use and to run their businesses. To ensure that customers receive safe, reliable and cost effective natural gas, CSU needs to be able to make timely resource investments to accommodate customer needs. This section outlines the forecast upon which CSU evaluates the ability of current resources to meet the changing needs of its customer base.

The assumptions and methodology used to forecast annual, daily, and hourly loads for the CSU customers' territory are defined here. A partnership between the Office of Economic Development (OED) and the GIRP Core Team resulted in numerous scenarios of multiple linear regression analyses to forecast customer growth and usage demand of CSU's customers.

The forecast is broken down into two major parts. The first is the annual forecast, which estimates the growth in total natural gas sales and throughput. The annual forecast is mainly affected by large scale factors such as economic outlook, population growth and changes in appliance efficiencies.

The second part of the forecast covers the peak-day and peak-hour forecasts, which are used to ensure that even in peak use, customers can continue to heat their homes and run their businesses. Historical data is used to forecast the peak-day and peak hour-demand, which accounts for the maximum expected demand on the system in the event of extreme weather, when heating load is the predominant use on the system.

Finally the forecasts are used to evaluate the ability of current resources to meet growing customer needs. Note that some customers arrange for a separate supply of natural gas and contract for distribution services only; the rate class G4T is special for such customers. Because CSU is not responsible for securing supply for G4T customers, the G4T usage forecast is used for distribution planning only. The forecast for natural gas usage by all other customers is used to evaluate the supply, demand, and distribution resources.

Corporate Annual Sales and Load Forecast

The purpose of the annual forecast is to provide volume, revenue, and customer forecasts, which serve as the foundation for the Annual Operating Plan, resource planning and daily operations. The annual forecast accounts for large scale trends, such as growing customer base and changes in use per customer for a variety of reasons (e.g., increased appliance efficiencies, changes in household size or household income). These large scale trends are reflected in the annual sales and load forecast which are based on fifteen-year weather averages.

The natural gas annual sales and load forecasts are derived from a combination of historical data, econometric models, economic data, political climate, trends, and organizational knowledge. The forecast is broken down by customer group, or rate class, because different types of customers react differently to factors such economic outlook and weather-related use.

The two largest customer groups, residential and commercial, are further broken down to customer forecasts and end-use models.

The customer forecasts are based off the population and employment forecasts. Econometric models depict statistical relationships between historical data and variables to predict future outcomes.

End-use models (also use-per-customer models) incorporate information, such as appliance efficiency standards and changing population demographics. The end-use models are used for the residential rate class, as well as the small and large commercial rate classes. The end-use models are used in addition to the customer forecast to create the overall sales forecast for these rate classes.

Economic data, political climate, trends, and organizational knowledge are used to forecast the seasonal commercial, indexed commercial, industrial, military, and G4T classes.

Economic Outlook

Local economic conditions impact the customer behavior of specific rate classes in our service territories. Therefore, economic data such as population forecast, employment forecast and GDP forecast are incorporated into the forecast models. A complete listing of the economic variables used in the models and a description of each variable's impact on the forecast can be found in Appendix A.

Sales Forecast by Rate Class

CSU primarily serves natural gas to residential, commercial, industrial and military customers. Rates are defined for each of these customer groups in the natural gas rate schedules, wherein each tariff defines a rate class. For example, the customer group "Commercial" consists of small, large, seasonal and indexed commercial rate classes.

CSU also provides a transportation service, G4T. As previously mentioned, these are customers who have contracted for an alternative source of natural gas supply and request delivery of the natural gas through CSU's distribution system. Therefore the forecast of the G4T customers is used in the adequacy evaluation for the distribution system only. Supply and demand evaluations do not account for G4T natural gas usage.

The pie chart below illustrates the throughput allocation among rate classes in 2014.

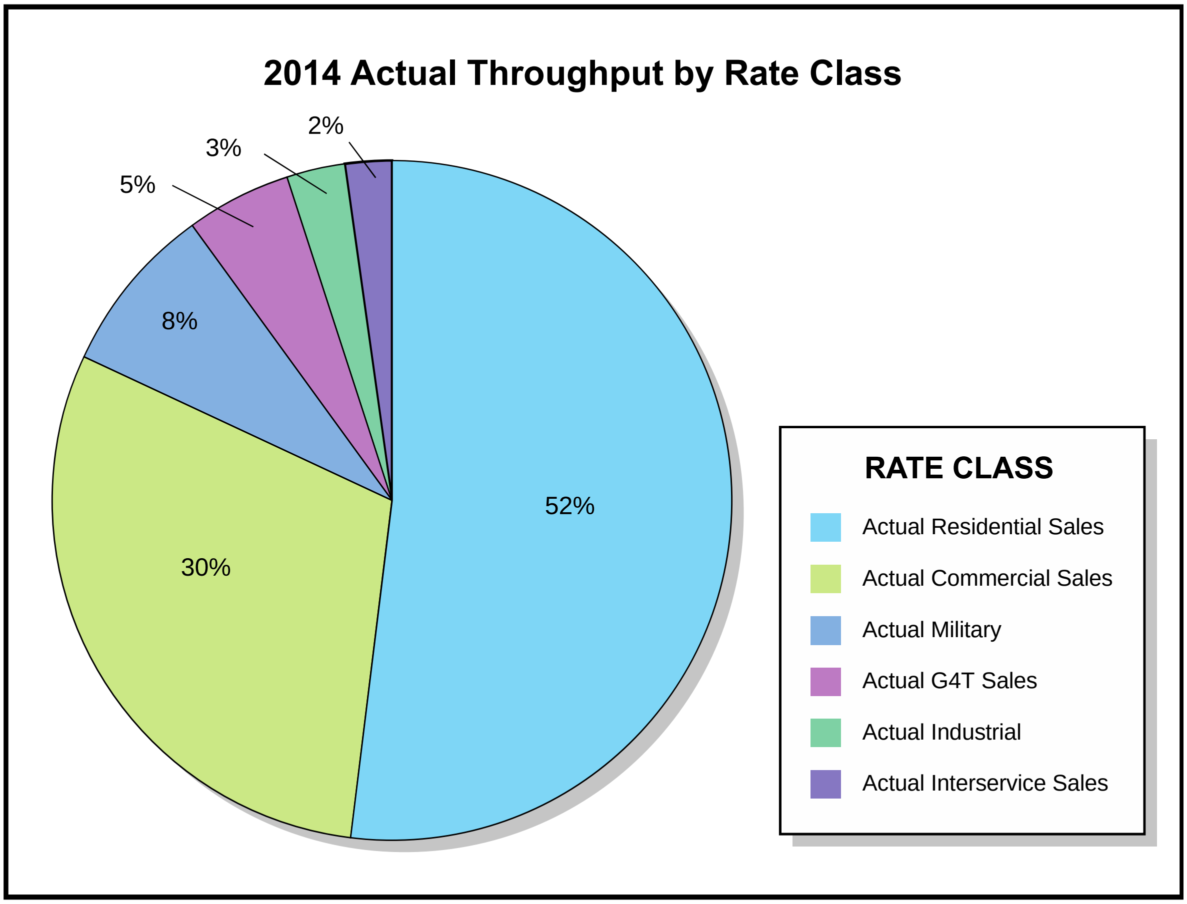


Figure 4.1: 2014 Natural Gas Throughput by Rate Class
Breakdown of natural gas customers in 2014 by customer type. Annually, over half of the natural gas load in the Colorado Springs are is for residential use.

Residential Sales Forecast

Customers in the residential rate class use natural gas primarily for home heating, water heating and cooking. Residential customers account for approximately 89% of the natural gas customers and approximately 52% of the natural gas distributed via the CSU distribution system. CSU is responsible for maintaining sufficient supply, distribution, and demand resources for this rate class.

This section will walk through the residential customer forecast and the residential use-per-customer forecast, and will then combine the two for the residential sales forecast. The following figure depicts the factors used to create the residential sales forecast.

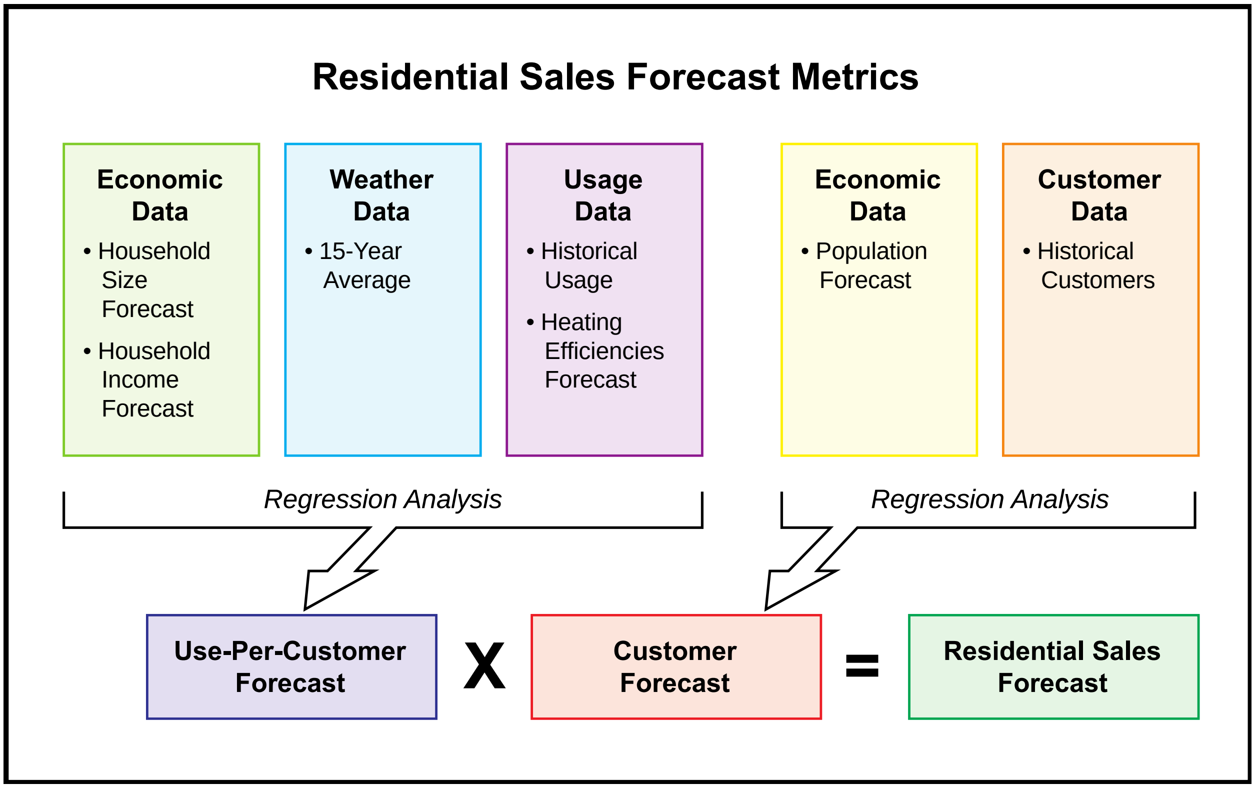


Figure 4.2: Residential Sales Forecast Metrics
Diagram depicts the process and metrics used in creating the Residential Sales Forecast for Colorado Springs Utilities.

Residential Customer Forecast

Residential natural gas customer growth is primarily driven by population growth. Residential customers are projected to grow at an average rate of 1.1% per year through 2024, which is lower than previous forecasts, as shown in the graph and table below. The new customer forecast model accounts for the fact that a 1% gain in population results in only a 0.7% gain in the number of customers. In previous forecasts, the assumption was closer to a one-to-one relationship.

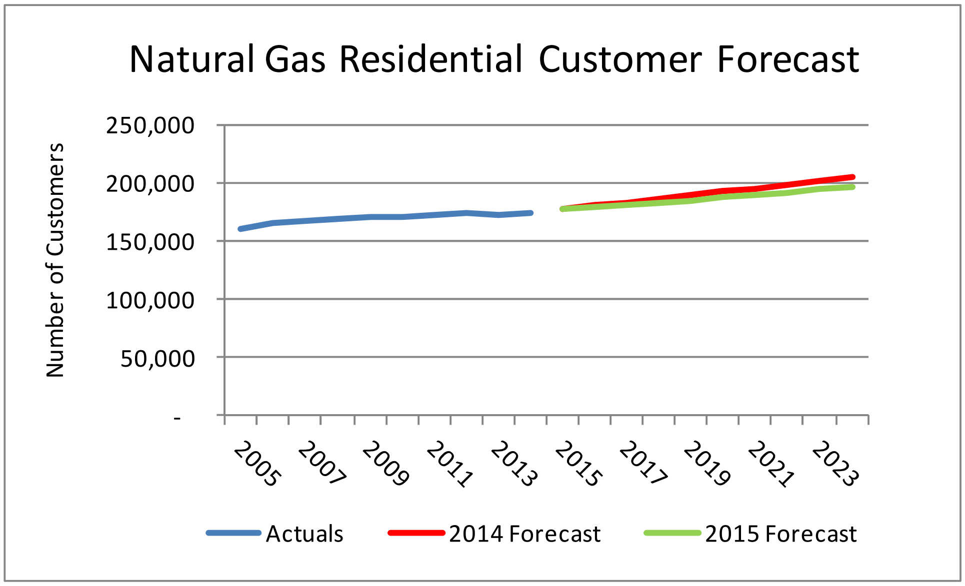


Figure 4.3: Natural Gas Residential Customer Forecast.
The ten-year projection for 2015 accounts for customer growth approximately 70% that of population growth.

Natural Gas Residential Customer Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	1.3%	1.1%
10-Year Historical	1.2%	1.1%
5-Year Forecast	1.6%	1.2%
10-Year Forecast	1.6%	1.2%

Table 4.1: Natural Gas Residential Customer Growth Rates The ten-year projection for 2015 accounts for customer growth approximately 70% that of population growth.

Residential Use-Per-Customer (End-Use Model)

One of the main trends affecting residential sales, which comprises over half of all natural gas sales, is use-per-customer. The two main drivers of use-per-customer are appliance efficiencies and economic outlook. These trends are analyzed using regression analysis.

Residential use-per-customer is heavily impacted by appliance efficiency standards, as natural gas-fired furnaces account for the majority of winter month natural gas usage. Over the past two decades the demand response has resulted in the annual average residential use-per-customer declining by approximately 25%. Appliances with improved efficiencies continue to contribute to the overall decline in use-per-customer. However, because most furnaces are currently at the higher efficiency level required by this appliance efficiency standard, the rate at which the use-per-customer declines is expected to slow as compared to previous years.

The economic data used in residential forecasts are household size and income. As referenced in the Economic Outlook section, household size is projected to decrease, while household income continues to increase. In general, this economic data is expected to reduce natural gas use-per-customer.

Overall the residential use-per-customer is expected to decline at a rate of -0.4% per year over the next ten years, due to both increasing efficiencies and the economic outlook.

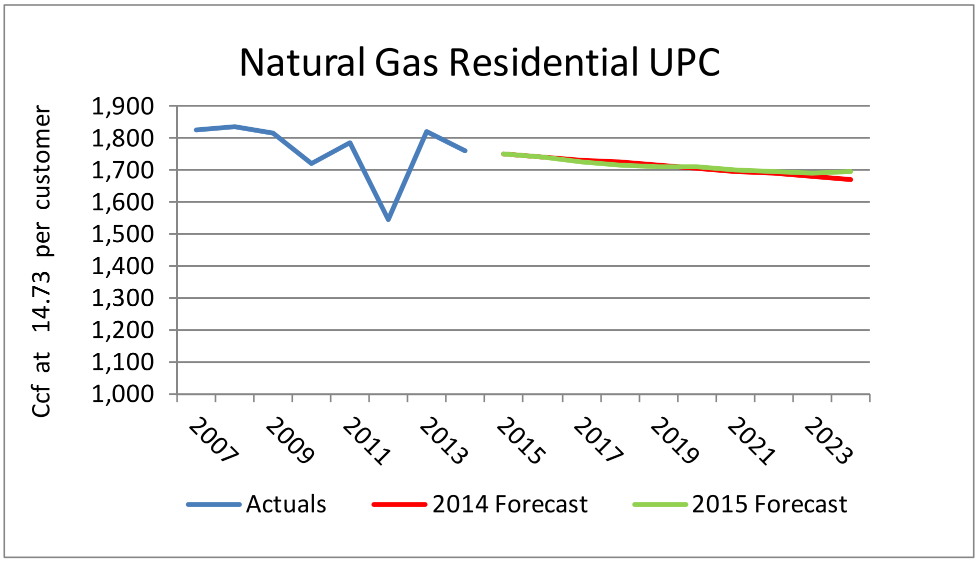


Figure 4.4: Natural Gas Residential Use-Per-Customer (UPC) Forecast
The graph shows both historical, and projected use-per-customer, which is expected to continue to decline at a rate of approximately - 0.4% over the next ten years. Note that 2012 was a particularly warm year, yielding less than average natural gas usage.

Natural Gas Residential UPC Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	-0.4%	-0.4%
7-Year Historical	-0.2%	-0.2%
5-Year Forecast	-0.4%	-0.6%
10-Year Forecast	-0.5%	-0.4%

Table 4.2: Natural Gas Residential Use-Per-Customer (UPC) Growth Rates
As more efficient appliances near market saturation, the rate of decline is expected to slow compared to past years.

Residential Sales Conclusion

The residential class uses the following calculation to forecast sales:

(Sales) = (Use-Per-Customer) x (Customers)

This methodology was reviewed and deemed to be more accurate than trending sales, which was the methodology used prior to 2014. The graph and table below illustrate the historical and projected changes in residential natural gas sales due to the combined effects of decreasing use-per-customer and the growing customer base.

Although long-term use-per-customer is declining (-0.4%) as a result of more efficient appliances and housing, this is offset by an increasing customer base (+1.1%), which contributes to the increase in the sales forecast. Residential sales account for an average of 52% of total throughput for the 2015 forecast, and are projected to increase by 0.7% over the next 10 years.

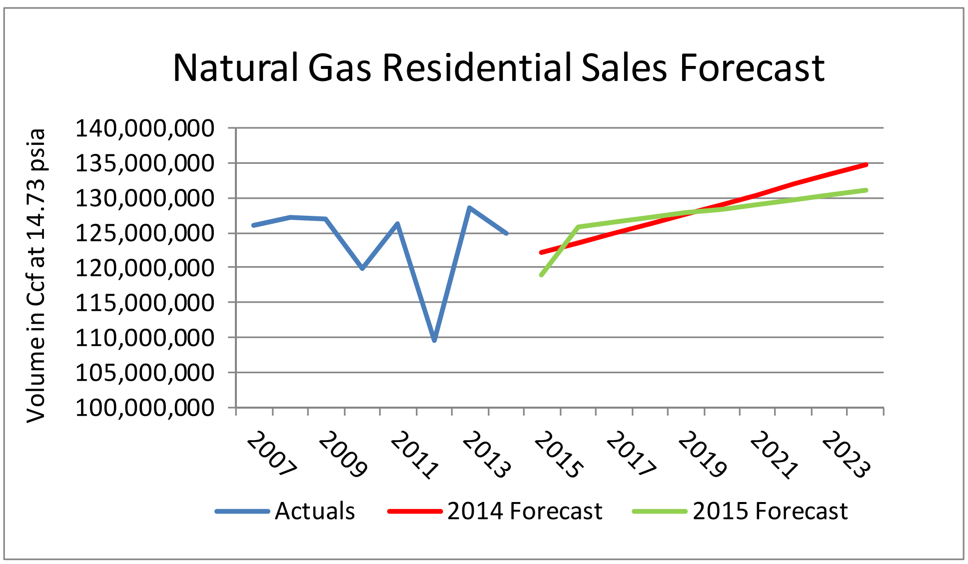


Figure 4.5: Natural Gas Residential Sales Forecast 2015
Forecast is based on six months of actual data currently available for 2015. Sales for 2015 are expected to end lower than the 2014 forecast due to much warmer than normal weather during the first half of 2015.

Natural Gas Residential Sales Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	0.9%	0.7%
7-Year Historical*	1.0%	0.3%
5-Year Forecast	1.1%	1.0%
10-Year Forecast	1.2%	0.8%

Table 4.3: Natural Gas Residential Sales Growth Rates
The 2015 projection accounts for a decrease in use-per-customer offset by a growing customer base, for a net projected gain of 0.7%. *Data only available for the last seven years.

Commercial Sales Forecast

Customers in the commercial rate class use natural gas primarily to run their businesses. Commercial customers account for approximately 10% of the natural gas customers and approximately 30% of the natural gas distributed via the CSU distribution system. There are four separate commercial rate classes: small, large, seasonal and indexed. CSU is responsible for maintaining sufficient supply, distribution and demand resources for all four of the commercial rate classes.

Commercial growth for small and large commercial customers is derived from regression analysis, historical customer growth and economic variables to model the growth expectations. This section will walk through the commercial customer forecast and commercial end-use modeling forecast, and will then combine the two for the commercial sales forecast.

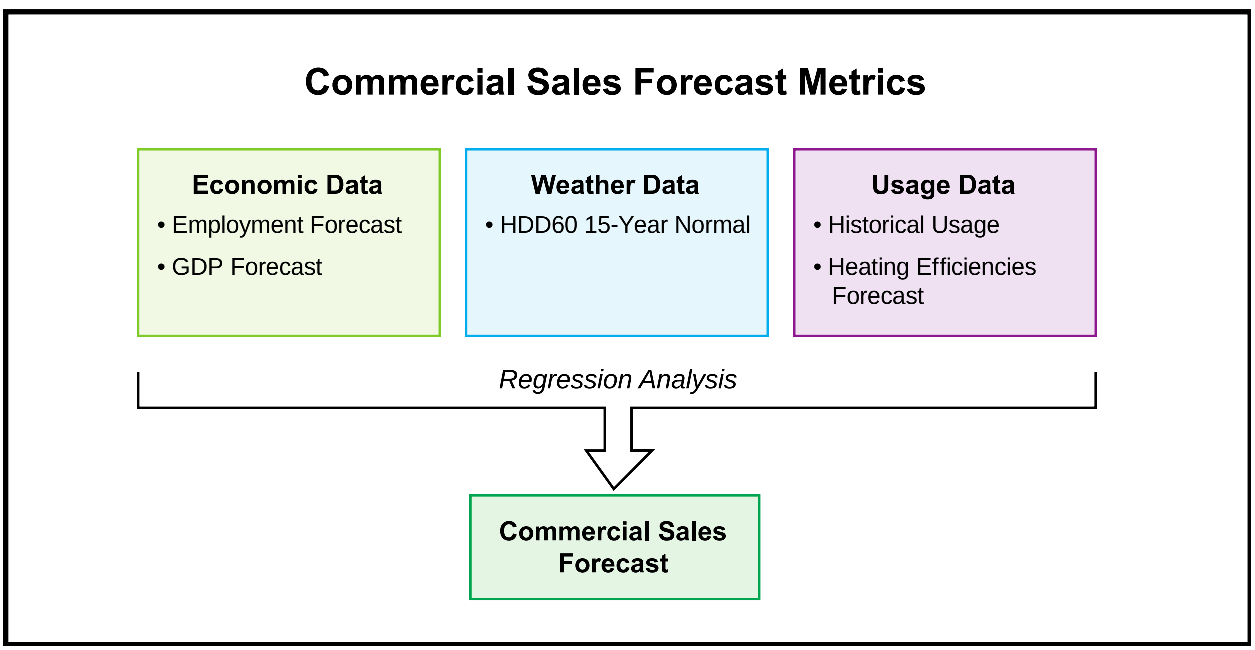


Figure 4.6: Commercial Sales Forecast Metrics

Diagram depicts the process and metrics used in creating the commercial sales forecast for Colorado Springs Utilities.

Note: where not specifically stated, "commercial" refers to small and large commercial customers only. Seasonal and Indexed commercial customers are noted at the end of the commercial forecast section.

Commercial Customer Forecast

The number of commercial customers is projected to grow at an annual average of 0.2% over the next ten years. This conservative growth projection is due to the current assumption of a slower economic recovery.

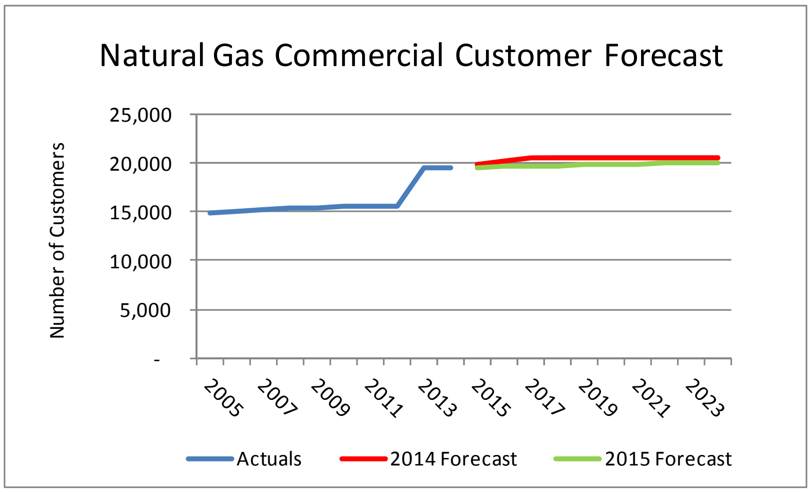


Figure 4.7: Natural Gas Commercial Customer Forecast
The forecast for 2015 is slightly lower than the previous forecast due to the current assumption of slower economic recovery. Note: Following a 2012 sales audit, approximately 4,000 residential customers were reclassified into the small commercial rate class, beginning in 2013. This explains the sudden spike in commercial customers in 2013.

Natural Gas Commercial Customer Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	0.4%	0.2%
10-Year Historical	3.5%	0.1%
5-Year Forecast	0.3%	0.3%
10-Year Forecast	0.3%	0.3%

Table 4.4: Natural Gas Commercial Customer Growth Rates

Commercial End Use Models

Similar to residential sales, commercial sales are heavily impacted by appliance efficiency standards. In this forecast, commercial sales were modeled using historical sales and other variables, rather than use-per-customer. The projected impact in the 10-year commercial forecast is a decrease of -0.7% due to increased efficiencies.

Commercial Sales Conclusion

Commercial sales are projected to increase an annual average of 0.5% through 2024. This is due to an expectation of conservative growth in the economy, coupled with a slight increase in commercial customers.

Seasonal and indexed commercial sales, which are rate classes within total commercial, are projected to be relatively flat to 2014 actuals. Total commercial sales account for an average of 30% of total throughput for the 2015 forecast.

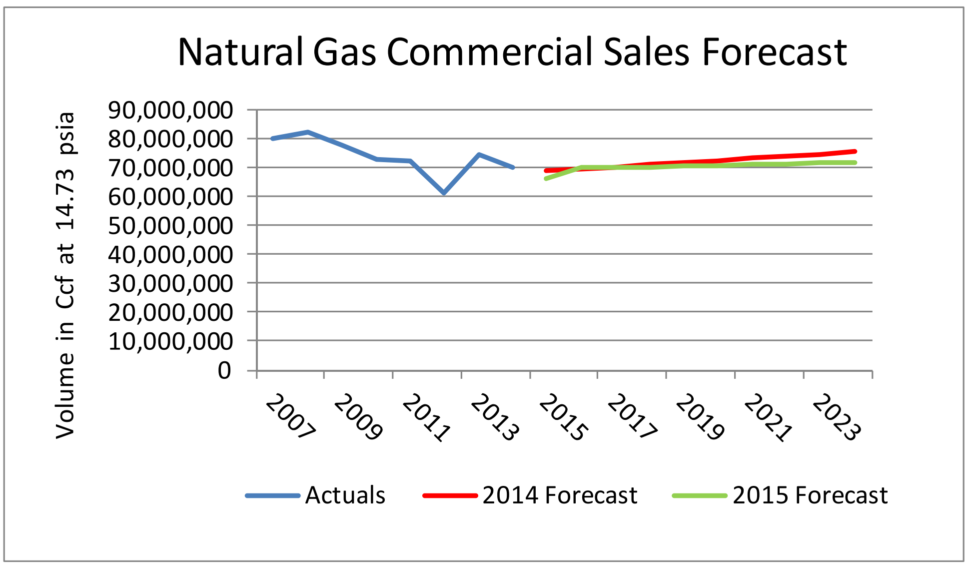


Figure 4.8: Natural Gas Commercial Sales Forecast 2015
This forecast is based on six months of actual data currently available for 2015. It is expected to end lower than the 2014 forecast due to much warmer than normal weather during the first half of 2015.

Natural Gas Commercial Sales Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	-0.2%	1.4%
7-Year Historical*	-0.6%	-0.6%
5-Year Forecast	0.2%	0.5%
10-Year Forecast	0.2%	0.4%

Table 4.5: Natural Gas Commercial Sales Growth Rates
This forecast is based on six months of actual data currently available for 2015. The current 2015 forecast (+1.4%) is so high because it's the growth over the 2015 projected sales, which are expected to be much lower than normal, due to exceptionally warm weather.

Other Sales Forecast

The industrial and military customers are forecasted to neither increase nor decline in natural gas usage from 2014.

The G4T customer forecast is decreasing by one customer in November 2015. This customer is still within our service territory, but moving to another rate class. G4T throughput and customer growth are expected to be slightly lower than the 2014 forecast due to rate class shifts for some customers, resulting in a net decrease of one customer for G4T.

The industrial, military and G4T customers combined account for less than 1% of the total natural gas customers. The average contribution to total throughput for the industrial, military and G4T classes is 3%, 8% and 5%, respectively.

Total Annual Sales and Throughput Forecasts

In this section, sales and throughput forecasts for all rate classes are combined to create the final annual forecast. In spite of increased appliance efficiencies, overall sales and throughput are projected to increase due to the increasing customer base. This increase is primarily driven by residential (+0.7%) and commercial sales (+0.5%), which make up the majority of natural gas sales. The graph below shows actual and projected total natural gas sales. Overall, natural gas throughput, which refers to all the natural gas distributed through CSU pipelines, is expected to grow by 0.5% annually for the next 10 years.

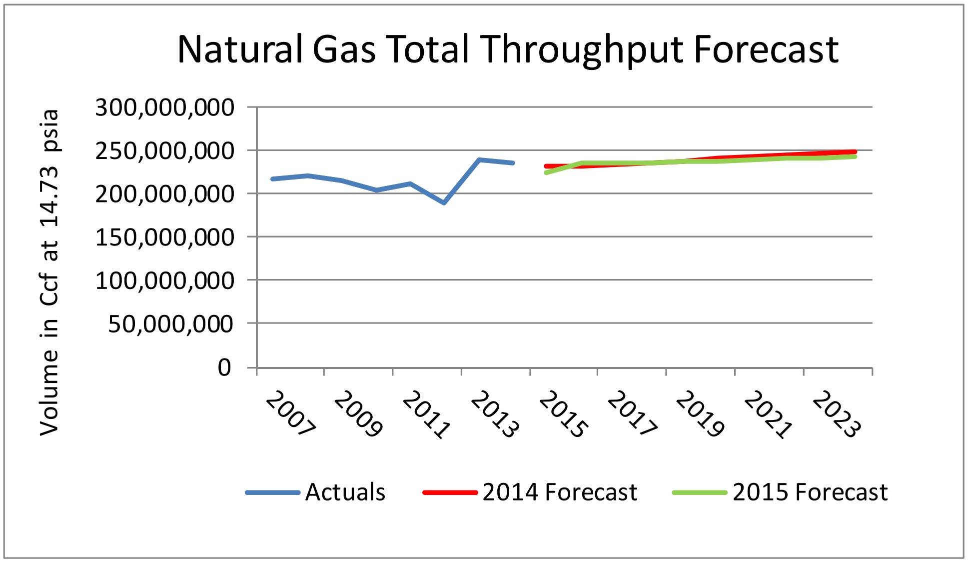


Figure 4.9: Natural Gas Total Throughput Forecast 2015
This forecast is based on six months of actual data currently available for 2015. The graph depicts historical sales, and the 2014 and 2015 forecasts, which are very similar. The base forecast assumes normal weather and growth.

Natural Gas Total Throughput Growth Rates		
Forecast Time Frame	2014 Forecast	2015 Forecast
Current Year Forecast	0.4%	1.5%
7-Year Historical*	0.5%	2.0%
5-Year Forecast	0.8%	0.6%
10-Year Forecast	0.7%	0.5%

Table 4.6: Natural Gas Total Throughput Growth Rates
This forecast is based on six months of actual data currently available for 2015. The 2015 forecast (+1.5%) is high because it's the growth over the 2015 projected sales, which are expected to be much lower than normal, due to exceptionally warm weather.

Natural Gas Peak-Day and Peak-Hour Demand Forecasts

Methodology and Assumptions

The second part of the forecast is the peak demand forecast. Due to the large number of residential customers, the amount of natural gas used on a given day increases significantly with colder and windier weather. In order to ensure all customers enough natural gas in such peak demand scenarios, CSU forecasts and plans resources for a one-in-twenty-five-year cold weather event.

Historical data is used to forecast the peak-day-demand, which is the maximum expected demand on the system in the event of such extreme weather, when heating is the predominant demand on the system. The peak-hour demand is a subset of the peak-day, again based on historical data.

In 2011, CSU set a new system record for natural gas demand. This was due to prolonged cold weather and excessively strong winds. The usage and weather data from this day – specifically temperature, wind speed and wind chill – is now used as a reference point in CSU's methodology to predict future peak usage. The peak-day (also called "Design Day") forecast is then combined with the customer growth forecast to create the final peak-day and peak-hour forecast.

Finally peak-day and peak-hour forecasts are used to assess the adequacy of current resources against future demand. The main supply resources are pipeline transportation capacity, storage deliveries, and on-system propane-air production. Additionally the CSU distribution resources and demand side management resources are evaluated against the peak-day and peak-hour natural gas usage.

Historical Weather and Demand Statistics

Colorado Springs Utilities understands that demand is a function of customer base usage plus customer weather-sensitive usage. Therefore, the goal is to predict both the base load and weather-sensitive demand in order to forecast natural gas usage for a given day. The correlation between usage and temperature is shown in the example scatter plot below. As the temperature decreases, the natural gas demand increases due mainly to heating. The base load, however, is not temperature-dependent, and accounts mainly for use such as industrial use and residential water heaters, which run regardless of outside air temperature. In other words, load stays relatively constant until heating demands require additional natural gas. The daily base load for 2010 was 17,800 Mcf (14.73 psia).

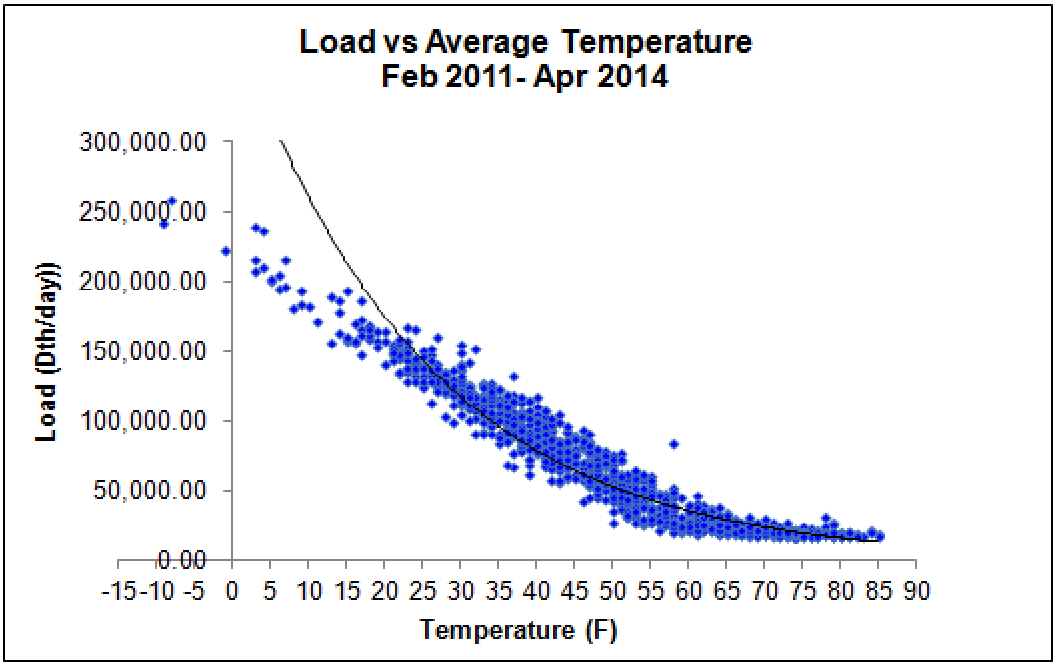


Figure 4.10: Load vs. Average Temperature
Graph shows the natural gas load (or demand) compared to average daily temperature. As temperatures decreases below 65°F, natural gas use increases due to heating. This is the weather-sensitive impact on the system.

Planning Criteria

Colorado Springs Utilities plans for a one-in-twenty-five-year event when assessing the adequacy of the system; for natural gas, that event is cold weather. Recently, wind data has been included in the weather-sensitive forecasting, because high winds coupled with cold weather drive natural gas demand even higher.

On February 1, 2011 Colorado Springs Utilities natural gas daily demand set a new system record of over 264,000 Mscf. This was due to prolonged cold weather and excessively strong winds. The actual temperature was - 7° Fahrenheit[1]. However, with strong winds of approximately 15 mph, the peak wind chill was -27° F. As such, the February 1, 2011 event created a new reference point for demand forecasting analysis, recognizing the significance of wind speed being included in the demand peak-day and peak-hour forecasts.

The last recorded coldest average daily temperature occurred December 21, 1990 at - 16° F,

[1]In natural gas forecasting outside average daily temperature is often referred to as Heating-Degree-Days (HDD). It accounts for the amount of heating that is expected, using 65° F as a reference point for when heating begins. Therefore average daily temperature of -7° Fahrenheit results in a 72 Heating-Degree-Day (HDD). Note that Heating-Degree-Days includes only average daily temperature: wind effects are not accounted for.

considered a one-in-sixty-year occurrence. Analysis of weather data dating back to 1946 indicates a one-in-twenty-five-year occurrence is -13 °F average daily temperature. Therefore, the peak projections will utilize -13 °F average daily temperature.

Table 4.7: CSU Weather Planning Criteria

CSU Weather Planning Criteria					
Time Period	Metric Used	Temperature	Heating-Degree-Days	Wind Speed (mph)	Wind Chill
Daily	24-Hour Average	-13 ° F	78.0	15.0 mph	-36° F

Load Study

Historical trends normally provide a reliable baseline to evaluate forecasted demand. However, natural gas demand is predominantly driven by weather-sensitive heating loads, as the industrial base in Colorado Springs is relatively small compared to other cities of a similar size. Since there is substantial weather volatility in the Colorado Springs Utilities service area, forecasting daily and hourly demands is a challenging process.

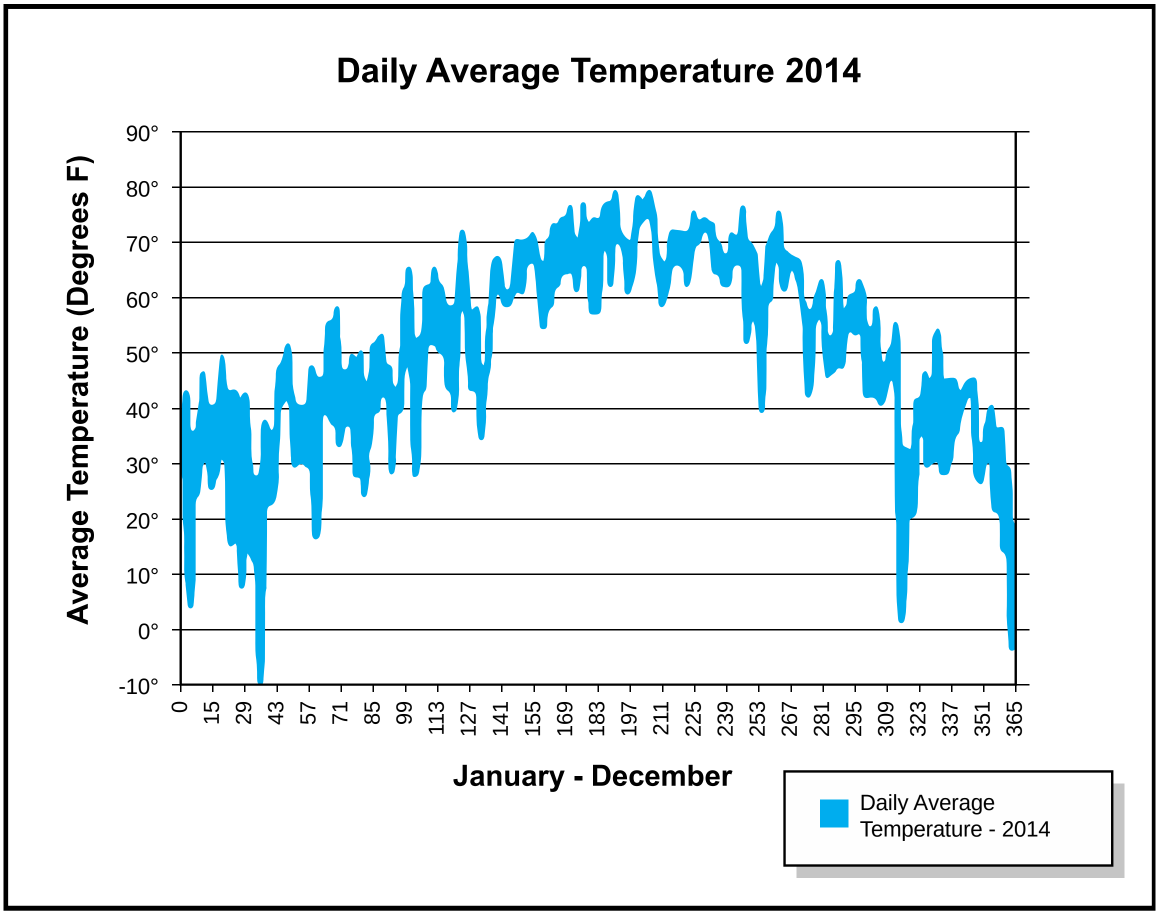


Figure 4.11: Daily Average Temperature 2014
Graph illustrates the day-to-day fluctuation in weather in the Colorado Springs area. Note that wind conditions are not shown or accounted for in this figure.

One of the key results of the 2011 GIRP was a revision in forecast methodology that better correlated forecasts with an actual peak-day and peak-hour event. The analysis looked at data through multiple lenses with the primary results described below (a more in depth discussion can be found in Appendix B).

- ***Average daily temperatures less than 45° F***
  Regression results using only loads >160,000 Mscf/day tended to underestimate actual 2011 loads at temperatures below zero and overestimate loads at temperatures from 0°F to +10° F. Results improved using expanded data sets of loads with average daily temperatures less than 45° F.

- ***Wind Effects***
  Adding wind or wind chill as a variable in conjunction with average temperature increased the peak load predictions and significantly improved correlation both statistically and comparatively to 2011 actual results. Results were nearly identical for wind speed versus wind chill.

- ***Day of Week***
  Correlations and comparison to 2011 actual data improved when weekend data was eliminated from the data set. Historical data demonstrated the peak-day and peak hour usually occur during a weekday and not on weekends.

- ***Hour of Day***
  For peak-hour forecasts, there was substantial improvement in correlations and comparison to 2011 actual by using data for 6-9 a.m. Historical data demonstrated that peak-hour usually occurs between 6-9 a.m. on a weekday. Based on actual peak events of February 2011, together with the expanded historical hourly load data, the methodology for forecasting peak-hour load is to multiply the peak-day load by a historical peak-hour factor of 5.3%

The current peak-day and peak-hour demand forecast incorporates all of the above-listed factors to create the most accurate prediction of peak natural gas usage.

Peak Demand Forecast

Accounting for the factors above and using the planning criteria of -13 °F average daily temperature and 15 mph winds results in the current peak-day forecast for the winter 2015-2016. The peak-hour forecast is then calculated assuming 5.3% of peak day per the results of the load study.

Table 4.8: Peak Demand 2015-2016 Heating Season

Peak Demand 2015-2016 Heating Season [Mscf @ 14.73]		
Daily	**Hourly**	**Peak Factor**
291,357	15,442	.053

Consistent with the conservative approach, the demand scenario also includes the natural gas usage for interruptible customers for planning purposes. The interdepartmental power plants Drake and Birdsall, however, are not included in the scenario, because they have an alternative fuel, and because they are controlled directly by CSU and therefore need not be encompassed in the supply and demand resource analysis.

Finally, to account for the growing customer base, the peak demand forecast is combined with the customer growth to project expected peak-demand over the ten-year planning horizon, as illustrated in the table and graph below. The long-term budgets of CSU, including resource acquisition or capital investment requirements, are aligned to accommodate this peak demand.

Table 4.9: Ten-Year Demand Forecast.

Ten-Year Peak Demand Forecast Scenario [Mscf @ 14.73 psia]		
Winter	**Daily Peak Demand (Dth/Day)**	**Hourly Peak Demand (Dth/Hour)**
2015-2016	291,357	15,442
2016-2017	295,611	15,667
2017-2018	300,310	15,916
2018-2019	305,442	16,188
2019-2020	310,507	16,457
2020-2021	315,400	16,716
2021-2022	320,295	16,976
2022-2023	325,225	17,237
2023-2024	330,215	17,501
2024-2025	335,256	17,769

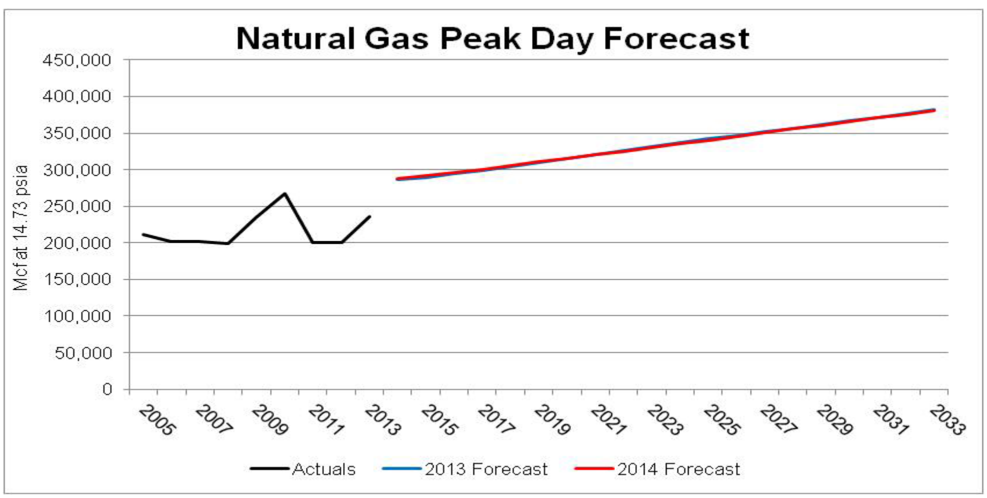


Figure 4.12: Natural Gas Peak-Day Forecast
Graph shows the natural gas peak-day forecast.

It should be noted that the historical peak-day usage shown in the graph above does not match the Peak-Day Forecast, nor is it expected to. This is because the peak day forecast predicts natural gas usage for a one-in-twenty-five-year event: in other words, it creates a worst-case scenario for planning purposes. This peak is then used to assess the adequacy of the system to supply and deliver natural gas to its customers even in the case of such an event.

Peak Demand Compared with Current Resources

Currently, Colorado Springs Utilities has several supply- and demand-side resources available to manage and meet customer demand. Supply resources include transportation capacity, storage deliveries and on-system propane-air peak shaving plant. Demand-side management resources currently consist mainly of interruptible customers – customers who have agreed in advance to curtail some or all of their natural gas usage at the request of CSU in order to minimize peak load and ensure all (other) customers sufficient supply.

Ideally, peak-day and peak-hour forecasts are used to assess the adequacy of current transportation capacity, storage deliveries, and on-system propane-air production against future demand and demand-side management resources. Currently, Colorado Springs Utilities has a maximum delivery capacity of 285,139 Mscf daily and 14,353 Mscf hourly, which is a combination of transportation capacity, storage deliveries and the current propane-air system. Additionally CSU has some customers that can be curtailed during peak periods, such as the interruptible customers and the transportation only (G4T) customers. Engaging interruptible customers can temporarily yield an additional delivery capacity of 26,746 Mscf and 1,357 Mscf daily and hourly respectively.

Table 4.10: Peak Demand 2015-2016 Heating Season

Maximum Supply Capacity [Mscf]		
Resource	**Daily**	**Hourly**
Transportation (CIG)	200,811	8,367
Storage	73,528	5,086
Propane-Air	10,800	900
Total Supply Resources	**285,139**	**14,353**

Demand-Side Management Resources [Mscf]		
Resource	**Daily**	**Hourly**
Interruptible Customers	17,736	940
Transportation (G4T)	9,010	417
Total Demand-Side Resources	**26,746**	**1,357**

Taking into account CSU's current resources and projected peak demand, system capacity is expected to become insufficient to meet peak-day demand starting in the winter of 2020-2021, and is expected to become insufficient to meet peak-hour demand starting in the winter of 2017-2018, as can be seen in the table and graphs below.

Projected Peak Demand and Projected Supply Shortfalls				
Year (Winter)	Projected Peak Demand		Projected Shortfalls	
	Daily Peak (Mscf/Day)	Hourly Peak (Mscf/Hour)	Daily Shorfall (Mscf/Day)	Hourly Shortfall (Mscf/Hour)
2015-2016	291,357	15,442	0	0
2016-2017	295,611	15,667	0	0
2017-2018	303,310	15,916	0	206
2018-2019	305,442	16,188	0	478
2019-2020	310,507	16,457	0	746
2020-2021	315,400	16,716	3,515	1,006
2021-2022	320,295	16,976	8,410	1,265
2022-2023	325,225	17,237	13,339	1,526
2023-2024	330,215	17,501	18,330	1,791
2024-2025	335,256	17,769	23,371	2,059

Table 4.11: Projected Peak Demand and Projected Supply Shortfalls
Forecasted natural gas shortages to provide for daily and hourly peak demand. The shortages shown are after accounting for maximum supply resources (transportation, storage and propane-air) as well as Demand-Side Management Resources.

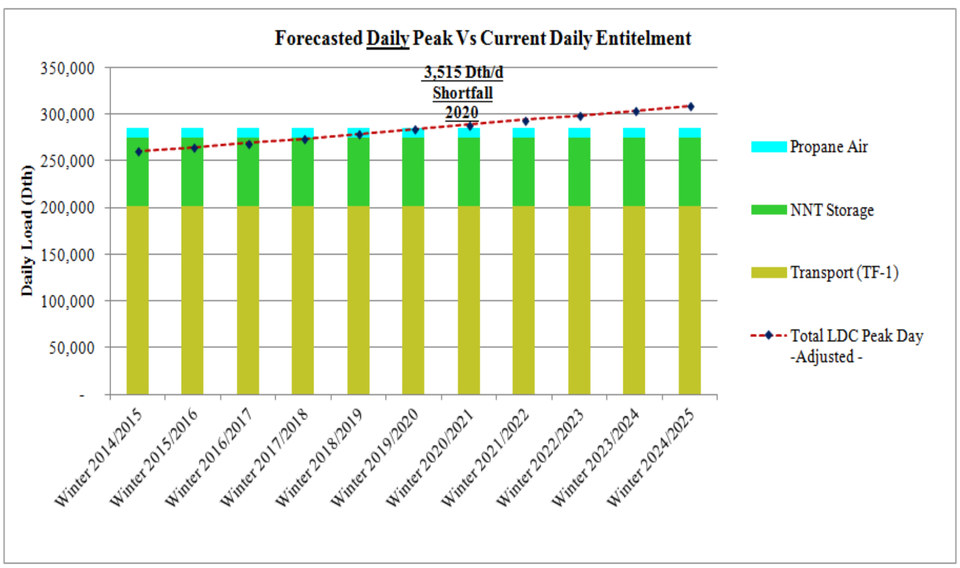


Figure 4.13: Winter Forecasted Daily Peak Load vs. Current Daily Supply
Comparison of forecasted daily peak with current supply resources at CSU. Note that "Total LDC Peak Day – Adjusted" is less than 26,746 Mscf for interruptible and G4T customers that CSU is not obligated to supply at all times.

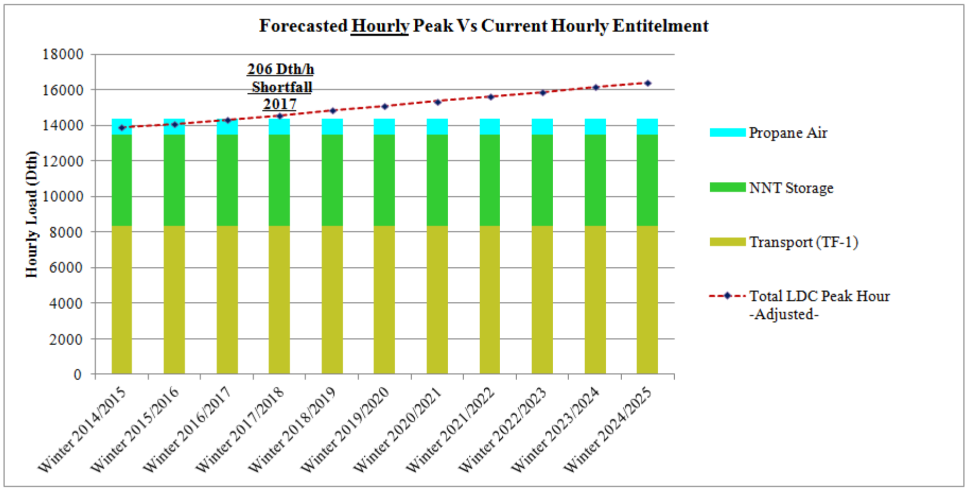


Figure 4.14: Winter Forecasted Hourly Peak Load vs. Current Hourly Supply
Comparison of forecasted hourly peak with current supply resources at CSU. Note that "Total LDC Peak Hour – Adjusted" is less than 1,357 Mscf for interruptible and G4T customers that CSU is not obligated to supply at all times.

Although this does not mean that customers would definitely run short of natural gas starting in winter of 2017-2018, it does mean that CSU would not be able to guarantee sufficient natural gas to all customers, particularly in the event of extreme weather. Mitigation options for this shortfall will be explored in the following chapters of the GIRP.

Conclusion

Colorado Springs Utilities used a conservative approach in forecasting loads in order to ensure appropriate budgeting, capital investment, and supply acquisition for the upcoming heating seasons. The Corporate Sales and Load Forecast provides the basis for which the GIRP process evaluates resource acquisition for distribution planning, supply-side resource needs and demand-side options in the CSU service territory, and is the starting point for the GIRP. The forecast methodology, which combines econometric inputs with end-use modeling, is continuously evaluated so that it effectively forecasts future demands. Most recently, the methodology was updated after the extreme cold weather and peak usage period from February 2011.

In addition to weather, Colorado Springs Utilities' approach to demand forecasting recognizes two additional drivers: customer growth and demand response of existing residential, commercial and industrial customers. Factors that influence new demand include population, employment trends, traffic area zones (TAZ) based on the Pikes Peak Area Council of Governments, construction trends, and possible new use development (e.g. natural gas vehicles). Demand response recognizes that customers adjust consumption in response to price, and modify their demand through conservation measures such as insulation, weather stripping, energy efficient windows, replacement of existing appliances with higher efficiency appliances, as well as behavioral adjustments. These factors have been identified and accounted for in the use per customer evaluation.

Comparing the current peak demand forecasts with current resources shows that for the winter of 2015-2016, CSU customers can expect that their natural gas needs will be met regardless of anticipated weather conditions. For this prediction, CSU uses a one-in-twenty-five-year low temperature. However, current forecasts compared with current resources do predict a possible shortage starting in 2017-2018. Therefore the following chapters will first describe current resources then possible resource options for modifying Supply, Distribution and Demand (Chapters 5, 6 and 7 respectively) to address the problem. Finally the GIRP process will weigh options so that system adjustments and possibly investments can be made as necessary to continue to serve our customers with safe, reliable and cost-effective natural gas.

Chapter 5 – Supply-Side Management

This section discusses supply side options to meet annual, peak-day and peak-hour demands as identified in *Chapter 4 – Demand Forecast*. The current portfolio and possible options are evaluated as to their adequacy over the entire planning period to provide safe, reliable and cost effective service.

As a Local Distribution Company (LDC), Colorado Springs Utilities does not own natural gas fields or intrastate/interstate transportation pipelines. Colorado Springs Utilities manages a diversified portfolio of natural gas supply resources that Include: Propane Air Plant capacity, contracts to purchase natural gas from several different supply basins with various terms, multiple contracts for pipeline transportation, and three different storage services.

On an annual, monthly, and daily basis, Springs Utilities contracts for the gas supply to meet customer demands. On a longer term basis, Springs Utilities contracts for delivery capacity and storage services to adequately serve the Colorado Springs community. In addition to the supply contracts, Colorado Springs Utilities operates a Propane Air Plant (PA Plant) in order to meet its firm sales customers' peak-day and peak-hour demands. Moreover the organization's goal is to hold a diversified portfolio of pipeline transportation and storage services to meet its supply obligations.

Weather

Developing the necessary asset portfolio to meet customer load demands is challenging because the City of Colorado Springs geographical location makes it vulnerable to large daily and hourly temperature swings. Located at over 6,000 feet in elevation, with the west side of the city at the base of the Rocky Mountains with its peaks over 14,000 feet, and the east side adjacent to grassy plains that stretch into Kansas, this unique geography has significant weather variations. According to the National Weather Service, these attributes combine to create one of the most difficult areas in the U.S. to predict short-term weather patterns. Since heating load primarily drives the city's natural gas demand, the strong correlation of gas demand to volatile local weather makes it quite challenging to maintain a balanced portfolio of transportation assets and supply contracts to ensure reliable gas deliveries.

Springs Utilities takes into account weather seasonality while planning for transport and supply acquisitions. Load characteristics are generally categorized by the primary weather trends found in the winter, summer, and the two shoulder months of November and April, that shape the annual acquisition strategy. Daily balancing is key to keeping storage in line with injection and withdrawal targets, especially in high weather volatility periods.

Natural Gas Supply Sources (and Transportation)

Rockies Supply

The Rockies supply region encompasses about 28 separate supply basins. The major supply basins in the Front Range include the Green River, Wind River, Powder River, Uinta, Piceance, and the Denver-Julesburg ("DJ") all of which deliver gas directly into CIG. Supply basins in the Front Range cover large geographical areas and contain huge potential and known reserves. Advanced technology has lowered drilling costs, and enhanced recovery methods have elevated the Front Range as one of the primary gas producing regions in the U.S far into the future.

Colorado Springs benefits from being close to multiple production basins in the Front Range supply region. Most Front Range natural gas production sites are located in Colorado, Utah and Wyoming (Figure 1.3 illustrates those basins).

However, less than 20% of the gas produced in the Front Range is consumed by communities in the Front Range. The remaining supplies are exported via interstate gas pipelines outside the region in all directions. Historically, as new natural gas production grows, the abundance of supply in the Front Range exceeds pipeline capacity, constraining supply deliveries to higher priced markets outside the Front Range region. This creates a supply surplus and pushes down local prices. Over time, this cycle has greatly benefited local Front Range communities. However, eventually the depressed local prices make it economically feasible to build additional pipeline transport capacity to move the gas out of the Front Range. The last two major pipeline additions have been "Rockies Express", which moves gas to mid-continent and eastern states, and the "Ruby Pipeline", which began moving gas to northern California beginning July 27, 2011. As indicated below, a majority of gas produced in the Front Range region is delivered to markets outside of the Front Range.

Total Front Range Region Natural Gas Production on December 31, 2014:	8.03 Bcf/day
Total Natural Gas Exports from Front Range Region:	5.24 Bcf/day
Implied Production to Local Front Range Markets:	2.79 Bcf/day

In winter, the local Front Range Markets use approximately 3.0 Bcf/day and as it stands today, there is sufficient pipeline export capacity in all directions so local wholesale natural gas prices are only marginally lower than the national average.

Mid-Continent Supplies

The Mid-Continent region includes all of Oklahoma and portions of Texas, Kansas, Nebraska, Arkansas, Missouri and Iowa. The most important gas producing basins are the Anadarko and the Arkoma. The Kansas Hugoton field, in the Anadarko basin near the Colorado Kansas border, is the largest gas field in the United States. Gas produced from the Hugoton Basin can be accessed from the CIG southern system and back-hauled into the Front Range.

Commodity Resources

Since transmission pipelines do not actually sell physical natural gas supplies, gas supply for Colorado Springs Utilities' system is purchased from natural gas production owners (e.g. Conoco, Shell, etc.) or brokers (marketers). The natural gas supply market is robust and fluid, with electronic commodity trading platforms rivaling those of bond and equity traders. Springs Utilities maintains an active and competitive gas trading and scheduling group that negotiates over $90 to $300 million per year in gas purchases for its retail gas needs. At any one time, Springs Utilities has many active contracts with producers to allow for competitive pricing negotiations and diverse sources of supplies for optimal pricing and delivery risk diversification.

Subscriptions are also maintained with online trading platforms, and many market and industry publications providing market intelligence and fundamental and statistical market data. Colorado Springs Utilities' gas traders and schedulers work on a trading floor with electric traders facilitating fast and accurate exchange of information to leverage the benefits of a multiservice utility based on real-time price opportunities. This organizational structure helps make Springs Utilities competitive in the daily and longer-term natural gas markets. Although, substantial gas supply is bought and sold in the daily market, Springs Utilities utilizes an annual request for proposals (RFP) process for long term and highly structured gas supply contracts. The combination of longer-term purchases, highly structured purchases and daily purchases provide a diversified natural gas portfolio.

Colorado Springs Utilities has a natural gas acquisition process that seeks to competitively acquire natural gas supplies while reducing exposure to short term price volatility. The acquisition strategy includes storage capacity, term purchases and spot purchases. Although the specific provisions of the plan are dynamic as a result of ongoing changes in market fundamentals, the following principles guide development of the acquisition plan.

Annual Gas Supply Acquisition Requirements

Colorado Springs Utilities manages its' natural gas acquisition and related activities on a system-wide basis, utilizing a number of regionally available supply options needed to serve customers. Structuring the gas contract portfolio to meet the load shape is essential from both a reliability standpoint and an economic standpoint. Since the gas load of CSU can swing from a winter high of over 278,000 Dth/day to a summer low of 18,000 Dth/day it is apparent that over or under contracting may be an issue.

In the winter, the utility typically has a portfolio of gas contracts that includes "base load" supplies that provide uniform daily supply volumes over a month or longer, and "swing" or "peaking" contracts that can be called on a day-to-day basis as needed. Master agreements are also maintained with many suppliers to buy daily "spot" supplies as loads vary. While both swing and spot supplies are scheduled daily, swing contracts allow the buyer firm rights to the underlying supply, while spot contracts are only on an "as-available" basis. Many variations on these contracts are negotiated, including different term (length of contract), receipt locations, market price formula, and other volume and price adjustments. The data below shows the diversity in the number and type of supply contracts held by Springs Utilities.

Number of Supplier Contracts:	40
Contracted Base Load Supplies:	6
Contracted Swing Supplies:	3
Spot Supplies	Variable

Since natural gas supply prices are not regulated, prices are negotiated competitively between buyers and sellers in very active markets. Most gas supply prices are negotiated relative to spot “index” prices, which are calculated by independent publishers for actual transactions occurring for the daily and monthly periods of interest.

Supply Portfolio Overview

Colorado Springs Utilities’ gas supply portfolio is diversified to balance changing market conditions and the risk of production cuts while maintaining reliable deliveries. Term base-load volumes are purchased under contracts ranging from one month to 30 years. The base-load contracting approach for the heating season, November through April, is to cover the expected customer base-load requirements. For the other period May-October, the approach is to have firm contracted supplies to cover the summer customer base-load and storage injection volumes.

Approximately 20% of the monthly base-load supply is acquired through a pre-paid 30 year supply contract executed in October 2008. Pre-paid gas supply contracts are funded by revenue bonds at below market prices. Springs Utilities’ existing pre-paid contract includes a price discount of approximately $0.98/Dth or 20% below current market prices.

Swing supplies are firm supply contracts with volumes nominated on a daily basis and are usually priced on a market price index. Spot supplies are negotiated on a daily basis at daily market rates. Figure 4.4 illustrates the composition of the Gas Portfolio for the 2014/2015 heating season. The portfolio is designed for the peak day and it is adjusted daily to meet customer needs.

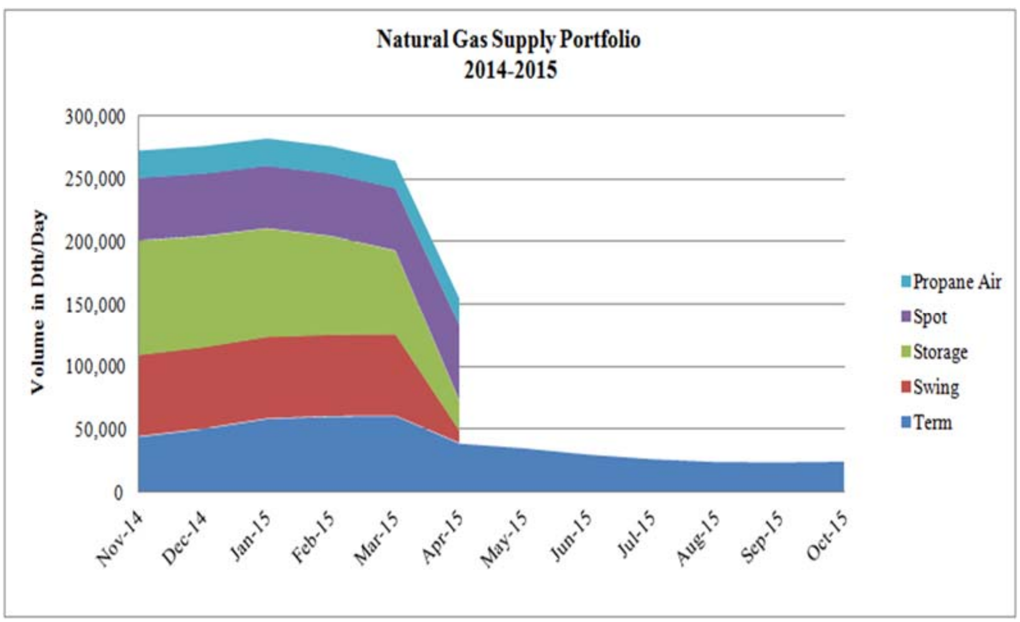


Figure 5.1: 2014 Daily Supply Portfolio.
Note the additional supply for the heating season (November –April). For the May-October period minimal supplies are planned as significantly less gas is used in the summer months.

Gas Transportation Pipeline Services Overview

Since transmission pipelines do not actually sell physical natural gas supplies, gas supply for Colorado Springs Utilities' system is purchased from natural gas production owners (e.g. Conoco, Shell, etc.) or brokers (marketers). The Colorado Interstate Gas Company pipeline is the only interstate pipeline serving Colorado Springs. CIG provides a variety of services with differing levels of reliability, availability and cost. Colorado Springs Utilities assembles a portfolio of contracted services tailored to meet the specific needs of its customer base on annual, heating season, daily, and hourly time frames. Springs Utilities executes primarily long-term contracts with CIG for the various services needed, and then manages them on a day-by-day basis according to CIG's tariff requirements.

The contracts identify specific locations to have supplies accepted on CIG's system (e.g. in the production areas) and locations where supplies are delivered to Springs Utilities (i.e. city gate stations and storage locations). Gas supplies accepted onto CIG's pipeline and transported to Springs Utilities' gate stations and storage facilities must be nominated each day through a structured procedure with two nomination cycles, approximately 19 and 15 hours in advance of the gas day. Limited changes can be made in the two "intraday" nomination cycles during the gas day.

Colorado Springs Utilities' transportation contracts are managed as an asset portfolio and represent a major cost component of the overall gas asset portfolio. Each time a new CIG "rate case" is pending before the Federal Energy Regulatory Commission (FERC), CSU intervenes and represents its customer's interests in an effort to negotiate lower rates. Contract terms are typically five years or longer with specific renewal rights, and often with different termination dates. This provides flexibility in restructuring transport contracts to meet the changing needs of the utility. While delivery capacity rights are purchased for supply reliability, rate negotiations and restructuring of expiring contracts and acquisition of new contracts form the framework for obtaining economic (cost) efficiencies as a key part of portfolio management.

Natural Gas Storage

An essential supply source for the CSU system needs is contracted storage. Natural gas is stored in underground formations and the typical economic model is to inject gas in the summer during a lower market price environment, then withdraw it in the winter, offsetting the higher winter price environment. However, the real benefit of storage is enhancing a utility's ability to balance supply and demand. The majority of utilities (including Springs Utilities) use traditional natural gas storage to smooth radically different loads over weekends and holidays when spot market supplies aren't available, as well as managing unpredicted load changes due to weather volatility, unplanned outages, or maintenance issues.

Storage capacity, as a key gas asset portfolio component, requires active daily and seasonal management. During weekends and holidays when there is no active gas trading market, storage is used to shape gas supply availability to meet predicted demand requirements and to address short-term unpredicted load changes. Purchasing gas directly from suppliers and transporting it to the LDC (without storage) requires a specific receipt and delivery commitment by both parties for a specific period to ensure proper upstream operations. Since gas well delivery capacity cannot easily be regulated up and down on a real time basis, storage capacity serves as a valuable tool in managing those demand and supply swings resulting from rapidly changing weather patterns.

Colorado Springs Utilities maintains two types of gas storage service. The first is a “scheduled” traditional service. Both the Young Gas Storage service agreement and the Tallgrass Storage service agreement require Injections and withdrawals to be “scheduled” over one to four different cycles for each delivery day.

The second storage service is a “no-notice” service, provided for under the no-notice transportation (NNT) rate schedule offered by CIG. No-notice storage serves as a critical balancing tool, since NNT service is not required to be scheduled ahead of time. Thus the injections and withdrawals under this service manage the net imbalances in pipeline deliveries versus actual consumption by the LDC’s customers.

Functionally, if all supplies (other than NNT) received by CIG and delivered to Springs Utilities during a given day are higher than demand, the difference is automatically injected into NNT storage. If supplies are lower than demand, the difference is automatically withdrawn from NNT storage. Another feature of NNT is the ability to cover large aberrations in hourly loads. Typically, early morning hours (between 6:00 a.m. and 9:00 a.m.) represent much higher hourly loads than the hourly average for the entire day requiring flexible supply capability during those hours to meet changing load demands.

NNT Storage service is served by four CIG storage facilities. Fort Morgan, Latigo, and Flank fields are located in eastern and southeastern Colorado. Boehm field is located in southwest Kansas. The Young scheduled storage facility is located northeast of Denver physically feeds into CIG’s system at a specific receipt point on a portion of Springs Utilities’ pipeline transportation entitlements. In addition, Hunstman – thru CMC2- is another source of gas supply.

Load Deviations

As mentioned earlier, matching supply resources with daily and hourly load requirements on Colorado Springs Utilities’ distribution system is quite challenging with the diverse weather events that occur in Colorado Springs and along the Front Range. Weather changes occur rapidly, even within a gas day period, especially in the shoulder months of November and April.

Figure 4.5 illustrates the load deviation of the day ahead forecast versus actual load for the three year period April 2011 to December 2014. Note the forecasted versus actual load can vary by as much as 60%. The daily weather volatility requires appropriate assets and timing to respond to the daily and hourly needs.

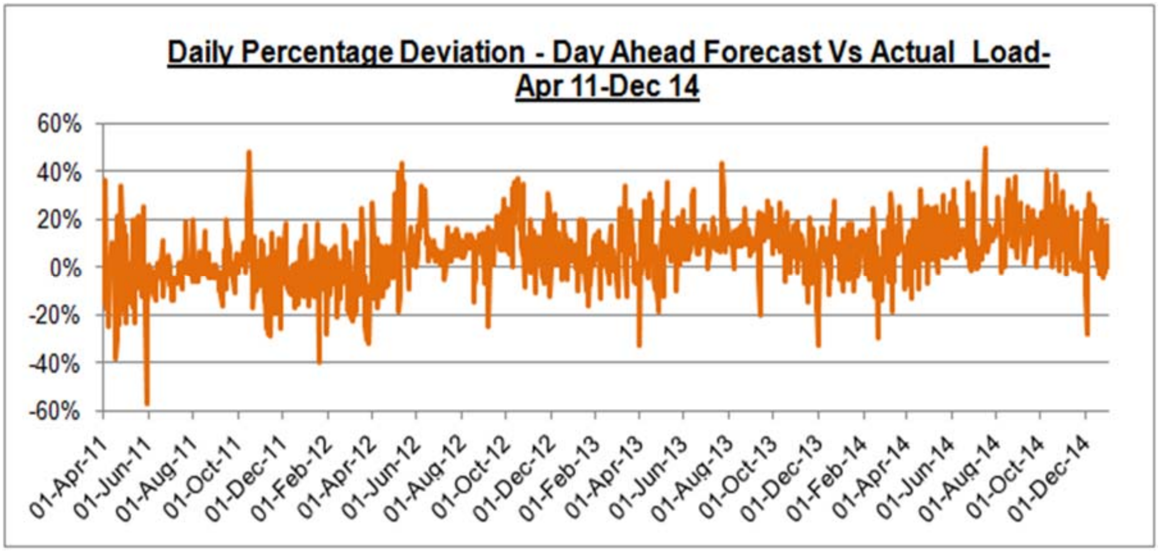


Figure 5.2: Daily Load Deviation Day Ahead Forecast vs. Actual Load
Load deviation for day ahead forecast versus actual load for the period of April 2011 to December 2014. Note that the forecasted load versus actual load can vary by as much as 60%. The volatility profile is useful in numerous assessments including monthly supply mix set-ups, rate design of transport customers behind the City Gate stations.

Propane Air Plant

Colorado Springs Utilities' propane air (PA) plant is a supply source located on the distribution system to provide supplemental supply during extreme peak weather conditions or potential interruptions of Springs Utilities' contracted gas deliveries to CIG's pipeline system. The PA plant was built in 1973-74 and is located near CIG's North Colorado Springs gate station on the east side of Colorado Springs.

There are forty-two 30,000 gallon (water capacity) propane tanks at the site holding a little over one million gallons of propane working storage. The plant can produce up to 900 Dth per hour (21,600 Dth/day) of propane-air gas designed to be compatible with the natural gas feeding the Colorado Springs service area. At this rate, the plant has over three days of full production capacity. In recent years, the plant has become a critical facility for managing peak-hour requirements, as well as the traditional peak-day requirements.

Asset Optimization

Gas supply assets (transportation, storage, and supply contracts) represent a major annual operating expense for Colorado Springs Utilities. Since most supply assets are structured around a straight "fixed/variable" rate design model, the contract holder pays for the service fixed costs on a year round basis, and variable costs on a volumetric use basis. Gas distribution companies, like Springs Utilities, need to have sufficient capacity available for meeting peak load requirements. Thus, on occasion, surplus capacity is available for optimization when market conditions exist. Any proceeds resulting from this optimization are returned to the customers. The amount of asset optimization varies year-to-year depending on market conditions. Colorado Springs Utilities does not enter into speculative trading of gas supplies, as dictated by the Utilities Board governance policy Executive Limitation 11 – Enterprise Risk Management.

The load duration curve in Figure 4.7 illustrates demand level versus the number of days throughout a year where that demand level occurs for three distinct time periods. Load duration curves are useful in identifying possible stress on storage in sustained high load periods. It's notable that on average, there were only five days where the actual load was above 180,000 Dth/day each season.

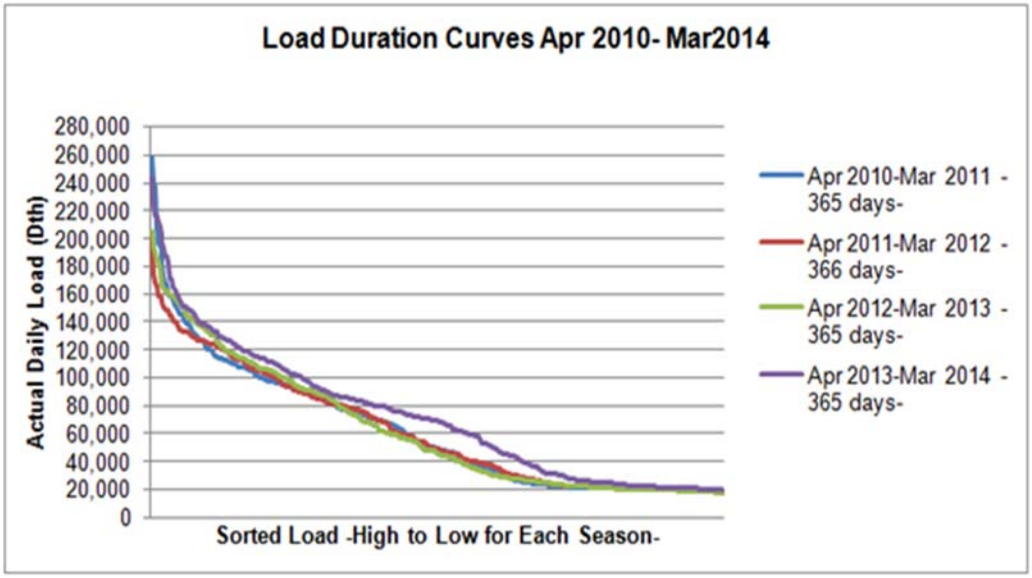


Figure 5.3: Daily Load Frequency April 2010 – March 2014

Total Supply Resources

Colorado Springs Utilities' portfolio of transportation and storage services including propane air at peak capacity is indicated in Table 5.1.

Table 5.1: Total Supply Side Resources

		Maximum Daily Quantity (Dth)	Hourly Entitlement (Dth)
Transportation			
	CIG Mainline	122,436	5,101
	CIG Cheyenne	78,375	3,266
Storage			
	CIG NNT Storage	73,528	5,086
Propane Air Plant			
	Propane Air (half day)	10,800	900
CSU Total Delivery Capacity		**285,139**	**14,353**

These are the total amounts on which the system relies to cover its demand needs, including peak demand. As shown in the previous chapter (*Chapter 4 – Demand Forecast*), due to demand growth, these supplies will become insufficient beginning in the heating season 2017-2018 and will require supplementation.

Demand and Supply Analysis

As shown in *Chapter 4 – Demand Forecast* and in Table 5.2 below, the forecasted *daily* demands won't be fully served in the 2020-2021 heating season. Likewise *hourly* demand requirements fall short in 2017-2018. The gradually increasing asset shortfall is being driven by a normal annual load growth forecast in the 1% to 2% range. Looking out over the planning horizon through summer 2017, many permanent and effective options can be considered.

Table 5.2: Projected Supply Shortfalls

Projected Supply Shortfalls		
Winter	**Daily Shortfall (Dth/Day)**	**Hourly Shortfall (Dth/Hour)**
2014-2015	0	0
2015-2016	0	0
2016-2017	0	0
2017-2018	0	206
2018-2019	0	478
2019-2020	0	747
2020-2021	3,515	1,006
2021-2022	8,410	1,266
2022-2023	13,340	1,527
2023-2024	18,330	1,791

Identified Supply Capacity Options

In this section several options and solutions to cover these shortages are listed below. These alternatives represent the normal growth of supply assets necessary to meet projected utility load growth over an intermediate planning horizon. Each alternative is evaluated by considering cost, reliability, and functionality within the portfolio, time to put in service, and strategic benefits.

The supply options identified are listed with discussion below:

- **CIG Tariff Allowances** - Up to 1,000 Mscf/hour overages won't be penalized when CIG's system is not capacity constrained. This option is subject to availability and is not an assured solution.
- **Contract Temporary Capacity From Other LDC's** – Temporary capacity may be available from another LDC for one to two heating seasons, however, the capacity would be more expensive than the current CIG rates and in addition require new air blending capacity at additional cost.

- **Acquire Additional Spot Delivered Gas Supplies During Peak Periods** – This approach has been successful for small volumes in the past, but volumes are subject to cuts if CIG's system is constrained. This option is subject to availability and is not an assured solution.
- **Air-Blend by CSU** - CSU can build and operate air blend capacity, separate from CIG, at an estimated cost that is considerably less than the approximately $3-$5/Mscf-Day per month for air-blending proposed by CIG. It can also be provided in units of capacity smaller than the 15,000 Mscf/day minimum offered by CIG. Implementation time is estimated at about 12 months. Air blending by CSU still requires transportation capacity be available and only works if that underlying capacity is available.
- **Expanding Existing Propane-Air Plant Capacity** – The existing Propane-Air plant can be expanded to deliver an additional 500 Mscf/hr over and above the current 900 Mscf/hr that is available while maintaining a nominal 3 days of on-site storage. No new storage would be required, only the replacement of certain process equipment with similar equipment of larger capacity. Thus the plant would appear very much the same as it does today. Combustion emissions from incrementally larger boilers used in the process would increase slightly, but no other environmental impacts are foreseen.

  The propane plant can serve both hourly and daily supply requirements and is best suited to meet occasional load demands. Its cost per unit for production is high compared to market prices for natural gas, but its annual carrying costs are low versus the reservation costs of firm transportation on CIG.

  Expanding this plant would also require updates due to the age of the plant. The update has an expected cost of approximately $2.07 M plus an additional $1.5 M for expansion for a total cost of $3.57 Million. This option would require approximately two years to implement.
- **Build an Additional Propane Air Plant** – A new propane-air plant could be built to provide an additional 1,000 Mscf/hr (or 24,000 Mscf/day), and allow for future expansion should the natural gas usage in the Colorado Springs area continue to grow as expected.

  This option would require approximately 10 acres of land, much of it providing a buffer from surrounding properties, and would be constructed with mounded storage, providing an atheistically pleasing profile where the storage tanks are buried under mounded earth. Traffic to and from the site would be expected to be minimal consisting of transport trucks to deliver propane after a period of use (generally restricted to the cold winter months) and CSU employees performing maintenance and other work.

  The potential to co-locate with future new electric generation will be explored. The total expected cost is approximately $9 Million for 1,000 Mscf/hr. This option would require 18 to 24 months to implement with the actual construction portion of the project taking about 9 months of that time.
- **Contract For Additional Storage Capacity** - Acquiring additional NNT capacity at current rates would be the most favorable supply alternative, unfortunately none is currently available. Potential options include:
  - NNT capacity trade opportunities with other LDC's may be possible, and Energy Supply personnel will seek these out, but availability is limited and timing may

be constrained.

- o CIG may be able to construct a new storage field, but its' accessibility and cost may be prohibitive. Further exploration of this option will continue.
- o CIG is exploring converting Colorado Springs Utilities' Young Storage Service into a NNT- like balancing service which would provide more flexibility in utilizing the Young Storage facility.

- **Contract Additional Firm Transport Capacity** - There is no unsubscribed TF capacity available on the CIG system, so additional capacity would have to be obtained via a CIG expansion project or be acquired from a third party who doesn't need it. A mainline CIG expansion project would include compression, air blending and pipeline looping back to key mainline points. The planning and implementation horizon on this type of new construction is 2-3 years.
- **Liquefied Natural Gas (LNG) peaking facility** - LNG plants are a readily available and salient response to short term gas supply shortages. LNG plants are scalable, including sizing the major features of the plant for injection, withdrawal and inventory capacities. Also, these plants can include capabilities to receive pipeline gas directly, liquefy the gas (into LNG), and store it. An alternative is to have trucks or trains deliver the LNG to the plant, saving on liquefaction facilities. Withdrawal (send-out) capability can be sized at a very high ratio when compared to traditional underground storage. For example, it typically takes several weeks or even months to totally withdraw traditional underground storage inventory because the reservoirs can only handle certain pressure changes. An LNG facility can be configured to withdraw its inventory in a few days. So, a small inventory can be maintained for a given level of short-term gas availability. This option will require extensive study and major capital investment in the order of magnitude of $50-$200 million. Partnering with CIG or other LDC's would likely be needed to achieve economies of scale to improve the project feasibility.
- **Segmenting The Distribution System To Avoid Air Blending** – New air blending capacity is expensive, so configuring expansions on the distribution system to take non air blended gas from CIG's other pipeline in the area may be prudent. For example, the areas east of Marksheffel Road could be configured and upgraded to use non-air blended gas. This would require new appliances in those areas to be de- rated with smaller orifices before installation and re-orificing completed on existing appliances in areas to be reconfigured. This approach would have the advantage of avoiding full scale re-orificing of the entire distribution system which would cost in the $30-$100 million range.

Conclusion

This section identified supply side options designed to meet annual, peak-day and peak-hour demands as identified in *Chapter 4 – Demand Forecast*. The options identified are a medley of temporary as well as permanent solutions and were evaluated by considering cost, reliability, and functionality within the portfolio, time to put in service, and strategic benefits. The supply options were evaluated together with any demand-side management options and the results are presented in *Chapter 8 – Action Plan*.

Chapter 6 – Distribution Planning

Colorado Springs Utilities' distribution system begins at the city gate stations and continues to the customer's meter. CSU's goal is to design, construct, operate and maintain this system to deliver natural gas to every customer in a safe, reliable and cost-effective manner. Areas specific to distribution planning scenarios requiring improvement are identified via computer modeling. Furthermore, the recent integration of customer growth forecasting and localized distribution planning enables CSU to better coordinated targeted distribution projects that are responsive to specific customer growth patterns.

CSU is in a good position to serve newly developed areas at a relatively low cost due mainly to two factors. Firstly, growth on the east side of Marksheffel Road is near the city gates therefore avoiding further strain on the already stressed extensive western side of the distribution system. And secondly, with natural gas use per customer declining due to improved appliance efficiency and energy conservation measures, the distribution system in existing areas of the city should be able to serve infill developments without adding significant infrastructure.

The ability of the distribution system to deliver needed volumes to specific geographic locations was analyzed using modeling software to identify locations where delivery pressures would not meet customer needs. Additionally the pipeline model allows computer simulation of new projects to evaluate the ability to serve customer growth. No distribution system deficiencies were identified in meeting the future peak-*day* and peak-h*our* requirements for the next ten years. Breaking point stress tests were modeled for power plants, military bases and single gate station failures in order to identify any relative weakness in the system.

Computer Modeling

When designing new main extensions, computer modeling is essential in optimizing the size for pipes (mains and services) and pressure regulator stations to meet current and future demands. Colorado Springs Utilities conducts gas distribution system load studies using the steady state pipeline network analysis software "Synergee®." The Synergee modeling tool allows Colorado Springs Utilities to analyze and interpret solutions graphically, based on our gas service territory. Computer modeling assists in the installation of appropriately sized gas mains and pressure regulator stations and avoids expensive replacement/reinforcement projects in the future due to under-sizing.

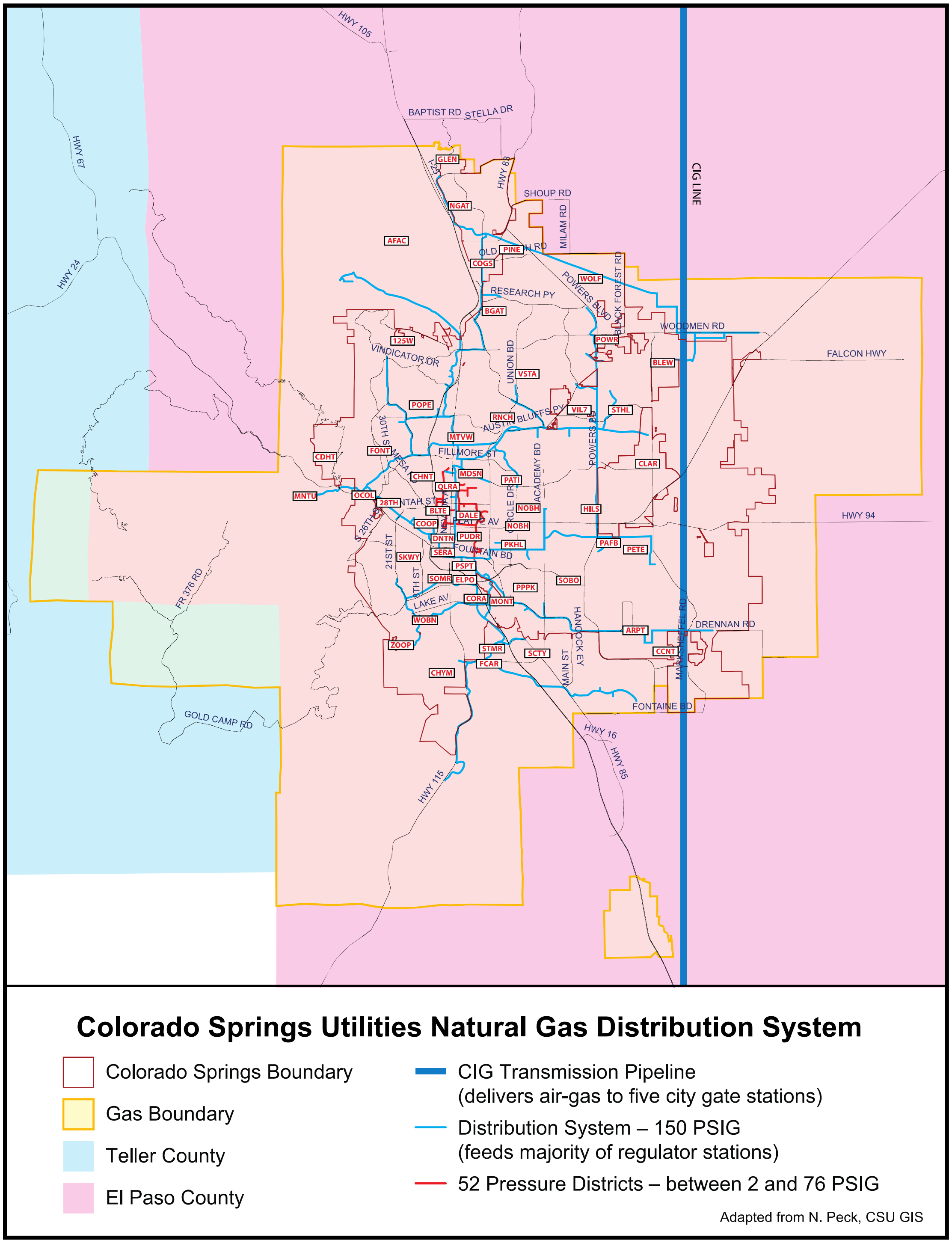


Figure 6.1: Colorado Springs Utilities Natural Gas Service Area Map
This map shows the relative location of the interstate pipeline (where natural gas enters the CSU network) on the east side of the Colorado Springs service territory with the vast majority of the distribution system creating a westward web to provide natural gas to our customers.

Model Creation

With the help of the software and data from the Geographical Information System (GIS) Colorado Springs Utilities has accurately modeled the current distribution system. Facility properties such as pipe internal diameter, connectivity, pressure regulator station size, and valve operating setting are captured to construct the model.

The city gate stations deliver natural gas at a pressure of 150 psig to an all-steel system. This 150 psig system acts as the “backbone” to distribute natural gas throughout the service territory.

From the 150 psig system, there are currently 52 isolated pressure districts within the Colorado Springs Utilities service territory. There are approximately 146 regulator stations throughout the service territory that lower the pressure from 150 psig to a range of fixed levels between 2 psig and 76 psig; most pressure districts are fed by more than one regulator station. The pressure districts then distribute natural gas throughout a specified area, and finally to customers.

Lastly customer usage data and forecasting data is added to the system in order to analyze system operation.

Modeling Benefits

Once the model is created, the results are used for numerous purposes, such as:

- Determine appropriate sizing for both new and renewal pipe projects.
- Identify system bottlenecks and provide insight into the capacity margin in the system (through capacity stress testing of the system)
- Analyze critical scenarios, such as key equipment failure, natural disaster events, extreme weather and excavator damage.
- Create system alarm points and simulate distribution system performance (such as isolating a portion of the system, creating a one-way feed, etc).

Gas Distribution Model Verification

In order to improve the model’s accuracy, verification is performed by comparing actual operating data with predicted model values for peak-hour and peak-day. Telemetry (automated communication and data collection) equipment gathers the actual pressure values at various locations through the system and the flow volumes at the city gate stations. Areas with a noticeable difference between predicted and actual pressure are reviewed in more detail, and adjustments are made as necessary.

During the verification procedure, it is essential to model existing conditions as closely as possible to achieve a more accurate result. Key data that is monitored includes:

- Large Customer Loads
- Up-to-date Graphical Information Systems (e.g. maps) data to capture all main installation
- Off-normal operating conditions, such as a valve closure or a regulator pressure adjustment (noted in the “Clearance” database)
- Production at the Propane-Air Plant

Verification results are used in defining the peak design criteria used by Colorado Springs Utilities for managing the system.

Planning Criteria

Considering various operating pressures throughout the natural gas system (ranging from 2 psig to 76 psig pressure districts, and the 150 psig backbone), Gas Planning and Design has defined minimum pressure criteria for planning purposes needed to maintain reliable service to customer locations. Model results that fall below these criteria are reviewed for improvement. The table below shows the minimum supply pressure at the inlet to the regulator at the customer meter, as established by Gas Planning and Design.

Minimum Supply Pressure Planning Criteria	
Pressure District	**Minimum Pressure**
Water Column (inches WC)	18" Water Column
Less than and equal to 34 psig	5 psig
Greater than 34 psig	10 psig

Table 6.1: Minimum Supply Pressure Planning Criteria
These minimum pressures will ensure deliverability as natural gas exits the distribution mains and travels through service lines to a customer’s meter.

Determining Pressure District Maximum Capacity

Using the constructed model, a detailed assessment is conducted for each of the 52 pressure districts. The heat load is increased beyond the peak-hour load until the pressures falls below the listed minimum pressure. At that point, the total volume of natural gas entering the system, theoretically, equals the maximum capacity before reinforcements are necessary. Thus, the difference between the maximum volume and the volume determined at the design peak-hour is the additional capacity that can be served by the distribution system as currently designed.

Since the approximate natural gas usage for the average customer is known, it can be determined how many new customers can be added to the distribution system before system reinforcements are needed. The Synergee® model and procedures are used with new construction proposals and/or mainline reinforcements to determine potential projects needed to maintain the integrity of the gas distribution system.

Load Forecasting

Load growth and expansion forecasting is performed to predict the distribution system's behavior and reinforcements necessary within the next ten years. System reinforcements and expansions are evaluated with the network Synergee® model. A major factor impacting the ability of the distribution system to accommodate load growth and expansion is the geographic location of the load on the distribution system. Therefore, Colorado Springs Utilities partners within the community to use a variety of organizations predicting load growth, such as Pikes Peak Area Council of Governments (PPACG) Small Area Growth Forecast, the approved Colorado Springs Utilities Corporate Annual Sales and Load Forecast, and land developer's master planning proposals. This results in a distribution planning forecast that is highly beneficial in preparing budget forecasts as a part of critical planning efforts.

New Growth

Master plan models are created for full build-out of new developments, laying out the pipe sizes and materials, along with any regulator stations that may be needed. Line extensions serving new developments are funded in advance, either by the developer or by Colorado Springs Utilities as determined by a feasibility analysis under CSU's Tariff provisions. Some major new master planned developments that are likely to see growth in the next ten years include Banning Lewis Ranch, Rolling Hills Ranch, and Santa Fe Springs.

Reinforcements

Based on current knowledge, no major reinforcement projects appear to be needed in the ten-year planning horizon. If major load expansions are needed due to infill development, they will be evaluated as they materialize.

Distribution System Enhancements

Computer-aided demand studies enable CSU to model numerous “what if” demand forecasting scenarios, constraint identification, and the corresponding optimum combination of pipe modification and pressure modification solutions to maintain adequate pressures throughout the natural gas distribution system.

Distribution system enhancements do not reduce demand nor do they create additional supply. However, they can increase the overall capacity and performance of a distribution pipeline system while utilizing existing gate station supply points. Distribution enhancement solutions can be identified in two broad categories: mainlines (pipes) and regulator stations.

Mainlines

Techniques used to plan mainline improvements include looping, upsizing and uprating are as follows:

Looping:
Mainline looping is the most common method of increasing capacity within an existing distribution system. This involves constructing a new pipe parallel to an existing mainline that has, or may become, a constraint point. Constraint points inhibit volume and pressure levels downstream of the constraint, creating inadequate pressure to serve customers during high demand periods. When the parallel line is connected to the system, this second alternative path allows natural gas flow to bypass the original constraint point and bolster downstream pressure levels. The feasibility of looping a mainline is primarily dependent upon the location where the mainline will be constructed. Installing gas mainlines through private easements, residential areas, existing asphalt, and steep or rocky terrain can greatly increase the costs, compared to alternative solutions.

Upsizing:
Mainline upsizing is simply replacing existing pipe with a larger sized pipe. The increased capacity, relative to the surface area of the original pipe, results in less friction and therefore a lower pressure drop. This option is usually pursued when there is damaged pipe or when pipe integrity issues exist. If the existing pipe is otherwise in satisfactory condition, looping is usually pursued, allowing the existing pipe to remain in use.

Uprating:
Mainline uprating involves increasing the maximum allowable operating pressure (MAOP) of an existing mainline. This enhancement can be a quick and relatively inexpensive method of increasing capacity in the existing distribution system before constructing more costly additional system facilities. However, safety considerations and pipeline regulations may limit the feasibility or lengthen the time before uprating can be completed. Also, increasing line pressure may produce leaks or other mainline damage, creating unanticipated costly repairs.

Regulator Stations

Regulator stations are used to supply a reduced pressure to an existing pressure district or new pressure district. Regulator stations are usually fed from the 150 psig system, and supply additional capacity to existing or new districts. Operating pressures of an established or new pressure district are determined by the maximum allowable operating pressure established in accordance with the Department of Transportation's pipeline safety regulations. For new districts, the maximum allowable operating pressure is 76 psig or less, which allows the use of polyethylene pipe materials throughout the district. Adding a regulator station to a pressure district increases the capacity of that district. This option is limited by the availability of a higher pressure gas source from the 150 psig system.

Distribution System Stress Tests

Multiple delivery capacity scenarios of system events were modeled to stress test Colorado Springs Utilities' distribution system. The breaking point was selected as the condition when the first customer load does not have sufficient delivery pressure, according to CSU's minimum pressure criteria. Multiple scenarios were created by distinguishing various customer classes, extreme weather, and gate station failure. The scenarios were built around the following customer categories and gate stations failure assumptions:

Core Firm Residential and Commercial Customers
CSU is obligated to have natural gas available to these customers at all times.

Military Installations
United States Air Force Academy (USAFA), Fort Carson, Peterson Air Force Base (PAFB) are areas that could potentially see substantial growth.

Interruptible Customers
CSU is <u>not</u> obligated to provide natural gas to these customers at times of peak usage.

Birdsall and Drake Power Plants
These electric power plants are connected to, and use, CSU's natural gas distribution system to help generate electricity.

Gate Station Failure
The system has five gates: McClintock, North, South, Drennan and Security. These are the supply sources to CSU customers. Loss of a gate station could potentially limit supply.

A brief discussion of the scenarios and the key results are indicated below.

Base Case
A base case was created to simulate actual capacity for a design peak-hour at a -13 °F average day. Using the Synergee® model, the system was then stressed to a breaking point (all gate stations on, interruptible and military customers on-line, no power plant

production). The results indicate that the current system will operate down to a -19 °F daily average temperature.

Birdsall Power Plant

This scenario was the same as the base case, except with two alternative conditions; (1) Birdsall Power Plant at full production (variable is average daily temperature), and (2) available capacity at -13° F daily average temperature. The table below lists the results.

Drake Power Plant

This scenario was the same as the base case, except with two alternative conditions; (1) Drake Power Plant at full production (variable is average daily temperature) and (2) available capacity at -13 °F daily average. The table below lists the results.

Birdsall *and* Drake Power Plants

This scenario was the same as the base case, except with two alternative conditions; (1) Birdsall and Drake Power Plants at full production (variable is average daily temperature) and (2) available capacity to serve both plants at a -13 °F daily average. The table below lists the results.

Military Load Growth

This scenario was the same as the base case, except adding load to each military installation to determine available capacity. The model indicates that load growths of 68% at USAFA, 49% at Ft. Carson, and 24% at PAFB can be supported without any modifications to the existing system, except for metering facilities.

Interruptible Customers

This scenario was the same as the base case, except with an increased load on Interruptible (industrial) customers. This scenario did not cause extra strain on the system.

Gate Station Failures

Full gate station failures would be an extremely rare event, as no event has occurred in the history of Colorado Springs Utilities. Nevertheless, models were created simulating failure of the gate stations one at a time. The table below lists the results.

Power plant breaking points and gate station breaking points from the scenarios described above are summarized in the following tables:

Power Plant Capacity Breaking Points				
Power Plant	**Total Hourly Demand Mscf/hr (14.73)**	**Percent Served (-13°F Daily Average)**	**Total Hourly Demand Served (-13°F Daily Average) Mscf/hr**	**Temperature Where 100% Served (°F)**
Drake	3,691	72.3%	2,671	56°
Birdsall	2,499	73.6%	1,840	54°
Both Drake and Birdsall	6,195	66.2% / 63.2%	2,444 / 1,582	65°

Table 6.2: Power Plant Capacity Breaking Points
Either power plant running on natural gas at 100% capacity restricts heating load on the system.

Gate Station Capacity Breaking Points Load Data (Mscf/hr @ 14.73 psia)				
Gate Station	**Total System Hourly Demand (-13°F Daily Average)**	**Percent of Total Served by Other Four Gates (-13°F Daily Average)**	**Total System Hourly Demand Served (-13°F Daily Average) Mscf/hr**	**Temperature Where 100% Served (°F)**
McClintock off	13,268	55.7%	7,396	24°
North off	13,268	68.7%	9,122	13°
South off	13,268	>100%	13,357	-14°
Drennan off	13,268	88.8%	11,788	-4°
Security off	13,268	>100%	16,686	-19°

Table 6.3: Gate Station Capacity Breaking Points
Complete failure of either McClintock, North or Drennen gate station, combined with extreme cold weather, would lead to restrictions on the system.

Conclusion

Colorado Springs Utilities' distribution system capacity is constantly reviewed after cold weather events, and as new customer loads are added and existing customer loads are increased. The distribution system operated well during the recent system peak demand event of February 1, 2011 with no customer outages due to capacity constraints. System capacity is currently sufficient for the load demands projected for the ten-year planning horizon, and the system can be expanded on a relatively short timeframe, should those projections change.

Potential loss of the McClintock, North, or Drennan gate stations on an individual basis could result in restricted capabilities on the distribution system during peak-day or peak-hour conditions. The likelihood of such an event is quite low, but those scenarios will continue to be monitored for possible system improvement opportunities that would minimize the risk at a reasonable cost.

Any load additions on the distribution system, due to compressed natural gas (CNG) fill station development, is expected to have minimal impact on delivery capability, especially if the demand occurs during off-peak hours. Many locations throughout the distribution system would adequately serve the needs of compressed natural gas refueling stations. Ideally those locations would be situated at and fed from the 150 psig system or other pressure districts with sufficient operating pressures. At-home refueling methods do not pose a problem for the majority of the distribution system.

Chapter 7 – Demand-Side Management

Demand-side management (DSM) is the activities that influence customers to reduce their energy consumption or change their patterns of energy use away from peak consumption periods or reduce overall consumption. This usually includes providing educational information and rebates to persuade customers to adopt sustainable conservation measures. DSM programs benefit both the utility and its customers. The utility benefits because DSM programs can provide cost-effective energy and capacity resources to help displace or defer the need for new supply-side resources and customers benefit because they can have more control of their energy use and utility costs.

Colorado Springs Utilities has offered natural gas DSM programs to its customers since 2001. In January 2003 Utilities Board adopted through policy governance the “Ends-Environmental Results”. This policy provided direction on managing DSM and other renewable programs. To date, these programs result in multiple benefits including reducing customers’ bills, reducing the immediate need of supply-side resources and reducing Greenhouse Gas (GHG) emissions. In addition, the benefits make acquiring cost effective demand side resources a very attractive resource alternative which Springs Utilities believes is the best strategy for minimizing energy service costs to its customers while promoting environmental stewardship.

Currently, energy policy and legislative activities are placing a high level of awareness and importance on environmental and energy use issues. Spiking energy prices in early 2008 and subsequent economic challenges later in 2008 and into 2009 have also led to increased awareness and interest in energy saving measures. In response, Springs Utilities is committed to providing natural gas solutions to help consumers reduce energy consumption through cost effective DSM programs.

Planning Process

The DSM planning process starts with defining its objectives. DSM can serve many purposes, such as customer satisfaction, environmental stewardship, and/or regulatory compliance. But in resource planning, DSM is treated as a resource on the same level playing field as supply-side resources.

DSM savings targets and program portfolios can be shaped by the objectives defined, together with the availability of DSM resources in the market. Due to resource and financial constraints, the targets and portfolios can simply be determined through a benchmarking and best practices approach without a detailed study of all possible DSM potential in the market. However, for integrated resource planning, it is strongly recommended to conduct a detailed study to identify all DSM resources, their potential and costs, and then integrate them with supply-side resources to produce a least cost plan to meet customer future demands.

Once DSM targets and program guidelines are determined, programs are designed and implemented accordingly, with regular feedback for improvement through program evaluation, measurement and verification.

When DSM techniques and programs are treated as a resource, they are competing with supply-side resources. Therefore, the value of DSM is measured by the avoided costs of displacing or deferring supply-side investments. The Colorado Springs Utilities 2015 GIRP will help identify the avoided cost. The avoided cost is a critical element in the DSM planning process.

Demand side resources are generally lower cost than supply-side resources, but the availability of these resources are not unlimited. These resources are constrained by the availability of energy efficiency technologies, their costs, and customers' acceptance of these energy efficiency technologies. So a comprehensive study of the technical, economic and achievable potential in the utility service territory is a critical step in a successful integrated resource planning process.

Cost Effectiveness

Cost effectiveness is a fundamental concept to DSM. In simple terms, it is the determination of whether the present value of the energy savings (net of non-energy benefits) for any given conservation measure is greater than the cost to achieve the savings. Colorado Springs Utilities begins by understanding what the objective is for DSM, such as resource constraints, customer satisfaction, as well as environmental and/or regulatory issue. Based on the objective we then understand the magnitude of impact we are trying to achieve, such as utility benefit, rates benefit, or societal benefits. Table 6.1 indicates the questions and approaches used to review and select those DSM programs that provide benefit to our customers based on the desired objective.

Table 7.1: Demand-Side Management Program Assessment Matrix

Demand-Side Management Program Assessment Matrix			
Test	**Acronym**	**Key Questions Answered**	**Summary Approach**
Participant Cost Test	PCT	Will participants be better off?	Comparison of costs and benefits of participant
Utility Cost Test (Program Administrator Cost Test)	UCT	Will the total bills of energy services decrease?	Comparison of utility costs to supply-side resource costs
Total Resource Cost Test	TRC	Will the total resource costs (utility + participants) of energy services in the utility service territory decrease?	Comparison of utility costs and participant costs to supply-side resource costs
Ratepayer Impact Measure Test	RIM	Will the utility rates decrease? (Impacts of program costs and lost revenues on general ratepayers)	Comparison of utility costs and utility bill reduction (revenue lost) to supply-side resource costs

Conservation Measures

Conservation measures that achieve uniform year round energy savings independent of weather temperature changes are considered base load measures. Examples include high efficiency water heaters, cooking equipment and front load clothes washers. Measures that are influenced by weather temperature changes are weather sensitive measures which include higher efficiency furnaces, ceiling/wall/floor insulation, weather stripping, insulated windows, duct work improvements (tighter sealing to reduce leaks) and ventilation heat recovery systems (capturing "exhaust" heat). Weather sensitive measures are desirable in resource planning, as they save the most energy during the coldest periods thus displacing or extending the need date for the more expensive peaking or seasonal supply resources.

Conclusion

The value of demand-side resources depends on their capability to cost-effectively displace or defer supply-side resources. The GIRP can help identify a DSM value (i.e., avoided cost) for the evaluation of cost-effectiveness of DSM measures and DSM potential in Colorado Springs Utilities' natural gas service territory. Springs Utilities recognizes and will request a budget for a comprehensive natural gas DSM potential study in 2016. The results of this study will be inputted into and integrated with supply-side resources in the subsequent revisions of the GIRP.

Chapter 8 – Action Plan

As shown in the previous chapters, due largely to local population growth, the customer demand for natural gas in the Colorado Springs Utilities coverage area will exceed current supplies starting in the 2017-2018 heating season. The 2015 GIRP evaluated resource options needed to meet annual, peak day and peak hour customer demands forecasted through 2025. The plan takes into account existing resources, the distribution system, electric generation, and efficiencies to produce a set of potential resource options that are tailored for the specific Colorado Springs Utility requirements in specific time frames going forward.

The GIRP core team employed rigorous technical analysis to ensure safe, reliable and cost effective natural gas supply. A multi-discipline project team evaluated possible options (see *Chapter 5 – Supply-Side Management* and in *Chapter 7 – Demand-Side Management)* to the upcoming supply shortfalls and recommended good solutions for detailed analysis and implementation. The outcome of the analysis is summarized below:

Table 8.1: Summary of Options Analysis

Options	Probability	Issues or Concerns	Cost Estimate	Plan going forward
Buy More Air Blended Capacity	low	This options is for baseload, not peaking. This has an 18-24 month lead time for new capacity additions. Capacity availability is fluid and somewhat constrained, but is available occasionally.	Cost for 12,000 Mscf/day $1.8 Million to $2.1 Million per year $12.50-$14.50/ Mscf-month.	Option is not optimal for peaking. It will not be explored further at this time.
Expand and Upgrade Existing Propane Air Plant	high	This will increase the output by 500 Mscf/hr (which is 12,000 Mscf/day). If this plant is going to continue to be part of the portfolio, it requires code improvements at a cost of $2.07 million. The existing storage capacity is sufficient for 72 hours of continuous operation, considered adequate. Plot size and storage volume will remain unchanged. This option will take 2 years to complete.	One time cost $3.57 Million - $2.07 Million needed for code upgrades and $1.5 Million for expansion. No additional land needed. Minimal ongoing costs for operation and maintenance.	Option will be further analyzed for implementation. Detailed Engineering will be performed.
New Propane Air Plant	high	Starting at 1,000 Mscf/hr (24,000 Mscf/day), this options is expandable to align with future growth. Ten acres of land needed for plant, equipment density is thin and environmentally friendly. Permit required from Fire Department. Location near gate station. Potential to co-locate with future new electric generation will be explored. This option will take an estimated 18-24 months to complete.	One time cost $9 Million - for 24,000 Mscf/day. Does not include cost of land. Minimal ongoing costs for operation and maintenance.	Option will be further analyzed for implementation. Detailed Engineering will be performed.

Table 8.1 (Continued)

Options	Probability	Issues or Concerns	Cost Estimate	Plan going forward
Air Blending by CSU	low	To make this option an assent, natural gas capacity is needed from the non-air blended line. This option can be added in conjunction with either of the propane air plants listed above, or as a standalone. Both peak demand and baseload can be served.	Cost < $1.00/Mscf-month (compared to CIG $3-$5/Mscf-month)	While the probability for the current period is low, this option may be reviewed for the longer term needs.
DSM Study	high	Perform a comprehensive natural gas Demand Side Management study to identify valuable options.	To be determined	Perform study to include results in future GIRP revisions.

Conclusion

Options to be analyzed further for possible implementation within this GIRP cycle are:

1. Restore the historic Propane Air Plant and increase capacity rating through targeted maintenance and equipment upgrades, to provide an additional 500 Mscf / hour (12,000 Mscf / day) of supply capacity. This option provides a permanent additional supply resource to the CSU system on both an hourly and daily basis. This provides a cost effective way to manage peak load (occasional use).

2. Construct an additional Propane Air Plant to provide 1,000 Mscf / hour (24,000 Mscf / day) of capacity above and beyond that of current Propane Air Plant. Similar to the existing PA plant, this option provides a permeant addition to the CSU supply portfolio for peak-day and peak-hour demand. Plant shall be strategically located near CIG pipeline. A new propane air plant takes approximately two years to build and commission.

3. Initiate a new Demand-Side Management (DSM) study to examine the ability of the existing conservation measures to create sustainable reductions in natural gas demand. Additionally, new ways to decrease peak usage will be identified and explored.

Appendix A - Economic Outlook

Certain local economic conditions impact the behavior of specific rate classes in our service territories. Therefore, we incorporate those variables into the forecast models. The following section lists the economic variables used in the models and describes each variable's impact on the forecast. Each economic variable is also assigned an elasticity, or sensitivity, which measures how the percent change in one variable impacts the percent change in another.

Population

The basis for the residential and commercial customer forecasts is the population forecast developed by Moody's Analytics. In past years, CSU has assumed a very strong correlation between population growth and customer growth. However, in the 2015 forecast, CSU has changed this assumption to an elasticity of 0.7. This means that for every 1% change in the population forecast, CSU assumes that the number of customers will grow by 0.7 of that, or 0.7%. The graph and table below illustrate Moody's population forecast for El Paso County, which projects an average increase of 1.5% over the next ten years. Based on this data and our elasticity assumption of 0.7, CSU is forecasting customer growth at around 1%, depending on the service.

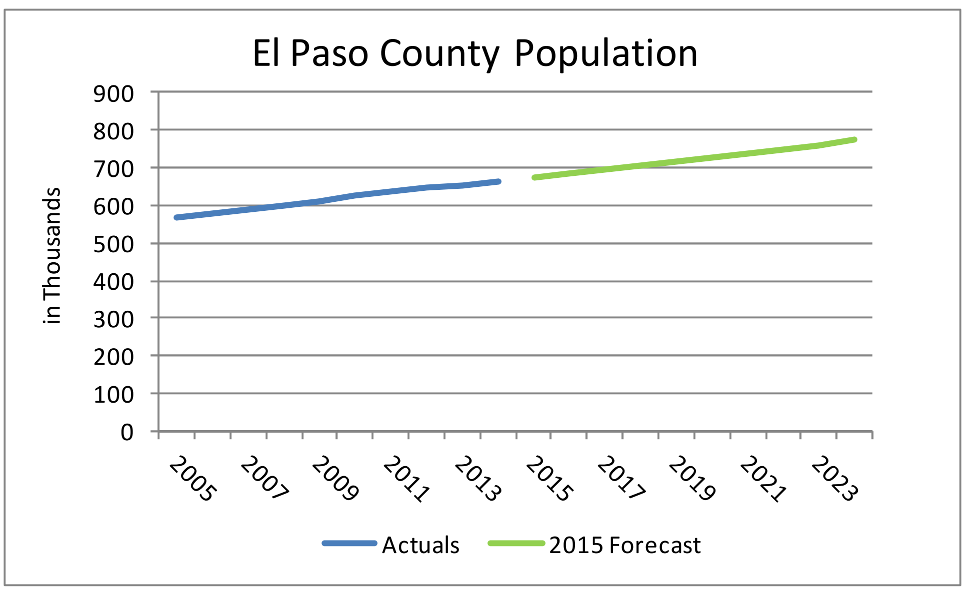


Figure A.1: El Paso County Population Growth Forecast
Graph shows past population growth for El Paso County dating back to 2005 and projected population growth going forward to 2023.

El Paso County Population Average Growth Rates		
Forecast Time Frame	2015 Forecast	2014 Actual
Current Year Forecast	1.5%	1.4%
10-Year Historical	1.8%	
5-Year Forecast	1.5%	
10-Year Forecast	1.5%	

Table A.1: El Paso County Population Average Growth Rates
Source: Moody's Economics.

Household Size

The number of people per household is an important economic indicator of utility usage. According to the Moody's forecast in the graph below, household size in El Paso County will decline over the next 10 years. The 10-year forecast for household size is an average decrease of -0.3%. CSU expects this to flow through as a decrease to use-per-customer in the residential forecasts. The elasticity used in modeling usage and household size varies slightly between services, but is approximately 0.2 for all.

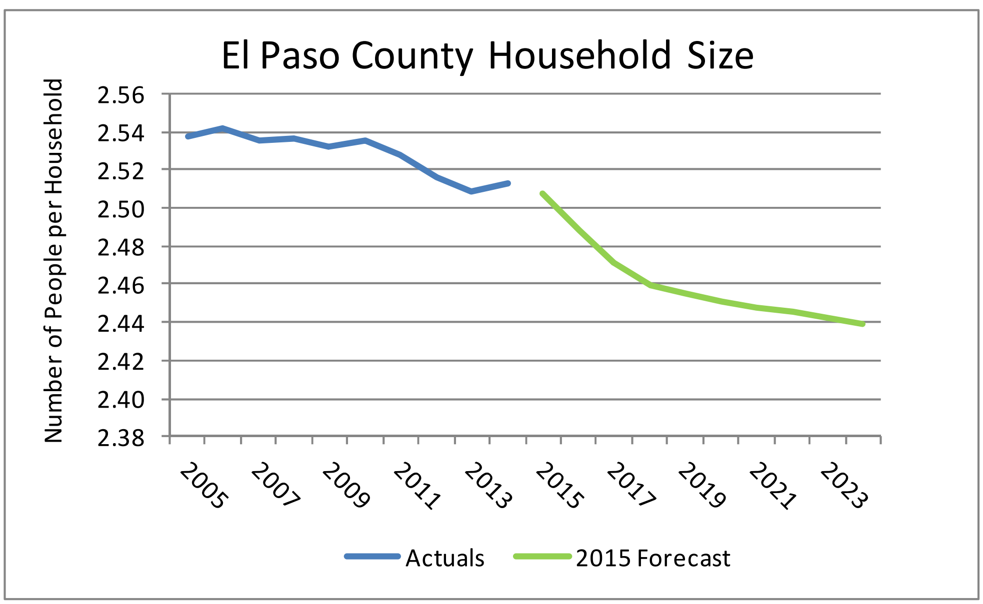


Figure A.2: El Paso County Household Size Forecast
Graph shows past household size in El Paso County dating back to 2005 and projected household size going forward to 2023.

El Paso County Household Size Average Growth Rates		
Forecast Time Frame	2015 Forecast	2014 Actual
Current Year Forecast	-0.2%	0.2%
10-Year Historical	-0.1%	
5-Year Forecast	-0.5%	
10-Year Forecast	-0.3%	

Table A.2: El Paso County Household Size Average Growth Rates
Source: Moody's Economics.

Household Income

Household income also impacts utility usage. The elasticity used in modeling usage and household income varies between services, but is minimal. CSU's service territories cover several geographic areas, each with varying demographics and construction. Higher income does not necessary correlate to higher usage, as the higher income could indicate a higher efficiency home. Conversely, a lower household income could have higher usage due to inefficient appliances and construction. Regardless of the various scenarios, the assumption is that there is a positive correlation between household income and usage. The graph below illustrates Moody's household income forecast for El Paso County that has been indexed to a base year. The purpose of calculating index values is to provide a baseline to compare changes. The 10-year forecast for household income is an average increase of 0.9%. We expect this to have a positive impact on residential use-per-customer.

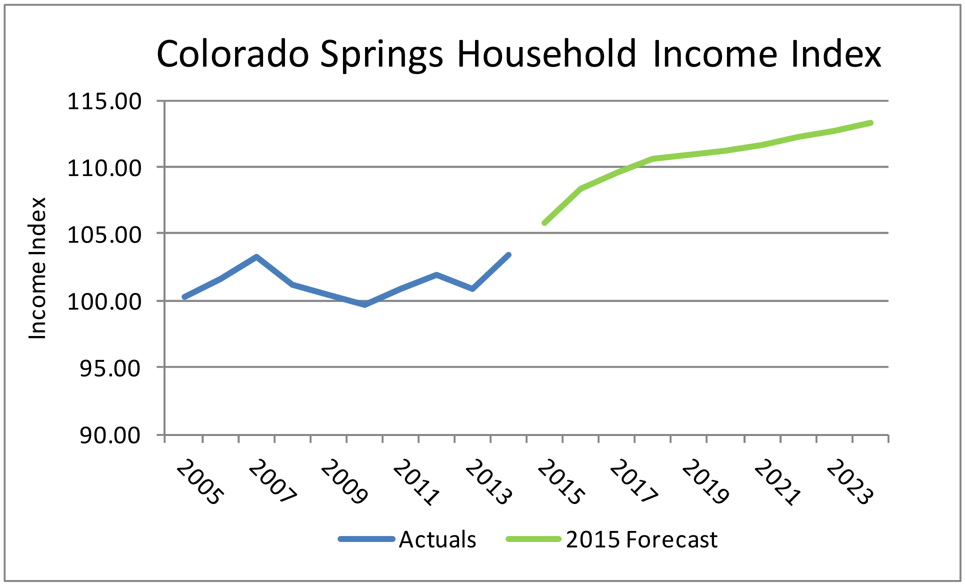


Figure A.3: Colorado Springs Household Income Index
Graph shows past household income in Colorado Springs dating back to 2005 and projected household income going forward to 2023.

Colorado Springs Household Income Index Average Growth Rates		
Forecast Time Frame	2015 Forecast	2014 Actual
Current Year Forecast	2.3%	2.6%
10-Year Historical	0.4%	
5-Year Forecast	1.4%	
10-Year Forecast	0.9%	

Table A.3: Colorado Springs Household Income Index Average Growth Rates
Source: Moody's Economics.

Total Employment

Local economic indicators predict continued economic recovery from the 2008 recession. Total employment is a variable used in the commercial sales models. As the graph below illustrates, Moody's data forecasts employment growth for El Paso County. The 10-year forecast for total employment is an average increase of 0.8%, which we expect will translate to commercial sales growth.

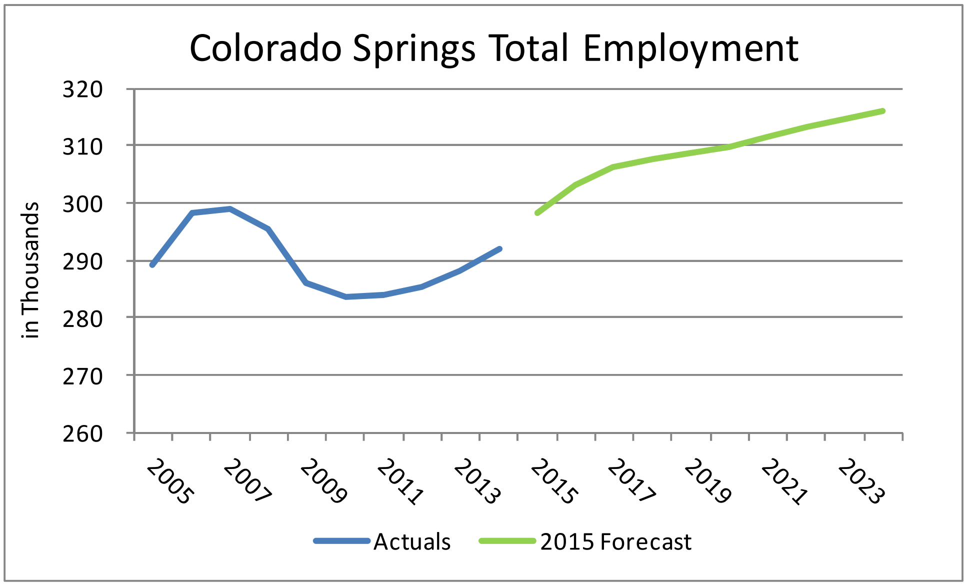


Figure A.4: Colorado Springs Total Employment
Graph shows past number of people employed in Colorado Springs dating back to 2005 and projected number of people employed going forward to 2023.

Colorado Springs Total Employment Average Growth Rates		
Forecast Time Frame	2015 Forecast	2014 Actual
Current Year Forecast	2.2%	1.4%
10-Year Historical	0.4%	
5-Year Forecast	1.1%	
10-Year Forecast	0.8%	

Table A.4: Colorado Springs Total Employment Average Growth Rates
Source: Moody's Economics.

Total GDP

The Gross Domestic Product (GDP) for El Paso County is another economic indicator related to commercial sales. GDP represents the total dollar value of all goods and services produced over a time period. Again, Moody's data forecasts GDP growth for the local economy. The 10-year forecast for total GDP is an average annual increase of 2.2%, as illustrated in the graph below.

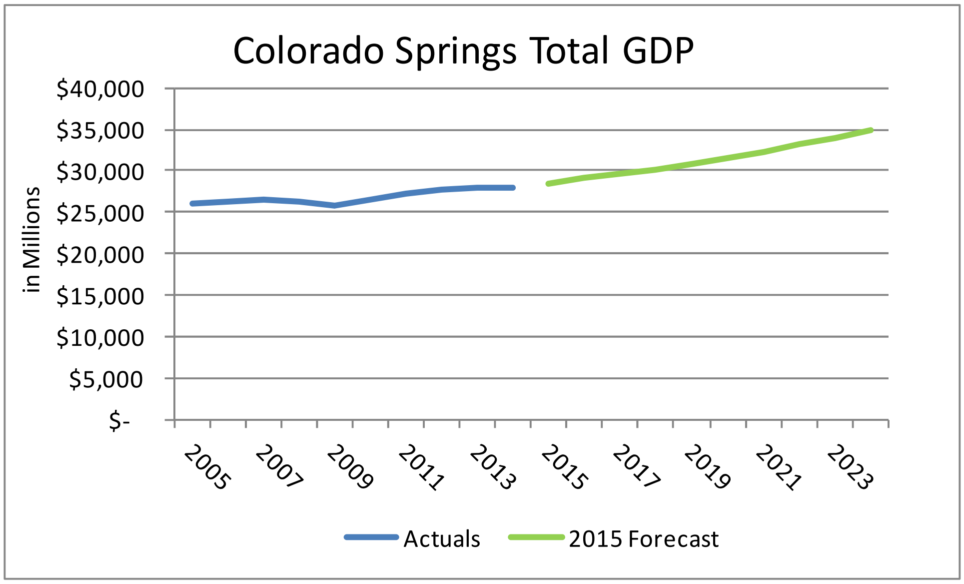


Figure A.5: Colorado Springs Total GDP
Graph shows past GDP for Colorado Springs dating back to 2005 and projected GDP going forward to 2023.

Colorado Springs Total GDP Average Growth Rates		
Forecast Time Frame	2015 Forecast	2014 Actual
Current Year Forecast	1.3%	0.1%
10-Year Historical	1.2%	
5-Year Forecast	1.9%	
10-Year Forecast	2.2%	

Table A.5: Colorado Springs Total GDP Average Growth Rates
Source: Moody's Economics.

Summary

In summary, the local economic outlook is positive for El Paso County and Colorado Springs. Although household size is projected to decrease over the 10-year forecast horizon, the population, along with household income, continues to grow and have a positive impact on residential sales. Additionally, employment and GDP is improving, which will positively impact commercial sales. The growth rate for each of these economic indicators is summarized in the following table:

Local Outlook 10-Year Forecast	
Assumption	**2015 Forecast**
Population Growth	1.5%
Household Size	-0.3%
Household Income	0.9%
Total Employment	0.8%
Total GDP	2.2%

Table A.6: Colorado Springs 10-Year Forecast
Table shows a summary of the 10-year growth forecast described above for El Paso County in terms of population growth, household size, household income, total employment, and total GDP. Source: Moody's

Appendix B – Weather Data

Usage for CSU's electric, natural gas and water services is predominately driven by weather. The summer heat can drive higher electricity usage, the natural gas usage is higher during colder temperatures, and water sales are highest when we experience a hot, dry summer. Considering the weather volatility in CSU's service territory, forecasting usage based on weather for even the next month can be very difficult, and reliable weather forecasts are not available for this purpose.

Normal Weather

The forecasts are based on normal weather, which is the average daily temperature over a defined period of time. CSU's Sales and Load Forecasting team assessed the accuracy of using different weather normal periods, and a 15-year normal weather variable was confirmed by a review of the model statistics as the best fit for our data. CSU calculated normal weather by averaging the average daily temperatures over the past 15 years. Defining normal weather is important because it provides a baseline to compare actual weather to and allows CSU to quantify variances related to weather.

Weather and Usage

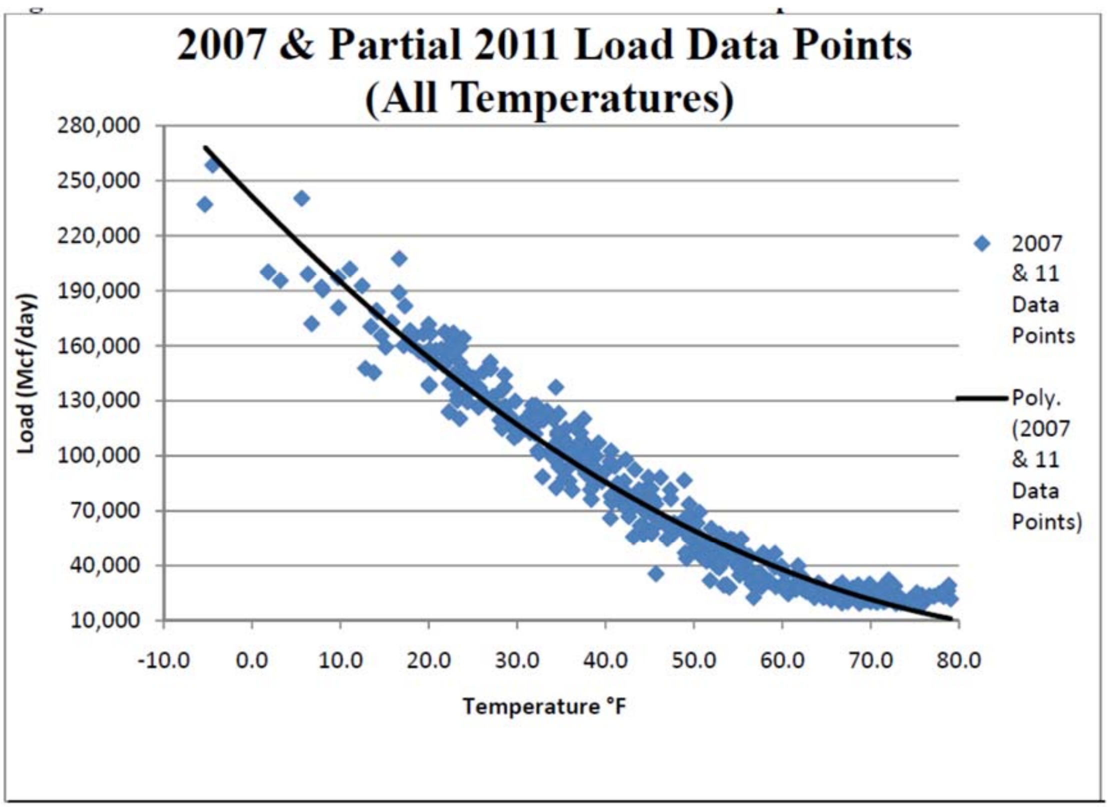
Weather impacts the usage of some rate classes more than others. Residential and commercial customers are most heavily influenced by the weather because of the need to heat and cool their homes and offices. The industrial rate classes are the least weather-dependent, as their energy use is primarily driven by production needs. More detail will be provided on the relationship between weather and usage in the "by-service" forecast sections.

Appendix C – Load Forecast Study

Load versus Temperature Trends

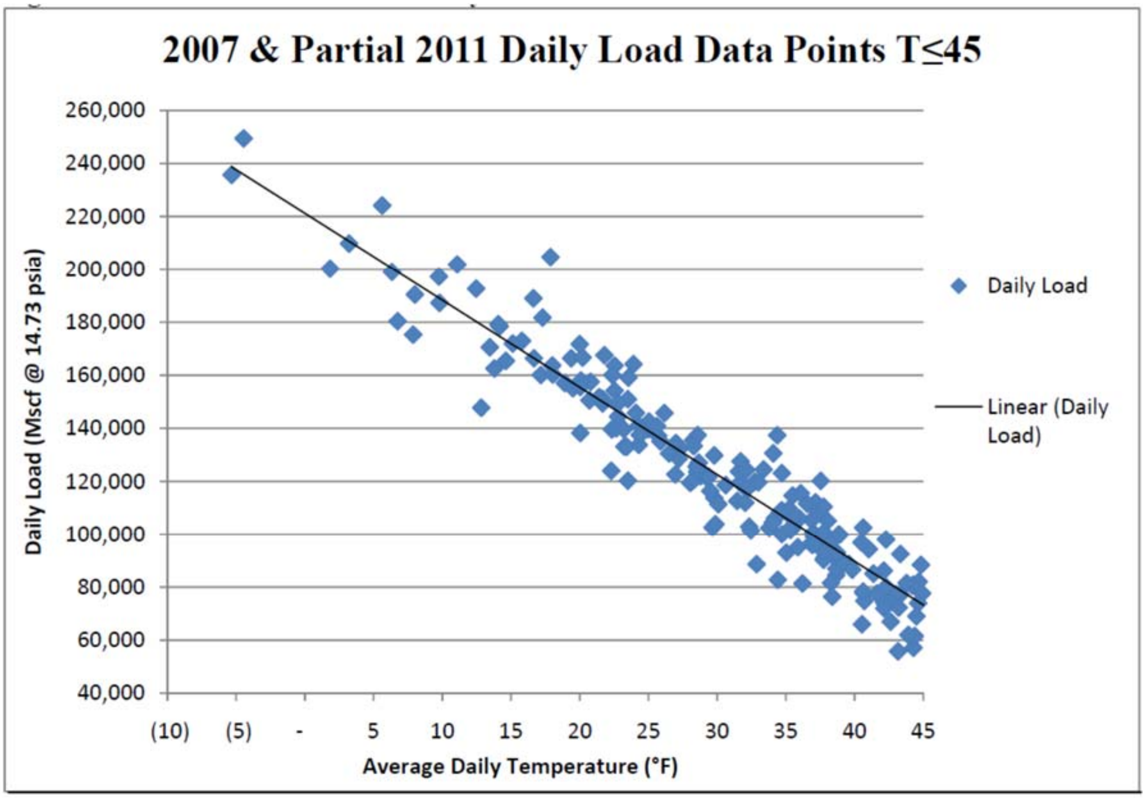
Colorado Springs Utilities understands that demand is a function of customer base usage plus customer weather sensitive usage. Therefore, the goal for a use per customer forecast is to develop base and weather sensitive demand coefficients that can be combined and applied to heating-degree-day (HDD) weather parameters to reflect average use per customer. This produces a very reliable forecast because of the high correlation between usage and temperature as depicted in the example scatter plot in Figure C.1. Note the base load is the flat trend of the chart where the temperatures are warmer than 65° F and then the line slopes upward as the heat sensitive load grows with warmer temperatures. The daily base load for Springs Utilities' distribution system for calendar year 2010 was 17,800 Mscf (14.73 psia).

Figure C.1: 2007 & Partial 2011 Load Data Points All Temperatures



Note in Figure C.2, that the trend becomes linear when the data set is limited to temperatures less than or equal to 45° F which is indicative of the growth in heating load as temperatures decline.

Figure C.2: 2007 & Partial 2011 Daily Load Data Points T≤45



Corporate Load Forecasting Details

The following regression coefficients and equation for peak day gas use per customer was used to forecast the peak-day load for the GIRP.

Table C.1: Gas Peak Day Equation

2011 Gas Peak Day Equation (regressing UPC)				
Forecast Model for Use_per_cust				
Regression(7 regressors, 0 lagged errors)				
Term	Coefficient	Std. Error	t-Statistic	Significance
--				
HDD_GAS_DAY	0.016407	0.000209	78.515018	1.000000
HDDLAG1	0.001911	0.000212	9.003215	1.000000
AVG_WIND_CHILL_	0.000371	0.000123	3.015601	0.997435
AVG_WIND_SPEED	0.004647	0.000474	9.802538	1.000000
JAN	0.020887	0.005112	4.085962	0.999956
FEB	0.020346	0.005201	3.912147	0.999908
DEC	0.018666	0.005275	3.538900	0.999598

Peak-Day Use Per customer = 0.016407*Gas Day HHD + 0.001911*Prior Gas Day HDD + 0.000371*Wind Chill + 0.004647*Wind Speed + 0.020887*Jan + 0.020346*Feb +0.018666*Dec

The design day variables are then plugged in and multiplied by customers to get peak-day.

Variable descriptions:

HDD_Gas_Day is the heating degree days for the gas day data based on 65°F HDDLAG1 is the heating degree days for the previous gas day data AVG_WIND_CHILL is the average wind chill for the current gas day (°F) AVG_WIND_SPEED is the average wind speed for the current gas day (mph)JAN, FEB, DEC is a binary variable where a 1 is entered if the data point came from one of those months

Methodology Review

The analysis for developing peak daily/hourly load planning criteria is based upon single and multiple factor linear regression analysis. Several different approaches were evaluated in an effort to improve the comparison with forecasted versus actual peak loads. Peak daily/hourly load records were broken in February 2011, which created a current reference for comparison. Weather and hourly load data were available for calendar years 2001-2010 and through March 2011. Weather data is normally captured on calendar day and load data is normally stated in gas day (8 a.m. to 8 a.m. standard time), so some minor deviations were created by that time offset. The analysis looked at data through multiple lenses as described below:

Data Set

Regressions were compared using data sets based upon load (e.g. >160,000 Mscf/day) and for average temperature (e.g. all temperatures or temperatures below some value e.g. 60°F, 45°F). Looking at data plots for all temperatures indicated that the profile was curvilinear when all temperatures were included. The trend became linear at average temperatures below 65° F, which is indicative of the point where temperature sensitive heating load starts. Regression results of looking at loads >160,000 Mscf/day tended to underestimate actual 2011 loads at temperatures below zero° F and overestimate loads at temperatures from 0-10° F. Comparative results were better using data sets where the temperatures were less than 45° F. Results varied from individual year to year, with the 2007 data providing the highest load results and best comparisons to 2011 actual. However, the 2007 data set didn't include any data where the average daily temperature was below zero, so the data set used for most analysis was a combination of 2007 data and the data from the first three months of 2011.

Customer Count

Logically, the daily loads increase as the number of customers increase. So when using multiple year data in regression analysis, the thinking was that by using the number of customers as a variable in a multiple factor regression, the respective coefficient should compensate for the load differences year to year. The results didn't support the hypothesis as the coefficient for customer count didn't compensate for what is projected in other analysis by Gas Planning and Design. The customer adjustment was only in the neighborhood of 0.08 Mcf/day/customer where a more realistic number is 0.80 Mcf/day/customer.

Wind Effects

Adding wind or wind chill as a variable along with average temperature increased the peak load predictions and improved correlation both statistically and comparatively to 2011 actual. Results were nearly identical for wind speed versus wind chill.

Day-of-Week

Correlations and comparison to 2011 data improved when weekend data was eliminated from the data set.

Minimum Temperature

Regression statistics improved slightly when minimum temperature was added as a factor for daily forecasts. However, minimum temperature assumptions are difficult to forecast, so minimum temperature was not included as a factor in the final planning criteria.

Hour-of-Day

For peak-hour forecasts, there was substantial improvement in correlations and comparison to 2011 actual by using data for hours 4-9 a.m. or 6-9 a.m. when the peak-hour normally occurs. The 2007 and 2011 population combination provided better 2011 comparative results than the 2006 and 2011 population combination.

Interruptible customer loads were considered to be in the data as interruptible customers were only curtailed in recent years for portions of gas day January 31 and February 2, 2011 and for the entire day February 1, 2011.

Tables C.2 and C.3 indicate the improvement in statistical results looking at daily and hourly loads through differing lenses. The forecasted peak loads were based upon a -13° F average daily temperature and a -25° F minimum hourly temperature for the respective load forecasts. (Notation – "Mcf" represents 1,000 standard cubic feet @ 14.73 psia and 60° F, "WDO" stands for weekdays only.)

Table C.2: Regression Statistics 2007 and 2011 Daily Load Data

Data Set - T<45									
	Day of						Std Error	Load Calc (Mscf/d @ -13°F)	
2007 & 11	All	Y	-	-	0.9564	0.9147	11,110	263,921	196
2007 & 11	WDO	Y	-	-	0.9632	0.9278	10,582	269,765	134
2007 & 11	All	Y	Y	-	0.9632	0.9277	10,253	275,103	196
2007 & 11	WDO	Y	Y	-	0.9690	0.9389	9,771	279,395	134
2007 & 11	All	Y	Y	Y	0.9711	0.9431	9,126	283,370	196
2007 & 11	WDO	Y	Y	Y	0.9760	0.9526	8,641	287,131	134

Table C.3: Regression Statistics 2007 and 2011 Hourly Load Data

Data Set - T<45								
Year(s)	Days/Hours	Min T°	Wind Chill	Correlation	R^2	Std Error (Mscf)	Load Calc (Mscf/hr @ -25°F)	Observations
2007 & 11	All/All	Y	Y	0.8474	0.7181	1,048	13,134	5,064
2007 & 11	WDO/4-9	Y	Y	0.8807	0.7756	1,028	14,834	1,112
2007 & 11	All/6-9	Y	Y	0.8919	0.7955	917	14,886	1,009
2007 & 11	WDO/6-9	Y	Y	0.9023	0.8141	908	15,129	721
2006-11	All/All	Y	Y	0.8151	0.6440	1,036	12,877	19,987
2006-11	WDO/All	Y	Y	0.8206	0.6733	1,055	13,075	14,199
2006-11	WDO/4-9	Y	Y	0.8227	0.6768	1,180	14,514	4,455
2006-11	WDO/6-9	Y	Y	0.8363	0.6992	1,114	14,757	2,874

Figure C.3 indicates the differences of data sets of the previous forecast (based upon loads

>160,000 Mscf/day) versus a data set of loads where the temperature was less than 45° F. Figure C.4 also illustrates the load increase, the line shifts upward, of adding wind chill to the regression analysis and additionally the impact of limiting the data set to weekdays only.

(Notation – "wc" represents wind chill, "WS" represents wind speed, "Int" stands for interruptible customer loads.)

Figure C.3: Peak Day Load Forecast versus Temperature Different Data Set Scenarios

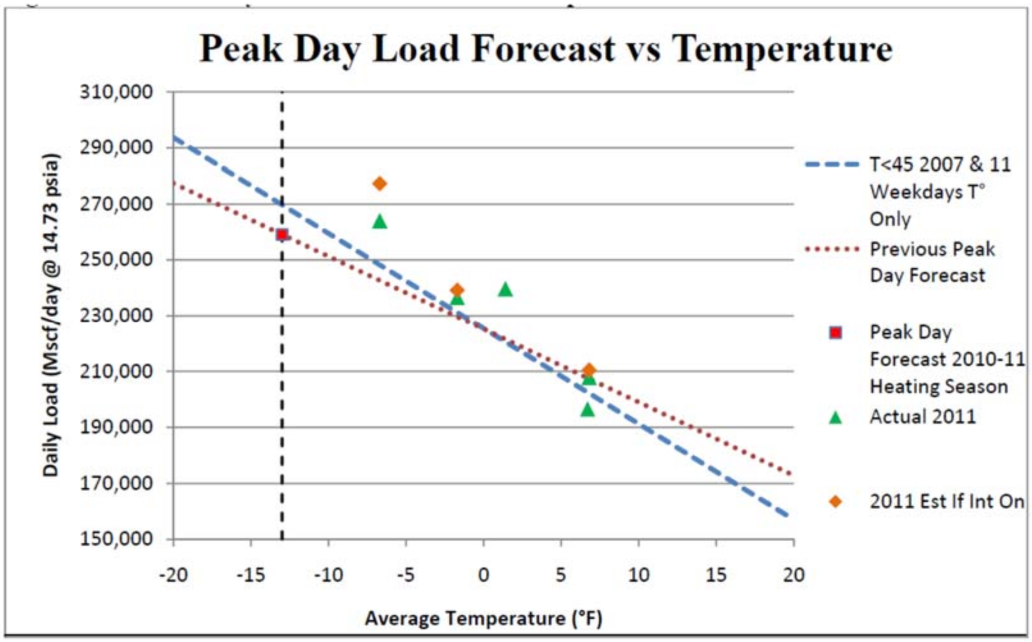
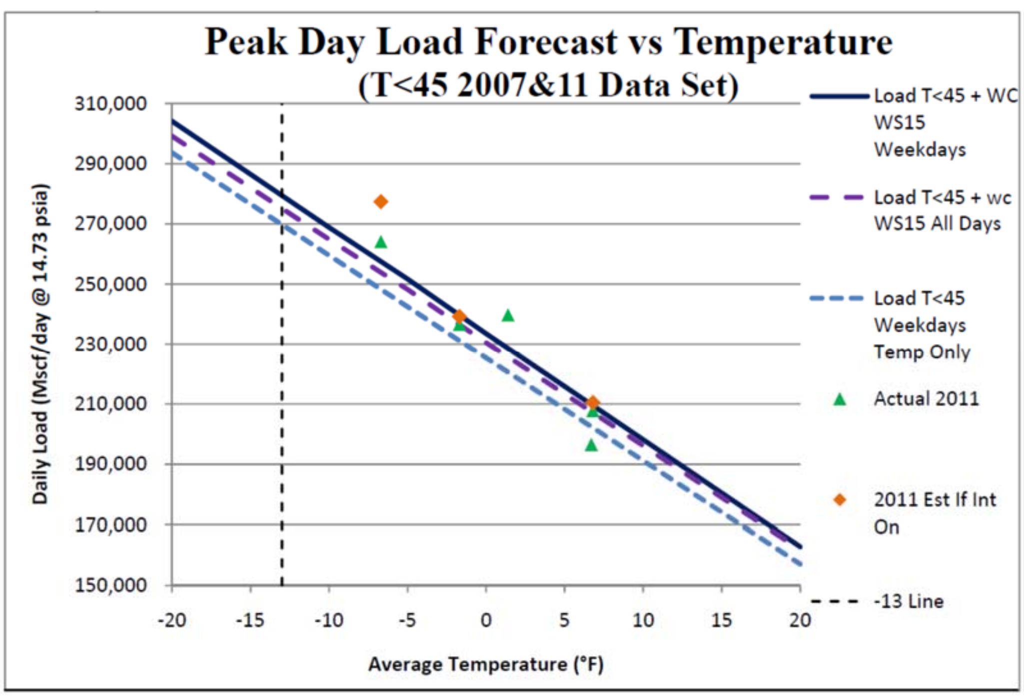


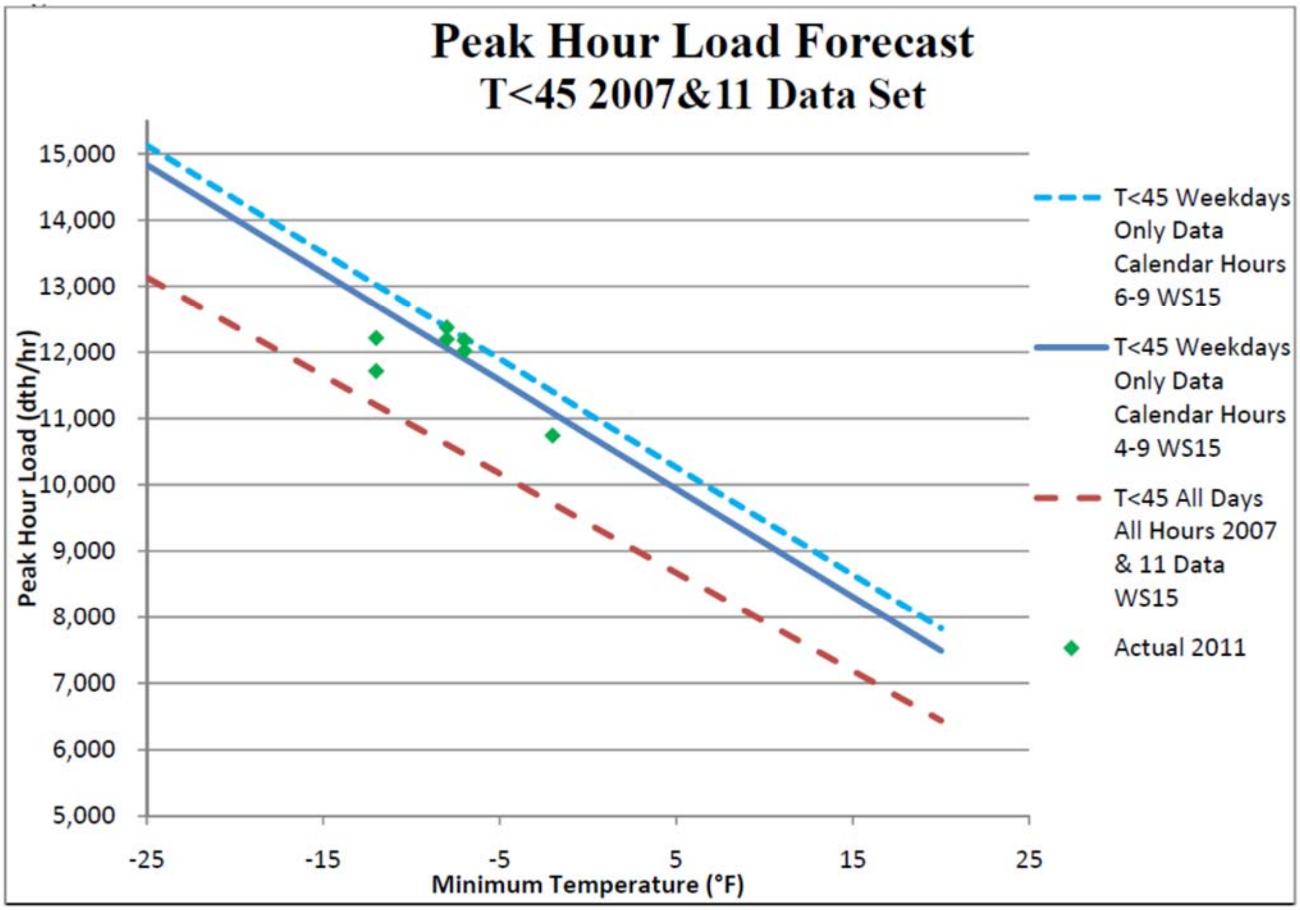
Figure C.4: Peak Day Load Forecast versus Temperature Adding Wind & Filtering



Weekdays

Figure C.5 indicates the increases in peak-hourly load by limiting the data set to hours 4-9 and 6- 9 when the peak-hours tend to occur.

Figure C.5: Peak Hour Load Forecast



Historic Load/Weather Data

Historic data listed in Table C.4 was the basis for selecting -13° F as the average daily temperature chosen for peak day planning criteria. The -13 temperature occurred three times in the period March 1983 to March 2011. ("Peak Factor" is the peak-hour divided by the load for the respective day and is an indicator used to compare peak loads from day-to-day and year-to-year, "Gas Day" is from 8:00 a.m. of date shown to 8:00 a.m. of next day)

Table C.4: Historic Peak Day Data

	Daily Load Mscf (14.73 psia)	Ave Temp	Ave WC	Peak WC	Ave WS	Peak WS	Peak Hour Mscf (14.73 psia)	Peak Factor (unit less)
01/31/2011	207,997	6.8	-15.7	-33	21	24	12,280	0.059
02/01/2011	264,110	-6.7	-27.3	-35.2	16.0	26.0	12,236	0.046
02/02/2011	236,603	-1.7	-12.4	-21.5	10.0	11.0	12,018	0.051
02/08/2011	241,126	1.4	-11.5	-20.2	10.0	16.0	12,180	0.051
02/09/2011	196,639	6.7	-3.6	-16.3	1.0	11.0	10,743	0.055
12/08/2009	235,149	-1.5	-15.2	-26.0	13.0	28	11,926	0.051
02/01/2007	208,719	7.3	-6.8	-22.0	11.7	19	12,114	0.058
02/02/1996	187,857	-7.0	-18.7		5.0	13	9,702	0.052
12/24/1992	156,895	16.0	-2.4		24.0	38	7,607	0.048
12/23/1990	165,003	-2.0	-12.9		5.0	10	8,550	0.052
12/22/1990	172,110	**-13.0**	-21.6		3.0	6	9,008	0.052
12/21/1990	181,523	-16.0	-30.9		6.0	9	9,674	0.053
12/20/1990	166,442	-3.0	-18.8		9.0	12	7,993	0.048
02/05/1989	184,800	-9.0	-30.9		15.0	33	9,131	0.049
02/04/1989	190,450	**-13.0**	-31		9.0	16	8,939	0.047
02/03/1989	185,384	-10.0	-30.8		13.0	17	9,342	0.050
02/01/1985	162,530	-8.0	-21.4		6.0	12	8,217	0.051
12/24/1983	161,750	**-13.0**	-23.9		4.0	10	7,767	0.048

Note – Table C.4 above lists Gas Day Data 8:00 a.m. of date shown to 8:00 a.m. the following day. The peak hour listed on Gas Day 1/31/2011 actually occurred on calendar day February 1, 2011.

Table C.5 provides the historic peak load and weather data for new records established in the cold weather events in February 2011 along with the previous records (highlighted in blue).

Table C.5: February 2011 Peak Day Data

Date	Load Mscf (14.73 psia)	Ave Temp (°F)	Ave WC (°F)	Peak WC (°F)	Ave WS (mph)	Peak WS (mph)	Peak Hour Mscf (14.73 psig)	Peak Factor (unit less)
01/31/2011	207,997	6.8	-15.7	-33	**21**	24	12,280	0.059
02/01/2011	264,110	-6.7	-27.3	-35.2	16.0	26.0	12,236	0.046
02/02/2011	236,603	-1.7	-12.4	-21.5	10.0	11.0	12,018	0.051
02/08/2011	241,126	1.4	-11.5	-20.2	10.0	16.0	12,180	0.051
02/09/2011	196,639	6.7	-3.6	-16.3	1.0	11.0	10,743	0.055
12/08/2009	235,149	-1.5	-15.2	-26.0	13.0	28	11,926	0.051
02/01/2007	208,719	7.3	-6.8	-22.0	11.7	19	12,114	0.058

Gas Day Data revised 4/25/2011

Appendix D – Executive Limitations

Colorado Springs Utilities Board Policy	
Category: **Executive Limitations**	Title: **ENTERPRISE RISK MANAGEMENT**
Date of Adoption: **July 21, 1999**	Policy Number: **EL – 11**
Revision: **5** **December 16, 2009**	

The Chief Executive Officer shall not cause or allow conditions, procedures or decisions which fail to identify, measure, monitor and manage, within established risk tolerances, potential events that may affect achievement of the Ends.

Accordingly, the CEO shall not:

1. Fail to establish and maintain a Risk Management Committee to ensure that duties associated with the identification, measurement, monitoring, management and reporting of risk on an enterprise-wide basis are fulfilled.

2. Fail to establish and maintain a written Enterprise Risk Management (ERM) Plan and an ERM program that includes management-level policies, procedures, and process controls to help ensure that enterprise-wide business risk exposures are properly identified, managed and reported to the Utilities Board. These business risks shall include at a minimum strategic, legal, financial, operational and hazard risks, some of which are separately addressed in greater detail below and in other Executive Limitations. The CEO shall not:

   A. Fail to maintain and operate under a written Energy Risk Management Plan that establishes appropriate internal controls, approval processes, training requirements, guidelines for minimizing risk, proper internal and external audits, and appropriate internal reporting to assure responsible compliance.

      a. Fail to use appropriate risk management techniques for acquisition or sale of energy that limits Springs Utilities exposure to price volatility.

      b. Allow the acquisition or sale of energy that would unreasonably jeopardize Springs Utilities' ability to meet customer needs.

   B. Fail to maintain and operate under a written Investment Plan which establishes investment scope, objectives, delegation of authority, standards of prudence, reporting requirements, internal controls, eligible investments and transactions, risk tolerance and safekeeping and custodial procedures for the investment of all funds of Colorado Springs Utilities.

C. Fail to maintain and operate under a written Financial Risk Management Plan that establishes objectives, internal controls, approval processes, guidelines for minimizing risk, proper internal and external audits, and appropriate internal reporting to assure responsible compliance.

D. Endanger the organization's public image or credibility, particularly in ways that would hinder its accomplishment of mission.

Semi-Annual Internal Monitoring
Semi-Annual External Monitoring

Appendix E - Glossary

Air-Blend Station

A station for blending natural gas (methane) with air. The natural gas distributed by Colorado Springs Utilities must first be air-blended, because undiluted/pure natural gas is too rich to burn in appliances at the altitude of the Colorado Springs area. It should be noted that air-blended gas is not the same thing as propane-air. Air-blended gas is air mixed with natural gas (methane) to dilute the natural gas. Propane-air is air mixed with propane to substitute or supplement natural gas.

Btu

British Thermal Unit – the amount of heat needed to raise the temperature of one pound of water by 1°F.

CCF

One hundred cubic feet – a unit of volume used to reference natural gas consumption on customer bills. One CCF serves approximately one person per day.

CF

A cubic foot – a unit of volume used to reference water consumption on customer bills. One cubic foot is equal to 7.48 gallons.

Colorado Interstate Gas Company (CIG):

A gas pipeline company with the only interstate pipeline serving the Colorado Springs area. Colorado Springs Utilities receives its gas from suppliers through the pipeline system that CIG owns and operates.

City Gate:

The point at which natural gas is transferred from a gas pipeline company, such as Colorado Interstate Gas, to a Local Distribution Company, such as CSU.

Common Carrier:

A company that transports goods or people via regular routes for any person or company at set rates, and which is responsible for any loss or damage to those goods or people along the way.

Compressor Station:

Along a gas pipeline system, stations which have one or more compressors. The stations take in the flow of the natural gas, which has lost pressure in the pipeline since leaving the last compressor station, and increase the pressure and rate of flow to ensure that the gas will continue to move along through the pipeline system.

CMC-2 (Firm Tallgrass Storage)

Is also a traditional storage service that was added to the gas portfolio in June 2014.

CNG:

Compressed Natural Gas.

Dekatherm or Dth

The quantity of heat energy equivalent to 1,000,000 British Thermal Units (MMBtu). One Dekatherm of gas is the quantity of gas which contains one Dekatherm of heat energy, reported on a dry MMBtu (or Dth) basis. Dth is the standard quantity unit for Nominations, Confirmations and Scheduled Quantities in the United States. For the purpose of Colorado Interstate Gas' Tariff, MMBtu and Dth are considered synonymous.

Design Day

A 24 hour period used to plan the capacity and service needs of a natural gas system.

Distribution

Delivery of gas within the Colorado Springs Utilities system to end users.

District Regulating Station

Stations within a gas service territory that modify the pressure for the gas end user. These stations are physically located fairly near the end user.

Dry Natural Gas

Natural gas (methane) that is free from liquids and impurities.

Demand-Side Management (DSM):

Techniques for modifying gas consumption at the point of the end-user.

End-User:

The actual user of the gas. In the case of Colorado Springs Utilities, end-users include not only residential customers heating their homes and cooking their food, and businesses heating their buildings and offices, but also occasional supplemental power for two of CSU's four electric power plants – Birdsall and Martin Drake.

Federal Energy Regulatory Commission (FERC):

A federal agency within the Department of Energy, charged with regulating interstate gas pipelines and interstate gas sales in accordance with the Natural Gas Act.

Firm Delivery/Firm Customer

The requirement that gas must be supplied to the customer in whatever volume is demanded. Most gas customers of Colorado Springs Utilities have a firm delivery requirement. This differs from interruptible customers, who have made an agreement with CSU to have their service interrupted when extra supply is needed to meet the demand from firm customers.

Firm Storage Young (FS-Y)

FS-Y service is a traditional gas storage service. Injections and withdrawals must be scheduled according to pipeline transportation scheduling cycles. While this service is used to balance supply and demand at the city gates, it must be scheduled each day, and is not an automatic balancing service.

This type of service is especially helpful over multi-day scheduling periods (e.g. weekends and holidays) and for known daily changes in the supply demand balance. The FS-Y service requires separate pipeline transportation for all injections and withdrawals. Young inventory balances must be reduced between June 1 and July 1 of each year to 49.4% or less.

G4T

Customer rate class for eligible customers who have contracted for an alternative source of gas supply and have requested Colorado Springs Utilities to transport such alternative gas for the customer's account.

Gas Day

A 24-hour period during which gas service is measured. CSU's gas day begins at 8:00am of the date shown to 8:00am the following day, standard time.

Gas Transmission Grid

The extensive and complex system of transmission pipes used to transport gas throughout the country.

Gathering Line

A relatively small pipeline that carries natural gas from the original point of extraction (well or oil field) to either the mainline transmission grid or to a gas processing plant.

GIRP

Gas Integrated Resource Plan – a comprehensive long-term plan used to assess the resources and systems of Colorado Springs Utilities, the needs of its customers, and the resources or system modifications required to continue to meet those needs into the future.

HDD

Heating-Degree-Day – the amount of energy required to heat a building to 65°F based on outside air temperatures. For example, if the outside temperature is -13°F, the 78 HDD.

Home Rule Municipal Corporation

A local government that operates and makes decisions independent of state government.

Home Rule Charter

The guiding document for an independent local government, and gives that government the authority to operate. It is equivalent to a constitution.

Interruptible Customer

Interruptible customers sign agreements with CSU to have their service temporarily suspended when needed in order to meet the demands of other customers. In exchange, they pay a lower rate for their gas. An interruptible customer is typically an entity that has made the decision that they can accept a temporary interruption in service or an entity with an alternative fuel supply or backup fuel supply.

Interstate Pipeline

A gas transmission pipeline which moves natural gas between two or more states.

Intrastate Pipeline

A gas transmission pipeline which moves natural gas within one state.

Line Pack

The practice of "packing" gas into the delivery system during low use by allowing pressure in the system to build. Line pack is a technique that is used in the gas industry to meet a predicted short-term spike in demand through pipelines that generally accommodate less gas at lower pressures.

Liquefied Natural Gas (LNG)

Methane that has been cooled to liquid form (-260°F). LNG has a high energy density, and can later be heated to "vaporize" it for use when needed.

Local Distribution Company (LDC)

A utility which purchases gas from suppliers and then handles the processing, management and distribution of that gas within a specific region. Colorado Springs Utilities is an LDC.

Load

Synonym for demand, the amount of gas required by the system of customer.

Mainline Transmission System

The wide diameter pipelines networked throughout the U.S. that are used to carry natural gas from the point of extraction, processing plants and other receipt points to service areas.

Mscf

1,000 standard cubic feet of Gas at a pressure of 14.73 psia and at a temperature of 60°F. As a point of interest, Colorado Interstate Gas' reporting basis for gas transactions is thermal and Colorado Springs Utilities reports in measured volume.

Methane

The main component (ca. 95%) in natural gas, a hydrocarbon, with the chemical notation CH_4. It is colorless, odorless and efficient. CSU adds an odorant to the methane supplied to its customers as a safety measure in the event of gas leaks.

No-Notice-Transportation (NNT)

No-Notice-Transportation is a transportation and storage service that automatically balances long and short deliveries to the city gates. If CSU's selected supply for the day is less than actual loads for the day, CIG will automatically remove gas from NNT storage to make up the balance. If CSU's selected supply for the day is delivered to city gates, but is higher than actual loads for the day, CIG will automatically inject the excess volume into storage, crediting CSU's NNT storage account for future use, but also charging an injection fee.

Peak-Day

The theoretical day representing a one-in-twenty-five year cold weather event (therefore worst case scenario for the natural gas usage) and the corresponding expected demand. Peak-day is used in the gas industry for planning purposes.

Peak-Hour

Peak-hour is a subset of the Peak-Day, again representing a one-in-twenty-five year cold weather event. Peak-hour is used in the gas industry for planning purposes.

Peak Shaving

Supplementing the regular natural gas resources such as transportation capacity and storage with an additional source such as propane-air in order to meet demand during peak periods. Peak shaving is a technique that is used in the gas industry to meet demand on systems when use is significantly higher than usual such as in extreme cold weather.

Pipeline Company

A company that owns and operates one or more gas transmission pipelines. The pipeline company does not own the gas that is in the pipelines, but allows suppliers to transport their gas through the pipelines to purchasers such as Local Distribution Companies.

Processing Plant

A plant where impurities, water and other liquids are removed from "raw" natural gas to create pipeline quality natural gas.

Propane

A hydrocarbon, with the chemical notation C_3H_8. Propane is abundant, has a higher energy density in liquid form than liquefied natural gas (methane), and is easier to store in liquid form than liquefied natural gas, due in part to propane's boiling point of - 43°F (contrasted with methane's boiling point of -260°F).

Propane-Air

Propane blended with air in specifically calculated proportions to produce a gas that is "interchangeable" with methane, or natural gas. Propane-air can be used as part of the base load supply or for "peak shaving."

Propane-Air Station

A station where propane is blended with air in specifically calculated proportions to produce a gas that is "interchangeable" with methane, or natural gas.

p.s.i.

Pounds per square inch – the pressure resulting from one pound of force being applied to an area of one square inch.

p.s.i.a.

Pounds per square inch absolute– a measurement that is used to make it clear that the pressure is relative to a vacuum rather than to the ambient atmospheric pressure.

Transmission

Delivery of gas from the supplier to a Local Distribution Company such as Colorado Springs Utilities.

Transportation Firm (TF)

Firm transportation service is predominantly contracted on a year-round basis and is used for core deliveries to Colorado Springs Utilities' city gate and storage facilities. The service cannot be interrupted without notice, but can be limited when system or flowing supply constraints occur on CIG's system. Gas volumes must be selected by CSU on a daily basis, and the volumes are transported to Colorado Springs Utilities' account for that day. This service limits hourly deliveries to 1/24th of the scheduled quantity for a specific gas day. Limited firm transportation service is available on a seasonal basis. Colorado Springs Utilities temporarily releases Transportation Firm capacity (the reservation of the gas, not the gas itself) to third parties to earn revenue on the asset when it is not needed for customer use.

Underground Storage

The storage of gas from the pipeline in underground formations during low usage months. This gas can then be re-injected into the system during high usage months. Underground storage is a technique that is used in the gas industry to smooth out both weekend loads when supplies are generally not available as well as the load difference form summer and winter months due to heating.

Wet Natural Gas

"Raw" natural gas that has not been properly processed and still contains liquids and impurities. Wet natural gas may include not only methane, but other hydrocarbons such as ethane, propane, butane and pentane, and non-hydrocarbons such as water, carbon dioxide, helium, hydrogen sulfide and nitrogen.