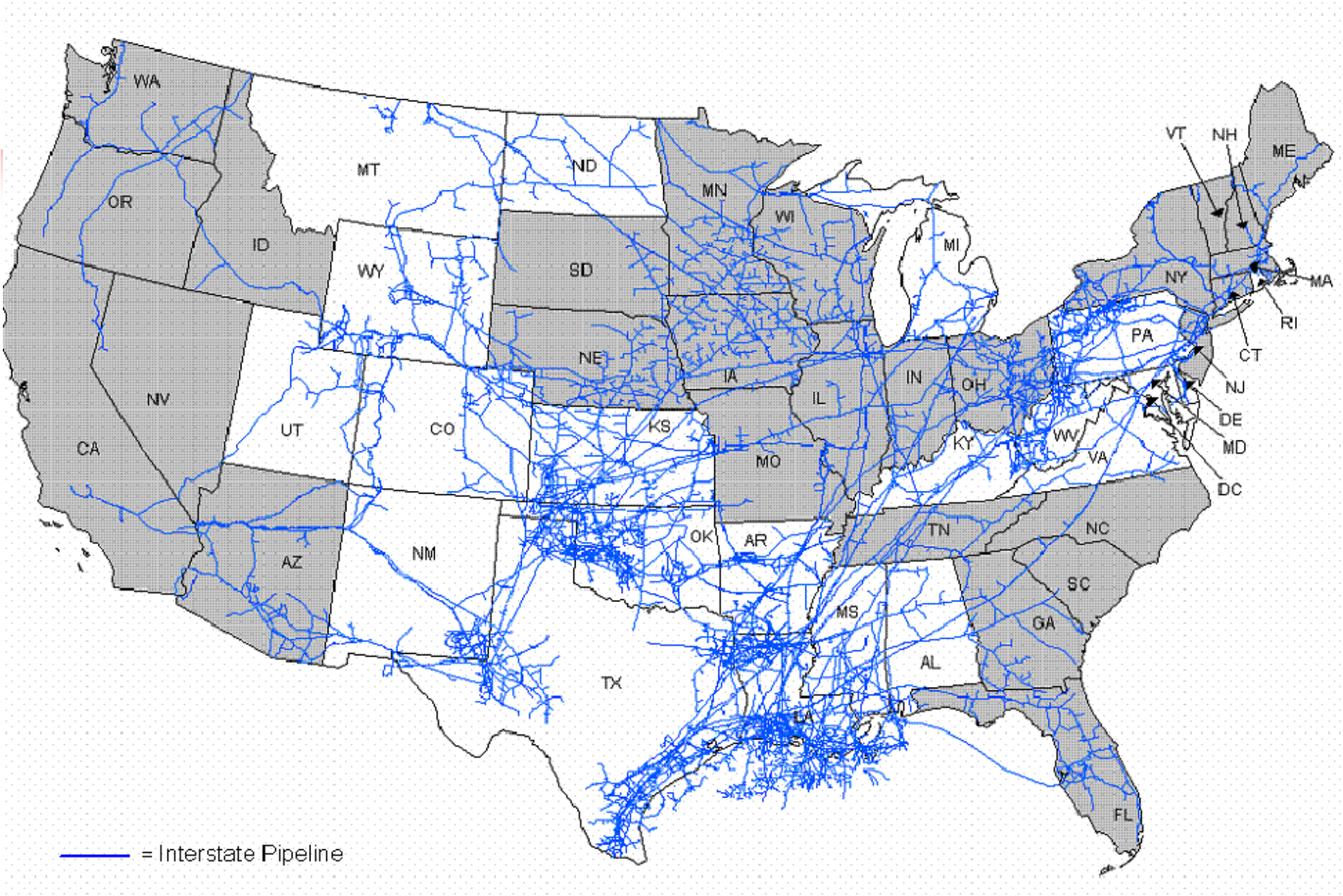
Structure of Natural Gas Market Sector in the United States

- Paul Metro – Pennsylvania Public Utility Commission

States in grey which are at least 80% dependent on the interstate pipeline network for their natural gas supply are:

New England - Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Southeast - Florida, Georgia, North Carolina, South Carolina, Tennessee
Northeast - Delaware, Maryland, New Jersey, New York, District of Columbia
Midwest - Illinois, Indiana, Minnesota, Ohio, Wisconsin
Central - Iowa, Missouri, Nebraska, South Dakota
West - Arizona, California, Idaho, Nevada, Oregon, Washington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= Interstate Pipeline

Interstate Natural Gas Pipeline Segment

•Two-thirds of the lower 48 States are almost totally dependent upon the interstate pipeline system for their supplies of natural gas.

•On the interstate pipeline grid, the long-distance, wide-diameter (20-42 inch), high capacity trunk-lines carry most of the natural gas that is transported on the national network. In 2005, 85 percent of the 48 trillion cubic feet of gas transported throughout the United States moved through facilities owned by the major interstate pipeline companies.

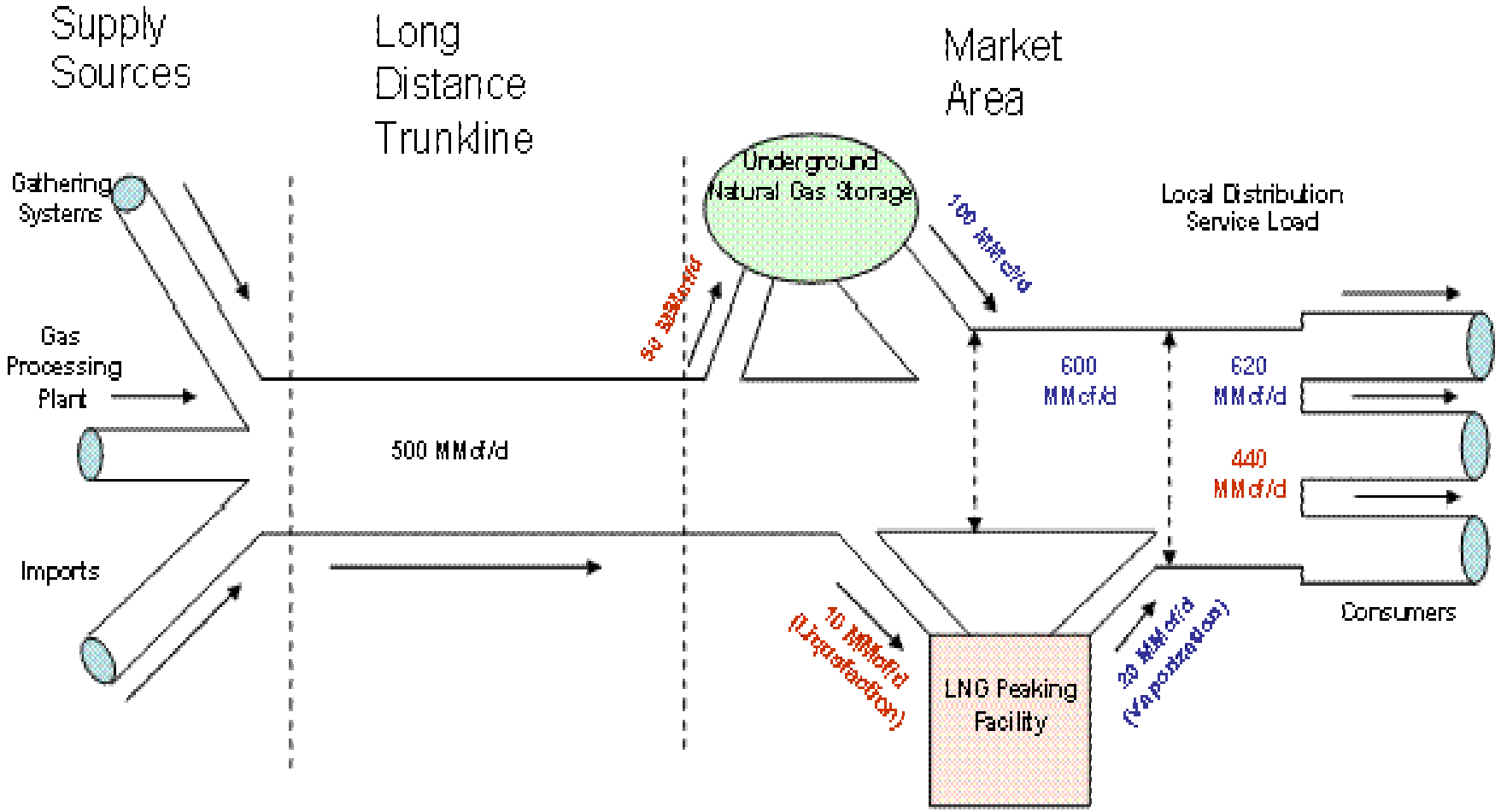
•The 30 largest companies own about 77 percent of all interstate natural gas pipeline mileage and about 83 percent of the total capacity (148 billion cubic feet) available within the interstate natural gas pipeline network.

Interstate Natural Gas Pipeline Segment

- Some of the largest levels of pipeline capacity exist on those natural gas pipeline systems that link the natural gas production areas of the U.S. Southwest with the other regions of the country. Sixteen of the thirty largest U.S. natural gas pipeline systems originate in the Southwest Region, with four additional ones depending heavily upon supplies from the region.

- Today, almost every major metropolitan area in the United States is supplied by, or is the final destination of, one or more of the major interstate pipeline companies or their affiliates.

- For instance, New York City is a major delivery point on several of the largest pipeline systems, including:
  - Texas Eastern Transmission Company
  - Transcontinental Gas Company
  - Tennessee Gas Pipeline Company, and
  - Iroquois Gas Transmission Company.



Note: MMcf/d = million cubic feet per day. Areas shown are not proportional to capacity volumes indicated. Other natural gas transmission pipelines may interconnect with and supplement the supplies of the mainline transmission or local distribution company in the market area to meet peak period demands.

Source: Energy Information Administration, Office of Oil and Gas

Network Configuration and System Design

- **Overview**
- A principal requirement of the natural gas transmission system is that it be capable of meeting the peak demand of its shippers who have contracts for firm service.
- To meet this requirement, the facilities developed by the natural gas transmission industry are a combination of transmission pipelines to bring the gas to the market areas and of underground natural gas storage sites and liquefied natural gas (LNG) peaking facilities located in the market areas.

Sizes of Transmission Lines and Integrated Storage Sites

- The design of natural gas transmission pipelines and integrated storage sites represents a balance of the most efficient and economical mix of delivery techniques given the operational requirements facing the pipeline company, the number and types of transportation customers, and available access to supplies from production areas or from underground storage.

- Many natural gas pipeline systems are configured principally for the long-distance transmission of natural gas from production regions to market areas. These long-distance systems are often referred to as trunk-lines.

- At the other extreme are the grid systems, which generally operate in and serve major market areas. Many of the grid systems can be categorized as regional distribution systems. For the most part, they receive their supplies of natural gas from the major trunk-lines or directly from local production areas. The grid systems transport natural gas to local distribution companies and large-volume consumers.

Design Criteria and Pipeline Size

- The design process includes the development of cost estimates for various possible combinations of pipe size, compression equipment, and inter-station distances to find the optimal combination that minimizes the transportation cost, given the desired flexibility and expandability goals.

- New trunk-lines typically are built with a larger diameter pipe than will be needed initially but with compression capacity limited to meeting current needs. Compressors can be added, in either new or existing stations, to increase capacity as growth in load occurs.

- A number of factors are involved in calculating how much natural gas a pipeline can carry. However, the most important factors are the diameter of the pipe and its operating pressure

Design Criteria and Pipeline Size

- Standard design codes require that all pipelines passing through populated areas reduce its maximum operating pressures for safety reasons.

- It had become common practice to maintain nominal pipe diameter but increase wall thickness where a line had to be derated for its surroundings (change in external stresses due to earth or traffic loads) in order to keep the working pressure rating more constant along the line. Increasing the pipe wall thickness or strength of the pipe will enable the pipe to withstand a greater pressure between operating and design pressure to adhere to safety requirements.

Importance of Underground Storage Integration

- Underground storage is an essential component of an efficient and reliable interstate natural gas transmission and distribution network. The size and profile of the transmission system often depends in part on the availability of storage.

- Access to underground natural gas storage facilities, particularly those located in consuming areas, permits the mainline transmission pipeline operator to design the portion of its system located upstream of storage facilities to accommodate the level of total shipper firm (reserved) capacity commitments and the pipeline operator's potential storage injection needs, commonly referred to as "baseload" requirements.

- The portion of the transmission system located downstream of the storage area (including LNG peaking facilities) is designed to accommodate the maximum peak-period requirements of shippers, local distribution companies, and consumers in the area. It is generally sized to reflect the total peak-day withdrawal (deliverability) level of all storage facilities linked to the system and estimated potential peak-period demand requirements.

Importance of Underground Storage Integration

- The daily deliverability from storage can also be factored into the design needs of a new pipeline or the expansion needs of an existing one. Some underground storage facilities are located in production areas at the beginning of the pipeline corridor and, in contrast to storage near consuming markets, can be used to store gas that may not be marketable at the time of production.

- For instance, natural gas produced in association with oil production is a function of oil market decisions, which may not coincide with natural gas demand or available pipeline capacity to transport the gas to end-use markets. Another example is the storage of natural gas produced from low-pressure wells, which may be injected into storage during the off-peak season and delivered, at high pressure, to the mainline during the peak season.

- These sites can be used by shippers to store short-term incremental supplies that exceed their reserve capacity on the pipeline system and the reverse when supplies fall below reserved capacity. Thus, the pipeline is relieved of additional demands for capacity brought on by temporary swings in the transportation demands of its customers.

Overall Pipeline System Configuration

- The overall pipeline system configuration should result in a comparatively lower usage level (load factor) for downstream facilities in the summer season but a much higher, albeit shorter term, usage level during the peak-demand season. The upstream trunk line portion of the system, on the other hand, could operate at a more sustained high load factor throughout the year. (This design minimizing is oftentimes referred to as peak-shaving.)

- With underground natural gas storage and LNG peaking facilities configured into a natural gas pipeline system, especially one serving climate-sensitive markets such as the Midwest and Northeast, system operators can minimize the facilities and costs involved in building the “trunk-line” portion of their system. Natural gas shippers, on the other hand, could avoid unnecessary costs incurred if they reserved additional firm capacity on an entire transmission system, rather than only a portion that would be used only on a few days during the winter season.

Overall Pipeline System Configuration

- During the non-heating season, for instance, when shippers do not need all the contracted capacity to meet their customer's current consumption requirements, natural gas can be transported and injected into storage. By the beginning of the heating season (November 1), inventory levels are generally at their annual peak. Working gas, the portion of natural gas in storage sites available for withdrawal and delivery to markets, is then withdrawn during periods of peak demand.
- In addition, the pipeline company can avoid the need to expand transmission capacity from production areas by using existing, or establishing new storage facilities in market areas where there is a strong seasonal variation in demand and where the system may be subjected to operational imbalances.

Beginning of Industry Restructuring

- In April 1992, the Federal Energy Regulatory Commission (FERC) issued its Order 636 and transformed the interstate natural gas transportation segment of the industry forever. Under it, interstate natural gas pipeline companies were required to restructure their operations by November 1993 and split-off any non-regulated merchant (sales) functions from their regulated transportation functions.

- This new requirement meant that interstate natural gas pipeline companies were allowed to only transport natural gas for their customers. The restructuring process and subsequent operations have been supervised closely by FERC and have led to extensive changes throughout the interstate natural gas transportation segment which have impacted other segments of the industry as well.

Regulations Today

- Most natural gas pipelines in the United States, including many in the intrastate segment as well, now only transport natural gas and no longer buy and sell it. Although interstate natural gas pipelines are no longer subject to as much regulation as before Order 636, many aspects of their operations and business practices, are still subject to regulatory oversight.

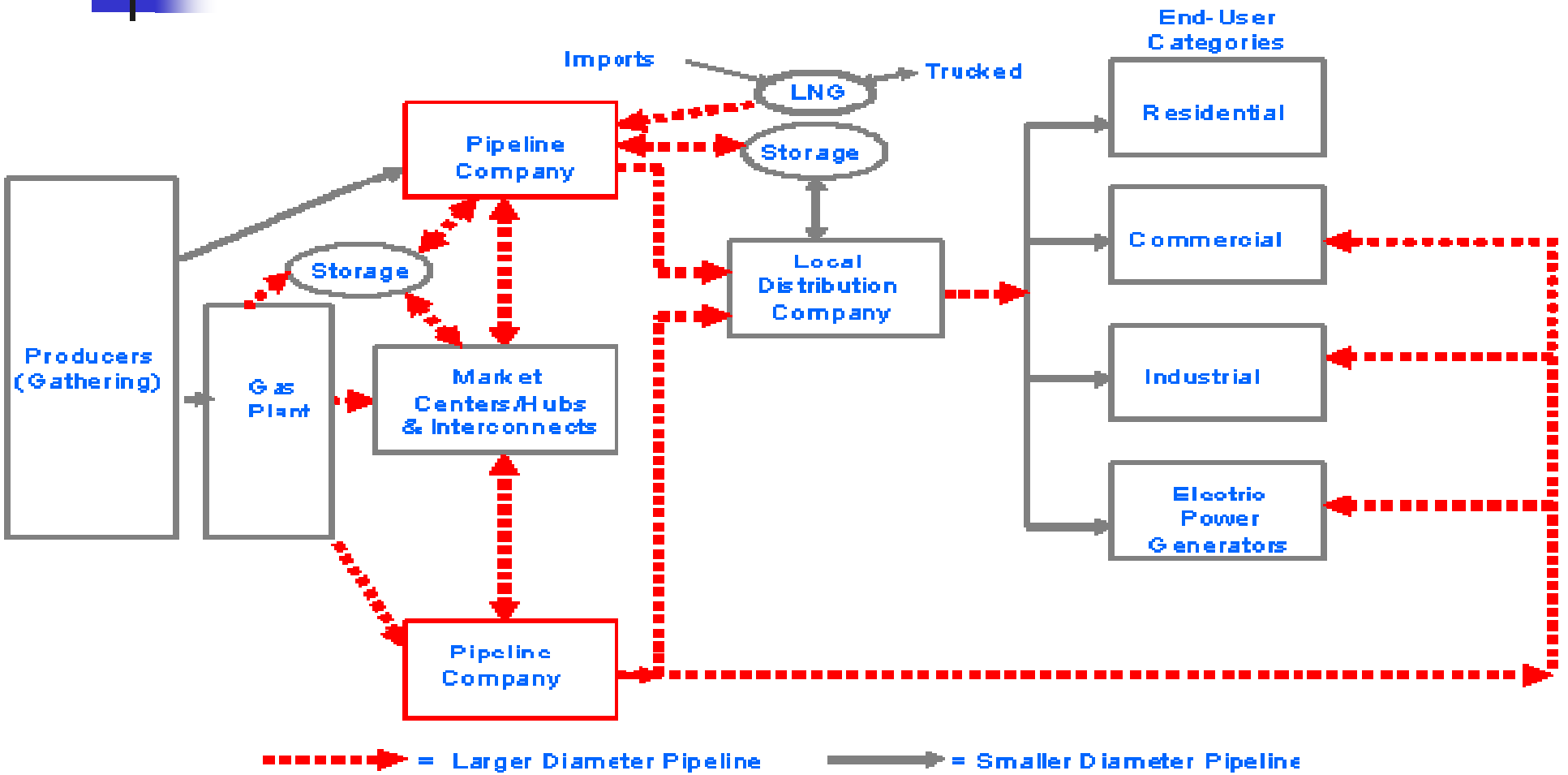
- For example, FERC determines the rate-setting methods for interstate pipeline companies, sets rules for business practices, and has the sole responsibility for authorizing the siting, construction, and operations of interstate pipelines, natural gas storage fields, and liquefied natural gas (LNG) facilities.

- Regulatory bodies have the authority to suspend some rules and regulations under specific circumstances, especially in response to emergency and disaster situations, placing needed projects on a regulatory fast-track.

Coordinating with other Regulatory Agencies

- Almost all applications to FERC for interstate natural gas pipeline projects require some level of coordination with one or more other Federal agencies. For example, the Environmental Protection Agency assists FERC and/or State authorities in determining if the environmental aspects of a pipeline development project meet acceptable guidelines. FERC is also required to take the lead on the environmental reviews under the National Environmental Policy Act, the Endangered Species Act, the National Historic Preservation Act, and the Magnuson-Stevens Act.

- Governing the safety standards, procedures, and actual development and expansion of any pipeline system is the job of the U.S. Department of Transportation's Office of Pipeline Safety (OPS). A pipeline may not begin operations until a line, or line segment, has been certified safe by the OPS. The OPS retains jurisdiction for safety over the lifetime of the pipeline.

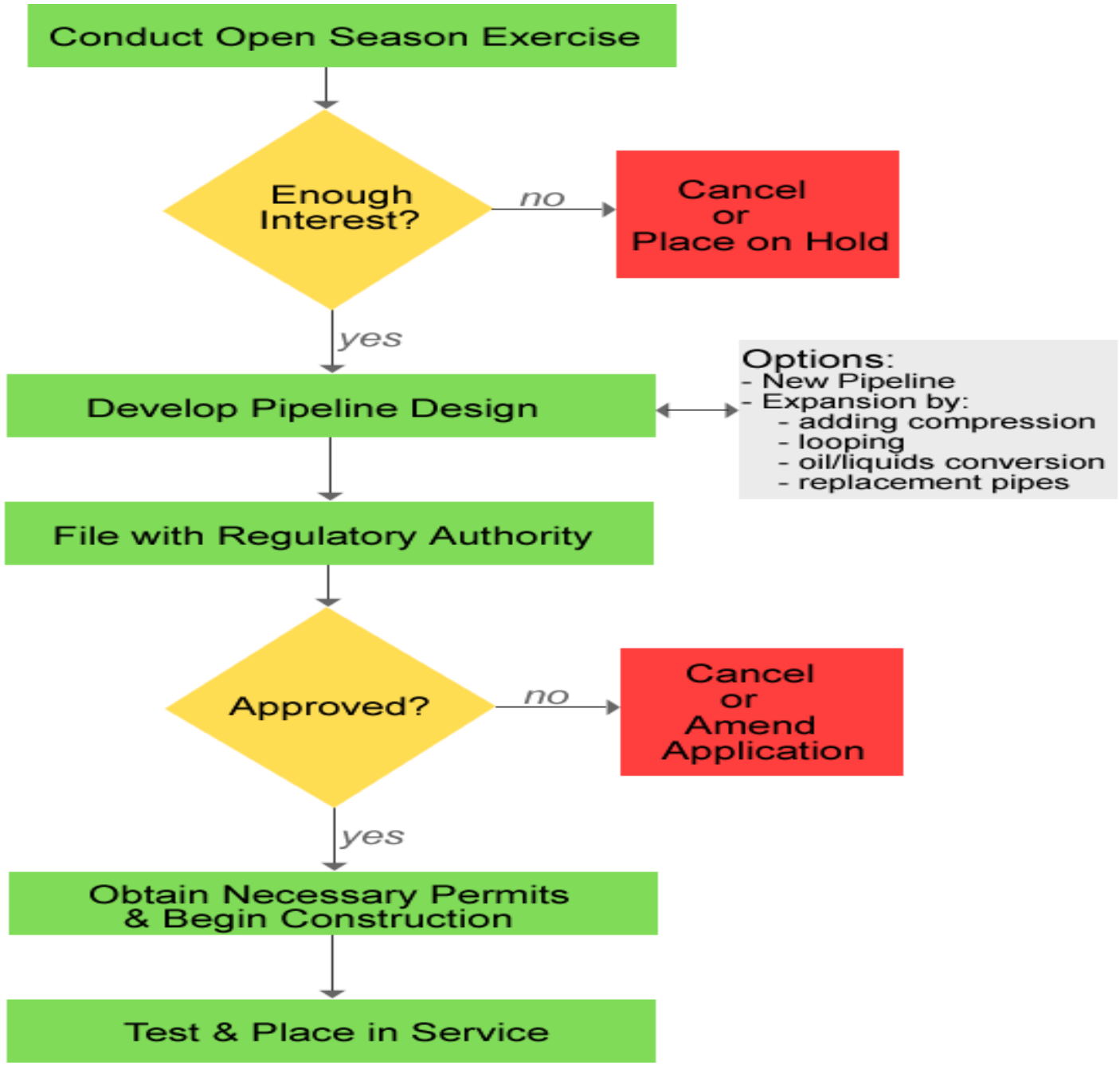


Source: Energy Information Administration, Office of Oil and Gas

Overview

- Transporting natural gas from the wellhead to the final customer involves several physical transfers of custody and multiple processing steps. A natural gas pipeline system begins at the natural gas producing well or field. Once the gas leaves the producing well, a pipeline gathering system directs the flow either to a natural gas processing plant or directly to the mainline transmission grid, depending upon the initial quality of the wellhead product.
- The processing plant produces pipeline-quality natural gas. This gas is then transported by pipeline to consumers or is put into underground storage for future use. Storage helps to maintain pipeline system operational integrity and/or to meet customer requirements during peak-usage periods.
- Transporting natural gas from wellhead to market involves a series of processes and an array of physical facilities. Among these are:
- **Gathering Lines** – These small-diameter pipelines move natural gas from the wellhead to the natural gas processing plant or to an interconnection with a larger mainline pipeline.
- **Processing Plant** – This operation extracts natural gas liquids and impurities from the natural gas stream.
- **Mainline Ttransmission Systems** – These wide-diameter, long-distance pipelines transport natural gas from the producing area to market areas.
- **Market Hubs/Centers** – Locations where pipelines intersect and flows are transferred.
- **Underground Storage Facilities** – Natural gas is stored in depleted oil and gas reservoirs, aquifers, and salt caverns for future use.
- **Peak Shaving** – System design methodology permitting a natural gas pipeline to meet short-term surges in customer demands with minimal infrastructure. Peaks can be handled by using gas from storage or by short-term line-packing.

- **Development and Expansion Process For Natural Gas Pipeline Projects**



Timing and Steps for a New Project

- An interstate natural gas pipeline construction or expansion project takes an average of about three years from the time it is first announced until the new pipe is placed in service. The project can take longer if it encounters major environmental obstacles or public opposition.
- A pipeline development or expansion project involves several steps:
- Determining demand/market interest
- Publicly announcing the project
- Obtaining regulatory approval
- Construction and testing

Determining Market Interest and Public Announcement & Expansion and Development Options

- To gauge the level of market interest, an open season is held for 1-2 months, giving potential customers an opportunity to enter into a nonbinding agreement to sign up for a portion of the capacity rights that will be available. If enough interest is shown during the open season, the sponsors will develop a preliminary project design and move forward. If not enough interest is evident, the project will most likely be dropped or placed on indefinite hold.
- Options for creating additional pipeline capacity include:
- Building an entirely new pipeline
- Converting an oil or product pipeline to a natural gas pipeline
- Adding a parallel pipeline along a segment of pipeline, called looping
- Installing a lateral or extension off the existing mainline
- Upgrading and expanding facilities, such as compressor stations, along an existing route. This option is usually the quickest, least expensive, and has the least environmental impacts.

Third Party Access

- **Obtaining Construction Approval**
- Developing the final project design and obtaining first financial commitments from potential customers may take from three to six months. Then, the project specifications are filed with the appropriate regulatory agency.

- **Pre-filing Review Process**
- Of the proposed project involves an interstate pipeline, that is, it falls under the jurisdiction of the Federal Energy Regulatory Commission (FERC), the project sponsor has the option of either requesting that a National Environmental Policy Act (NEPA) pre-filing review be initiated during the early states of project design, or waiting until later and filing with FERC under the traditional application review process.
- The pre-filing process is designed to facilitate and expedite the review of natural gas pipeline projects that would normally require FERC to prepare an environmental assessment, an environmental impact statement, or a historic preservation review as part of the traditional review process. The project sponsor must notify and request that the various regulatory agencies be involved in evaluating the project if a pre-filing review from NEPA is filed. In this case, FERC staff will take the lead in scheduling and coordinating the approval steps.

Approval of the Regulating Authority

- A FERC review of an interstate pipeline project takes from 5-18 months, with an average time of 15 months. No data are available on the average time for obtaining approval from an individual State agency. Usually, approval by the regulating authority is conditional, but most often the conditions do not constitute a significant impediment. The project sponsor must then either accept or reject the conditions or reapply with an alternative plan.
- **Construction**
- Pipeline construction is usually completed within 18 months and sometimes in as little as 6 months. Construction can be delayed because additional time may be needed to acquire local permits from towns and land-use agencies located along the proposed construction route.
- **Commissioning and Testing**
- Commissioning and testing the completed pipeline project usually takes about one to three weeks. This process involves subjecting the new segments of the pipeline to hydrostatic testing (water fill under high pressure) or other tests of the line in-place. Line packing, which involves filling the line with the initial baseload volume of natural gas, is usually needed only on a new pipeline or on larger expansion projects.

Reference

- Energy Information Administration – U.S. Department of Energy