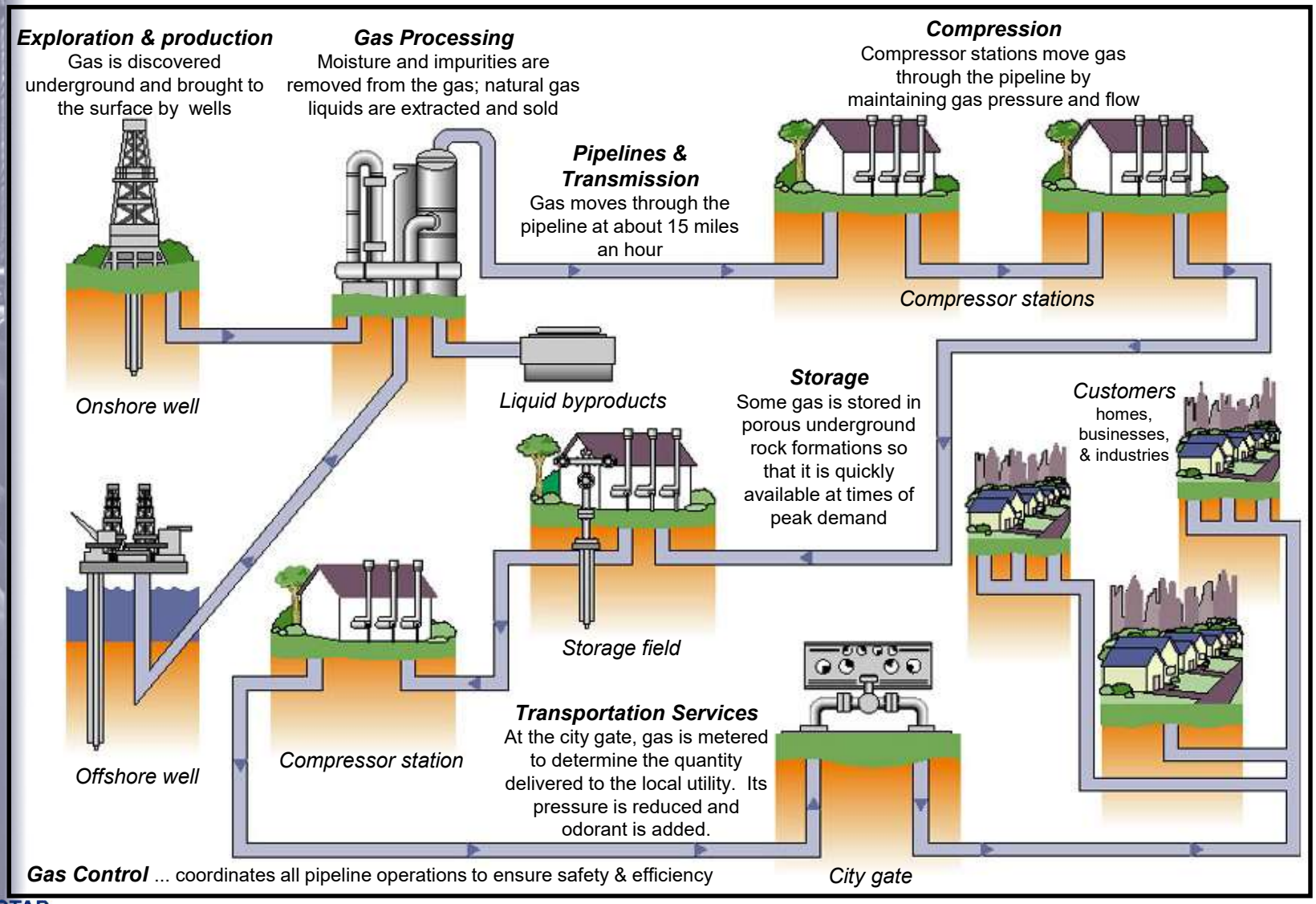
Wellhead to Burnertip

The path of natural gas

Wellhead to Burnertip

In the following slides we will follow gas as it travels “from wellhead to burnertip,” from its discovery underground to its final use by consumers:



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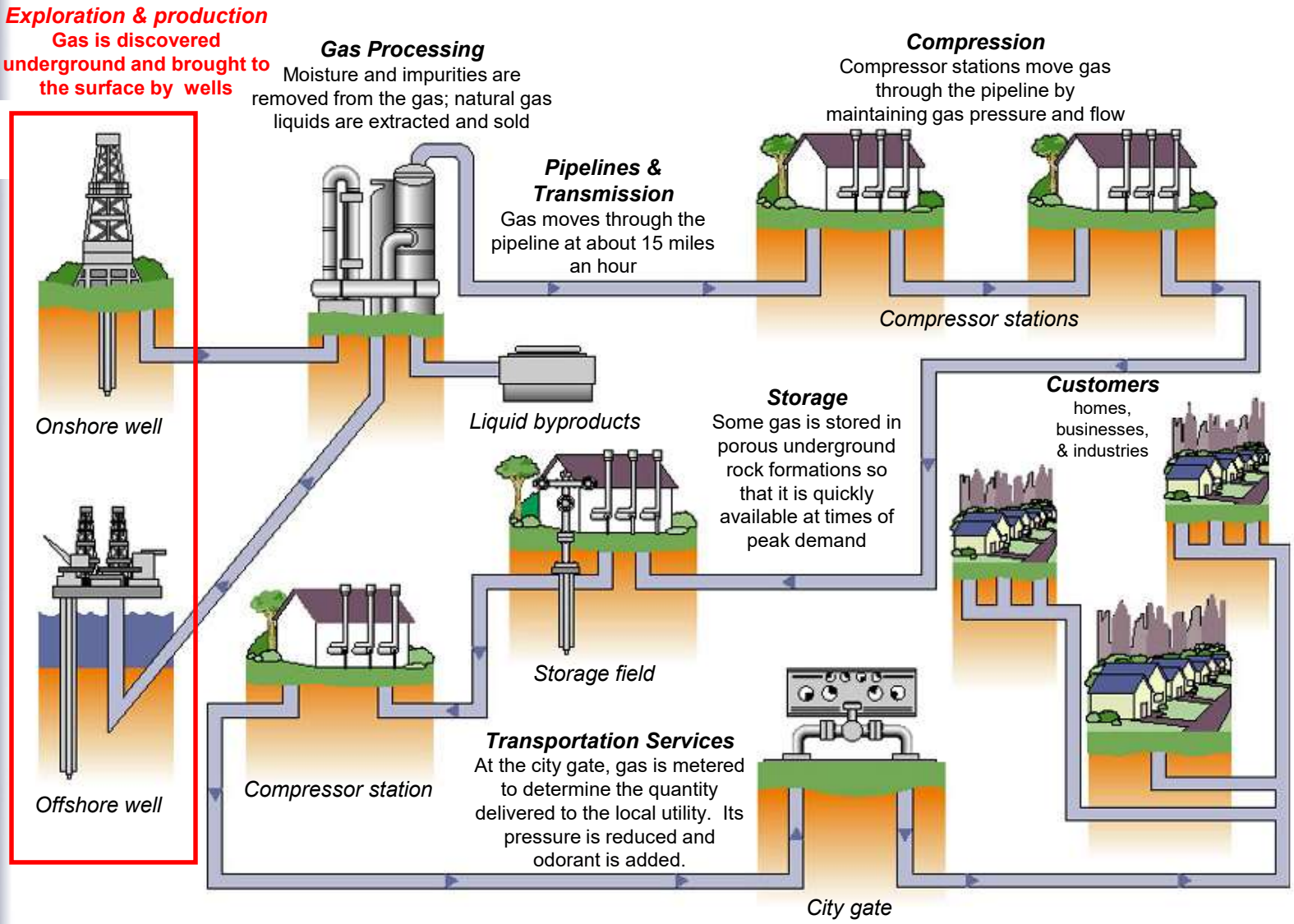
Exploration & Production

Finding the gas &
getting it out of the ground

Wellhead to Burnertip



Where and how is gas found? How is it made accessible?

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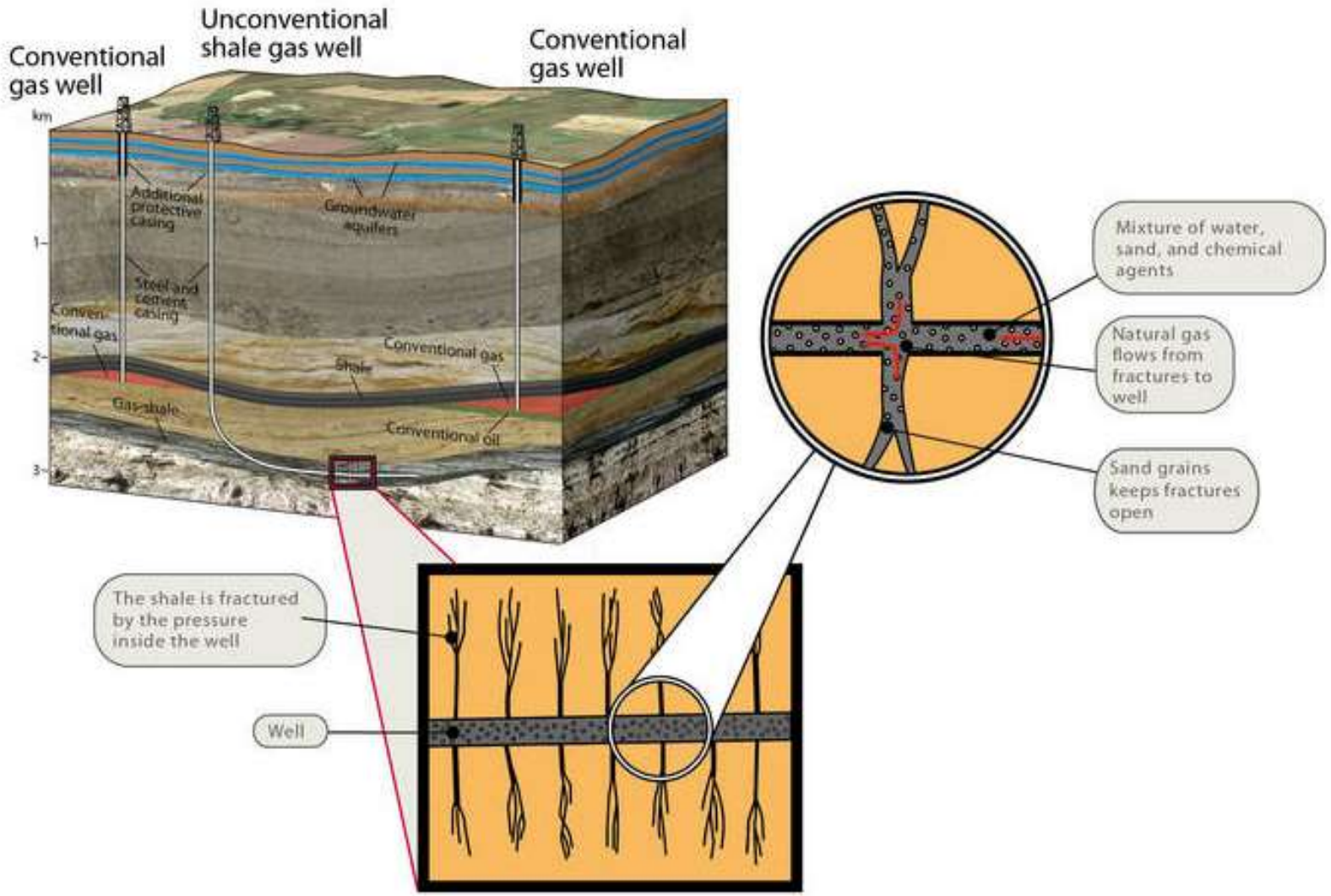
Exploration: Where is gas found?

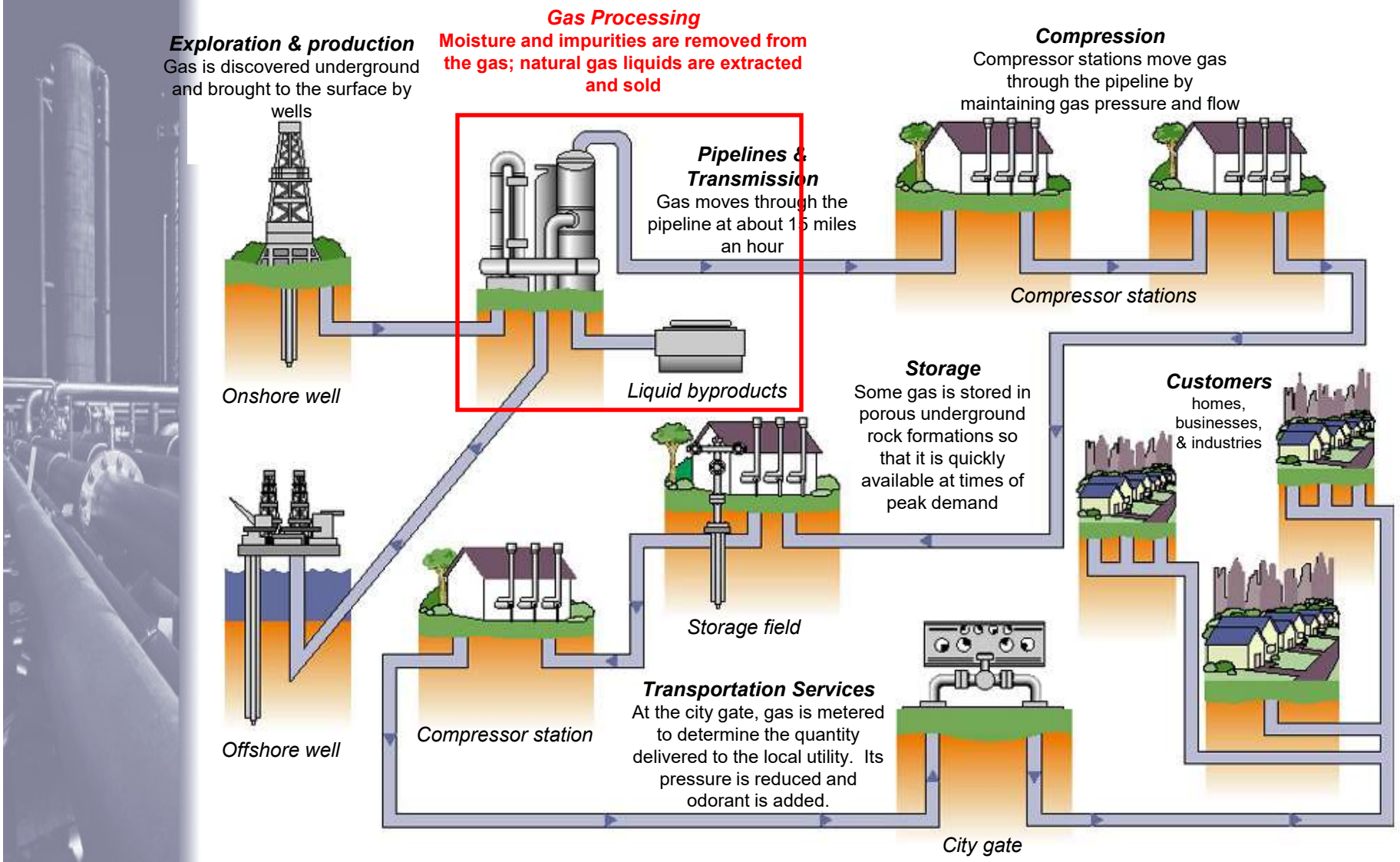


Shale Gas is natural gas that is present in shale rocks. Throughout the world, different types of sedimentary rock contain natural gas deposits, for example sandstones, limestone's or shale's. Sandstone rocks often have high permeability, which means that the tiny pores within the rock are well connected and gas can flow easily through the rock. In contrast, shale rocks usually have very low permeability, making gas production more complex and costly.

Gas Conditioning (a.k.a. Processing or midstream)

Converting wellhead gas to "pipeline quality" gas

Wellhead to Burnertip



What are the components of natural gas? Why and how is gas conditioned? Why is gas odorized?

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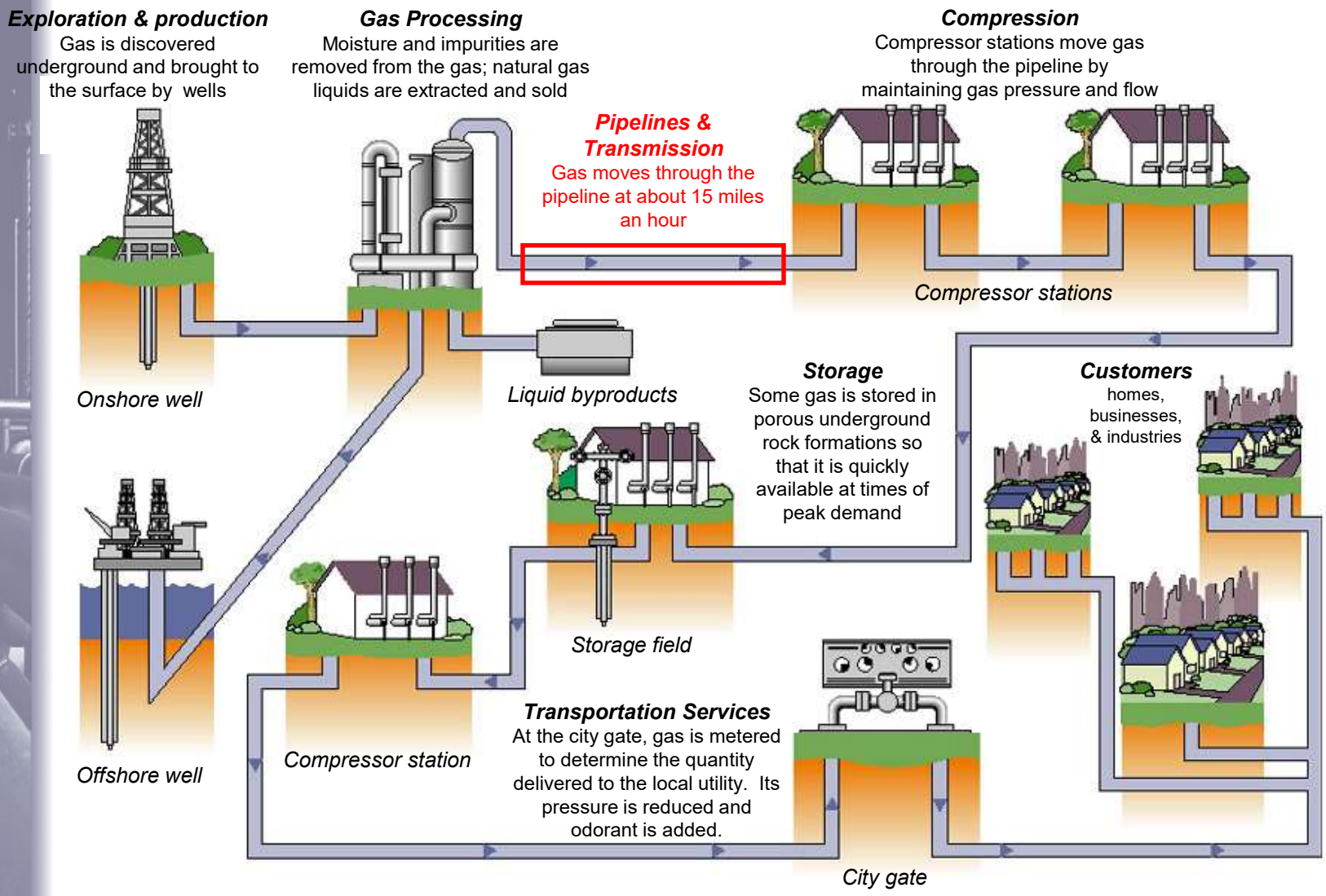
Components of wellhead gas

- Wellhead gas has no “typical” composition
- It may include:
  - hydrocarbon gases:
    methane, ethane, propane, butane
  - acid gases:
    carbon dioxide, hydrogen sulfide
  - inorganic gases:
    nitrogen, oxygen, helium
  - salt water
  - crude oil
- Gas quality is an ever growing concern across the pipeline industry as producers improve technology to extract new sources of gas.
- Natural gas is odorless. Companies add mercaptan.

Pipelines and Transmission

Transportation of natural gas through pipelines from production areas to market areas

Wellhead to Burnertip



How is gas transported? What are some pipeline safety issues?

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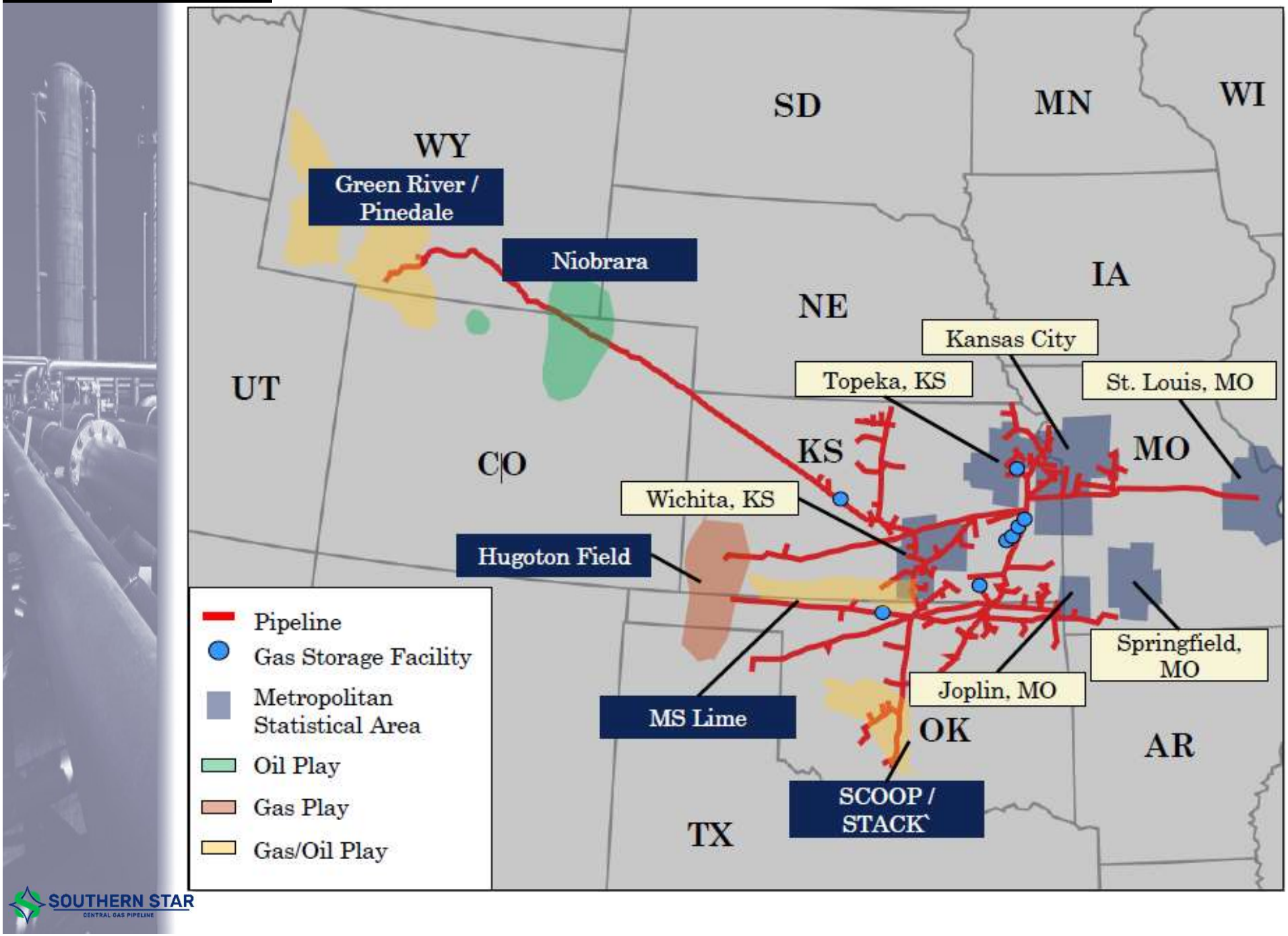

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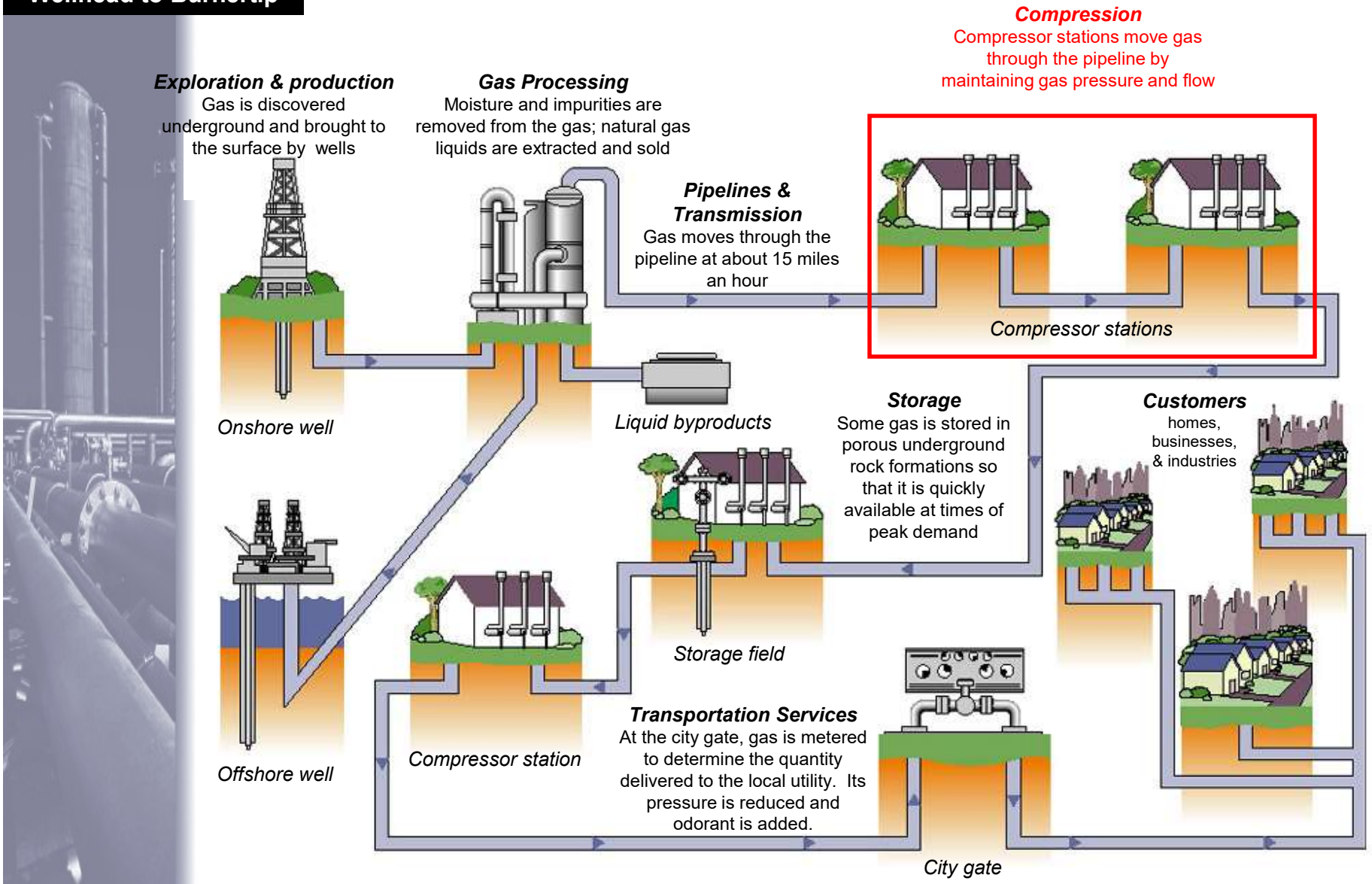
Protecting the pipeline

- Markers (AGM's) indicate the presence of a pipeline underground.
- Pipelines are regularly patrolled by air, truck, and on foot to monitor for problems.
- Right-of-way encroachments (such as digging to install utility lines) are managed very carefully to protect the line.
- *One-call systems* (811) inform the public of a centralized number to call before digging.
- Right of way is kept mowed & cleared.
- Sufficient coverage is maintained over the pipeline.
- Valves & other facilities are regularly inspected.
- Lines are cleaned and inspected with "pigs" propelled through the line with gas pressure.

Compressor Stations

Where the gas is compressed to push it along the pipeline

Wellhead to Burnertip



How is gas moved through a pipeline? What do you find in a compressor station?

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What's in a station?

- Buildings to house compression equipment
- Piping to route the gas as needed
- Cathodic protection equipment
- *Traps* used for "launching" & "catching" pigs
- Overpressure protection devices
- *Scrubbers* that clean the gas before it enters the main units for compression

Support/Control systems

A number of systems are critical for the proper operation of units:

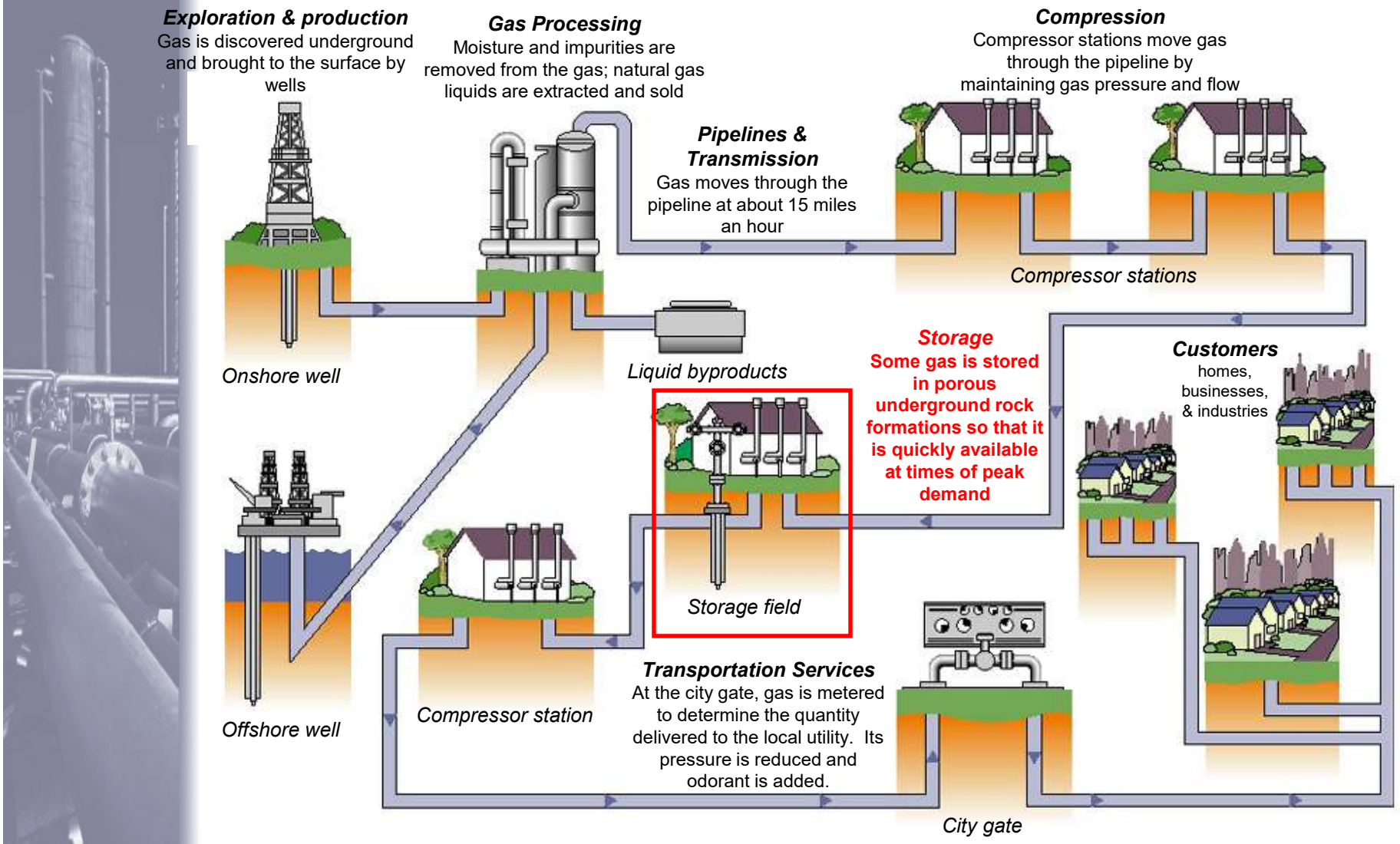
- Cooling, Lubrication, and Air systems
- Emissions control equipment

- Shut down units that are operating outside safe limits
- Detect dangerous conditions - fires, presence of gas - and shut down units or the entire station as needed
- Monitor and automatically adjust station operations to assure efficiency

Storage

Storage of natural gas helps even out seasonal fluctuations in demand

Wellhead to Burnertip



Why is storage needed?

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Why is storage needed?

- Demand for natural gas varies dramatically throughout the day & year because of its use in residential heating, power generation, and other processes.
- *Peak use periods* - times when gas use is at its maximum - make it hard to plan for the *throughput* (volume of gas carried) that is needed on a system at any given time.
- Stored gas can be used for *peak shaving*, the use of alternative sources of energy to supplement normal gas deliveries during peak use periods.

Transportation Services

Transportation, capacity marketing, storage, contracts, administration, gas scheduling, & other pipeline services

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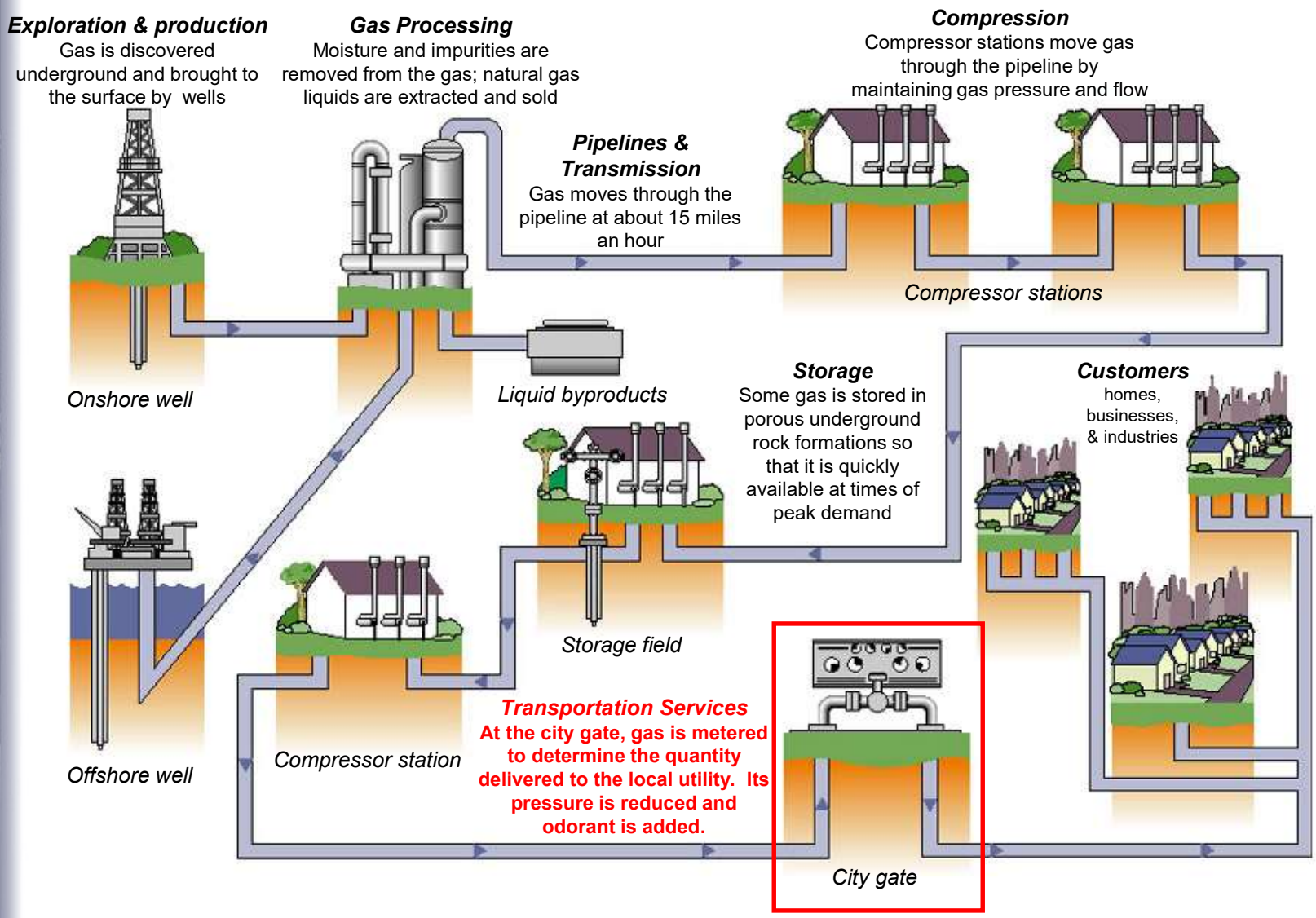

What kinds of services do pipelines offer to their customers?

How do we know how much gas a customer needs/uses?

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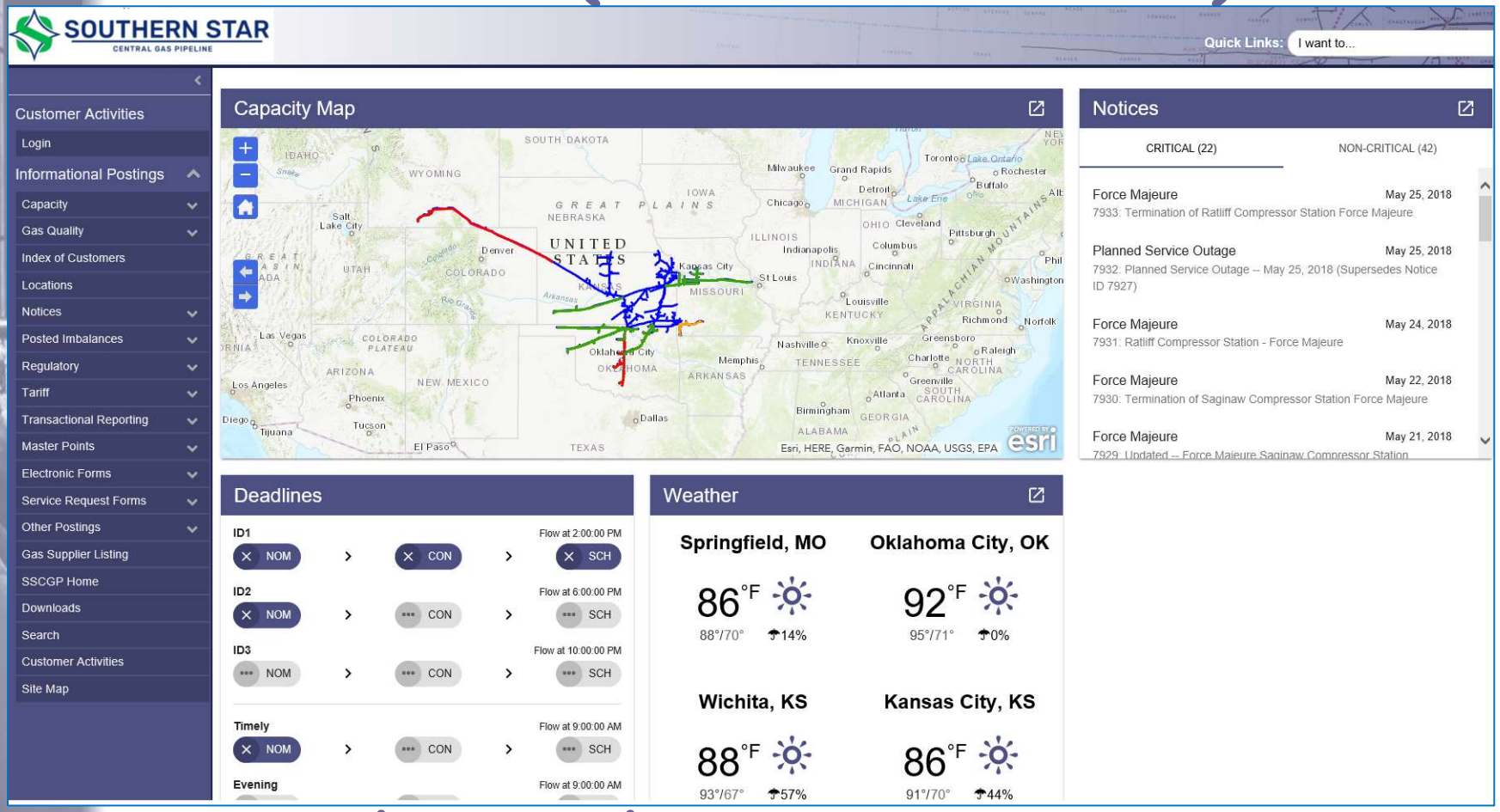
Just like "UPS"

Tariffs, contracts, & capacity

- A *tariff* is a document filed by a pipeline with FERC that outlines its:
  - services offered to customers
  - rate schedule (price list).
- Customers contract with the pipeline for the services they require, such as transportation or storage.
- In general customers are renting physical space on the pipeline; this is called *capacity*.

CSI (Customer EBB)



This is how customers schedule their gas

Measurement

The cash register
of the natural gas industry

What is measured?

- All natural gas transactions - rates, taxes, payments, reporting - are based on its:
  - volume
  - heating capacity, determined by the components in the gas; this is called its *thermal content* (Mcf vs. Dth or *Dekatherm*)
- Gas Quality continues to be an area of interest to end users (industrials, power plants, etc.)

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Gas Control

The group that coordinates the flow of gas from receipt point to end user

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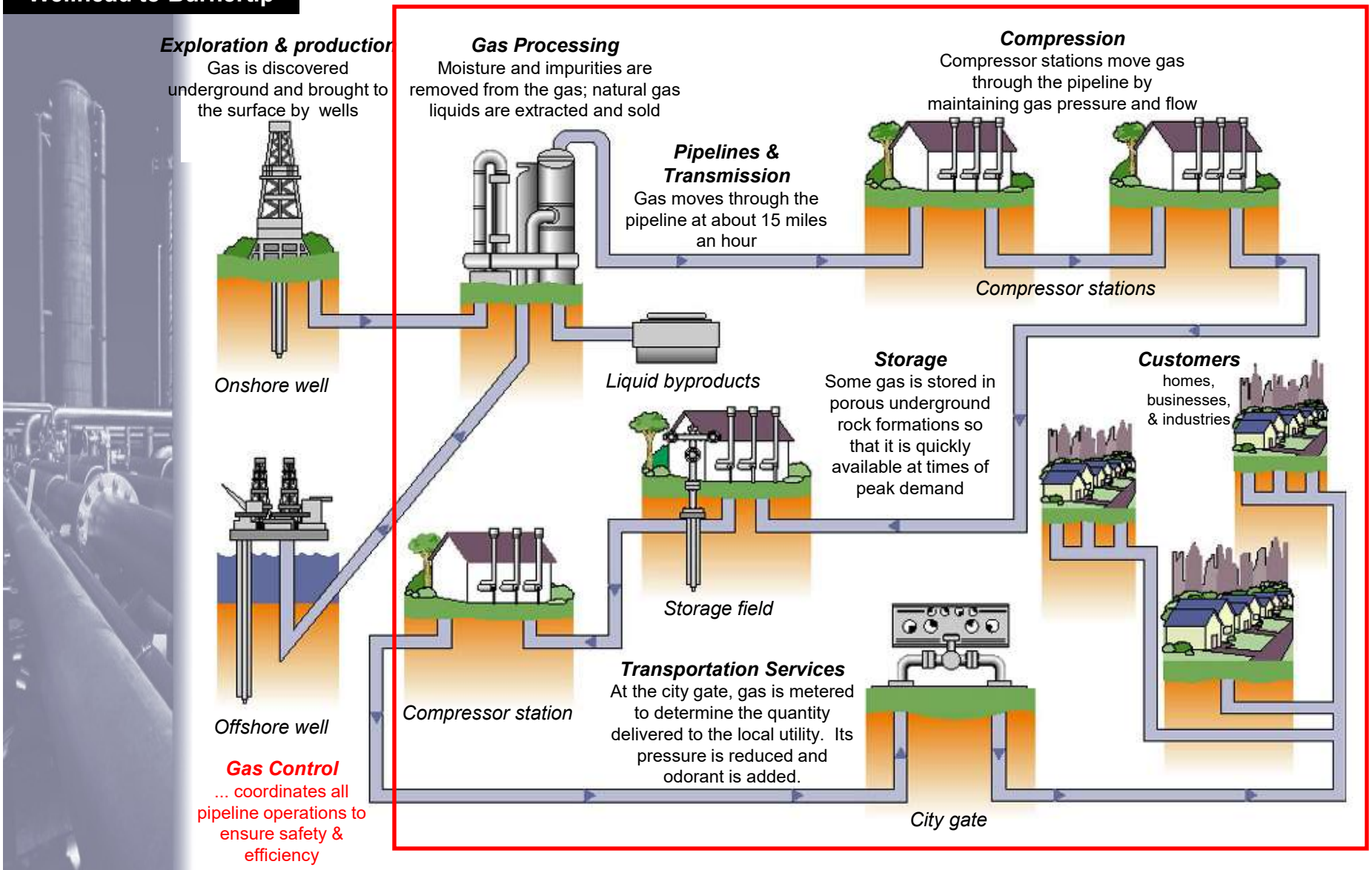

What is Gas Control? How does this group ensure the safe and efficient operation of a pipeline?

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What is Gas Control?

- Gas Control coordinates the fined-tuned operations of the pipeline system. **24 / 7 / 365**
- Regardless of conditions, assure uninterrupted delivery of gas to customers:
  - In a safe manner
  - Reliably
    - in the required quantities
    - at the required pressure and quality
  - In the most efficient, economical way possible