

Natural Gas Information

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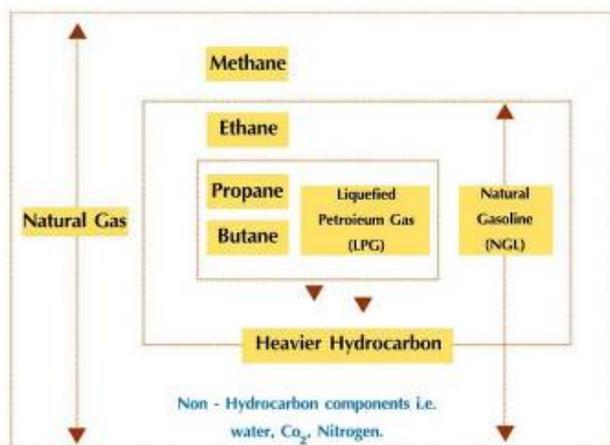
What is natural gas

Over the past 150 years, natural gas has secured its vital role in every aspect of the world development, particularly its role to replace coal and oil. Due to its different characteristics from other types of petroleum, natural gas has been well accepted as the energy for the world of today and tomorrow. Nowadays, the public do not only need the energy for their livings but most of all, they also want a better choice for environment.

Natural gas is the fuel giving both heat and light. It can be used as fuel in many sectors as; transportation, industrial, agricultural, and a raw material for petrochemical industry. Furthermore, natural gas can be used in a cooling system.



Natural Gas Components



Natural gas is a mixture of various hydrocarbon gas known in scientific names i.e. methane, ethane, propane, and butane. Over 70% of natural gas is formed by methane, the major component. To maximize its use, natural gas must be extracted. In addition to hydrocarbon, other components, for instance, carbon dioxide, hydrogen sulfide, nitrogen and water can also be found. The composites can be separated from the gas through the natural gas processing at the gas separation plants. Each of them has a wide variety of uses.

Physical Properties of Natural Gas



- It is a fossil fuel formed from plant and animal remains millions of years ago.
- It is hydrocarbon component with methane as a major component.
- It is colorless and odorless. For security during transportation or processing, a commercial odorant is added to allow users to detect the gas for safety.
- It is lighter than air with a specific gravity of about 0.6-0.8. If leaks, it disperses upward and dissipates into the air quickly.
- It is inflamed during a range of 5-15% by volume of gas in air. The self-ignition temperature of natural gas is 537-540 celsius degrees.
- As it is a clean fuel with cleaner burning nature, natural gas has lower environmental impact when compared with other types of fuel.

Different Forms of Natural Gas

- **Pipe Natural Gas** or natural gas that transport via pipeline, it is known in commercial term as Sale Gas. Sale Gas is mainly composed of methane. It is transmitted to customers to be used as fuel at the power generation and industrial plants.
- **Natural Gas for Vehicles (NGV)** is the form of natural gas used as fuel for vehicles. NGV is primarily composed of methane and transported through the pipeline to the gas stations. At the gas stations, low pressure gas will be compressed and stored at high pressure of 3000-3600 pound per square inch (psi) and can be then filled up the gas tanks.
- **Liquefied Natural Gas (LNG)** conventionally, the gas is transmitted through the pipeline from production fields to users. If the distance is over 2,000 kilometers, it requires a considerable amount of money to lay a pipeline. Therefore, LNG solves thus limitation. The gas is liquefied by lower temperature to minus 160 degrees Celsius and becomes 600 times smaller in volume, then stored at atmospheric pressure in designed vessels and transport to users. The cost of waterway transport is less than transportation through pipeline.



The Use of Natural Gas

There are two basic uses of natural gas.

1. Fuel We can directly use natural gas as fuel for power generation and in factories e.g. ceramic, sanitary ware as well as in the cogeneration system. And it can be used as fuel for Cogeneration system and for vehicles as known as Natural Gas for Vehicles (NGV).

2. Produce various products through gas separation process. As natural gas is made up from many beneficial compositions, at the gas separation plants, those compositions can be extracted for a number of products as follows:

Methane (C1) is used as fuel for power generation known as Sales Gas. If compressed in high-pressure cylinder, the product derived is called compressed natural gas or as known as natural gas for vehicles or NGV used as fuel for cars.

Ethane (C2) is used as feedstock for upstream petrochemical industry which will be used to produce plastic pellets and fibers for other synthetic products.

Propane (C3) and Butane (C4) are used as feedstock for upstream petrochemical industry as well. The compressed mixture of propane and butane at different proportions stored in a cylinder is called liquefied petroleum gas (LPG) or cooking gas. It is used as fuel for household, vehicles, metal welding, as well as in some industries.

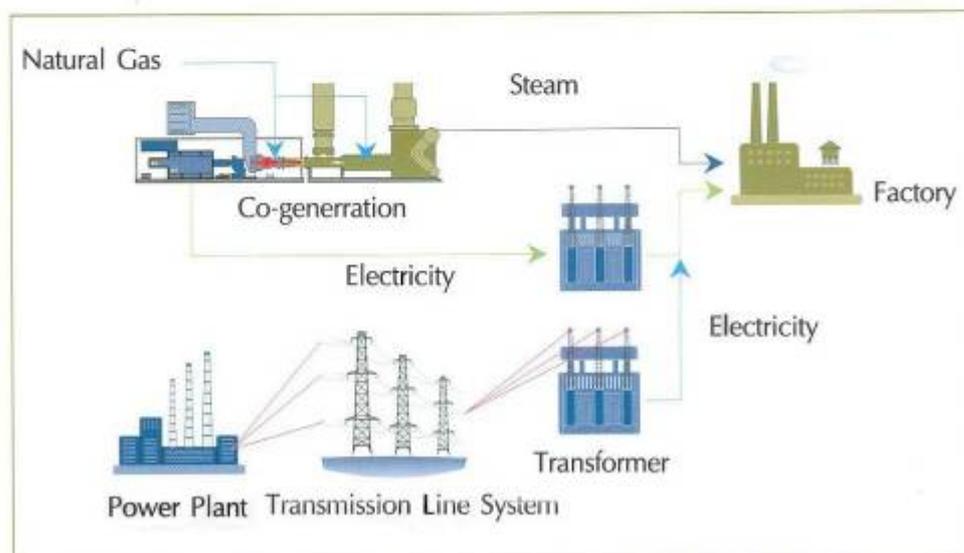
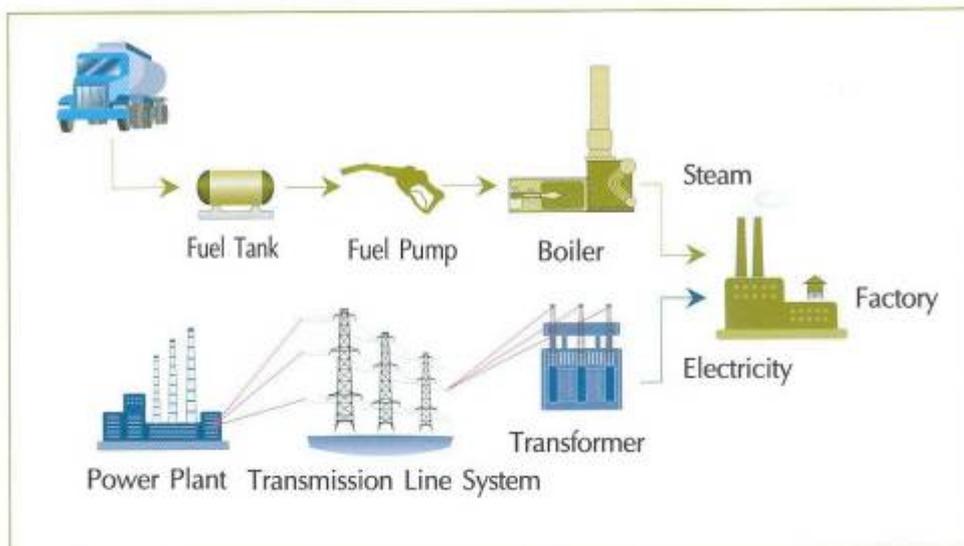
Heavier hydrocarbons are in a liquid form at atmospheric temperature and pressure. They can be removed and separated from hydrocarbon gas during production process. Condensate is removed at the production platform and transported via vessels and pipe to be refined as finished oil.

Natural Gasoline (NGL) is in a liquid form. Though condensate is already removed from the production process at the production platform, some liquid hydrocarbons are still mixed with hydrocarbon gas. These liquid hydrocarbons or natural gasoline can be separated at the gas separation plants and will be sent to the oil refinery to be mixed with finished oil like condensate. It can be used as solvent in some types of industries.

Carbon dioxide After extracted from the natural gas, carbon dioxide will be condensed to a solid which is called dry ice for food preservation industries, soft drink and beer industries, preserving food during transportation, artificial rain enhancement and production of artificial fog in entertainment industry e.g. concert and movie production.

Co-generation System

Co-generation is a production of electricity (mechanical power) and heat (high-temperature heat, high-temperature liquid and steam), which is known as Combined Heat and Power or CHP. From theoretical analysis and tests, it is found that the co-generation system provide more efficient than producing electricity and heat separately.





2. Benefit of co-generation

1.1 Co-generation is a high-efficiency energy system which encourages utilization of waste heat from electricity production to produce other types of energy such as steam and coolness. The system is over 80 % efficient energy utilization compared to conventional centralized power system which is 40-50 % efficient.

1.2 The system helps reduce oil import through the use of natural gas as fuel.

1.3 The system helps reduce energy expenses and industries' production costs respectively. Obviously, the system can curb the electricity expense which is the main production cost of industry and improves competitiveness.

1.4 The system is beneficial for industries which require both electricity and useful heat. Waste heat is used to produce other types of energy such as steam production, drying process and etc.



1.5 The system can reduce investment costs of large-scale power plants which have low efficiency but which require a large budget due to the different period of peak loads in a day.

1.6 The system helps decrease environmental impact by using natural gas in replace of fuel oil to produce steam, dry process and etc.

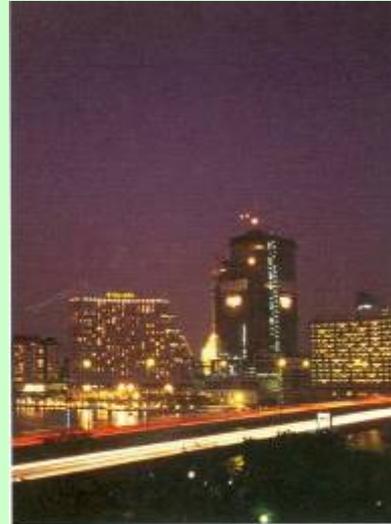
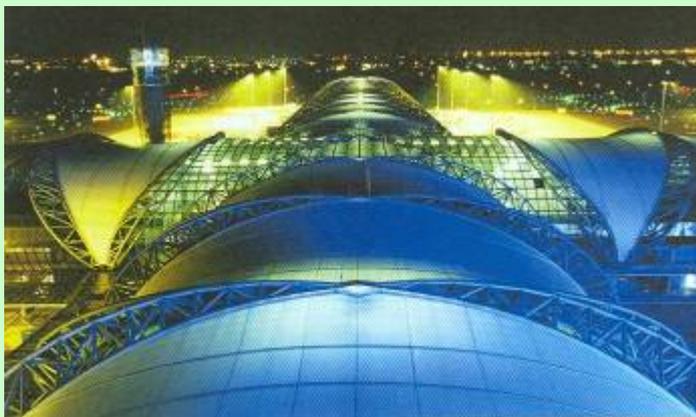


Natural Gas and Commercial Sector

Commercial sector such as department store, hotel, hospital, office buildings, condominiums and restaurants are normally located in the business and residential areas which have medium to high population density and requires a high volume of energy. Therefore, the energy must be clean, pollution free, safe, and environmentally friendly. Natural gas is thus an appropriate choice of energy due to its quality of cleanliness, cleaner burning and high safeness compared to other types of energy, as well as pollution free. In addition, the transportation through pipeline can help relieve traffic congestion.

Therefore, PTT is planning to expand the construction of pipeline into Metropolitan areas in order to expand the utilization of natural gas among business and service operators, hospitals, restaurants as well as residences. The application of the natural gas can be summed up as bellows:

- Gas district cooling and cogeneration is the production of electricity and chilled water for the cooling system in an office building. The application of gas cooling can be seen in both Thailand and overseas for instance, the new Tokyo national airport in Japan, Kuala Lumpur International Airport and Suvarnabhumi Airport, Thailand.



- Natural gas can be used for cooking in replace of LPG in hotels, hospitals, restaurants and residences. The gas can be used with all types of stoves, ovens, grills, and rice cookers.
- Natural gas is used for producing hot water and steam in hotels, laundry services, sterile process at hospitals and household residence.

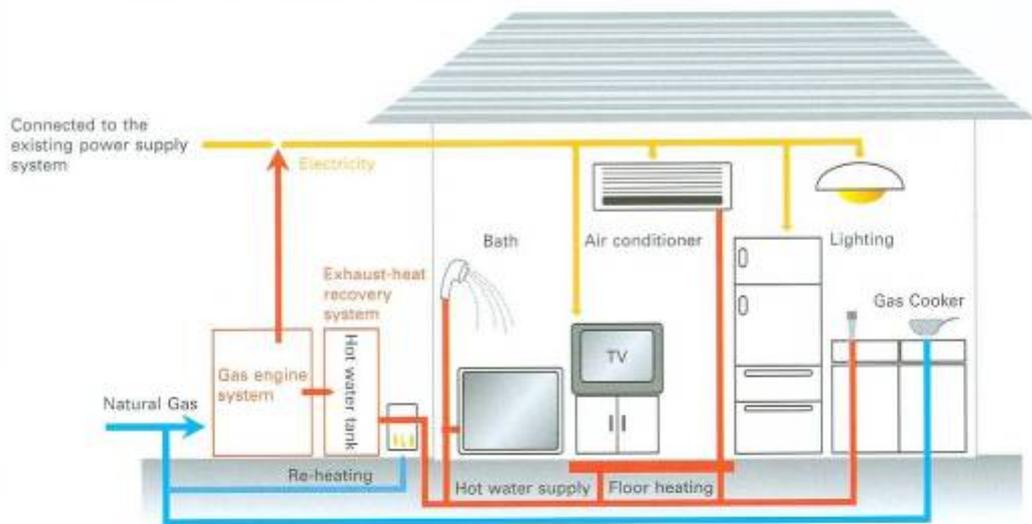
Advantages of Natural Gas Application in Commercial and Residence Sectors

- Increase efficient utilization of electricity and cooling system by 80% while the conventional system has 50% efficiency.
- Increase alternative of energy sources for buildings instead of electricity alone. The buildings can choose to use either natural gas or electricity or both.

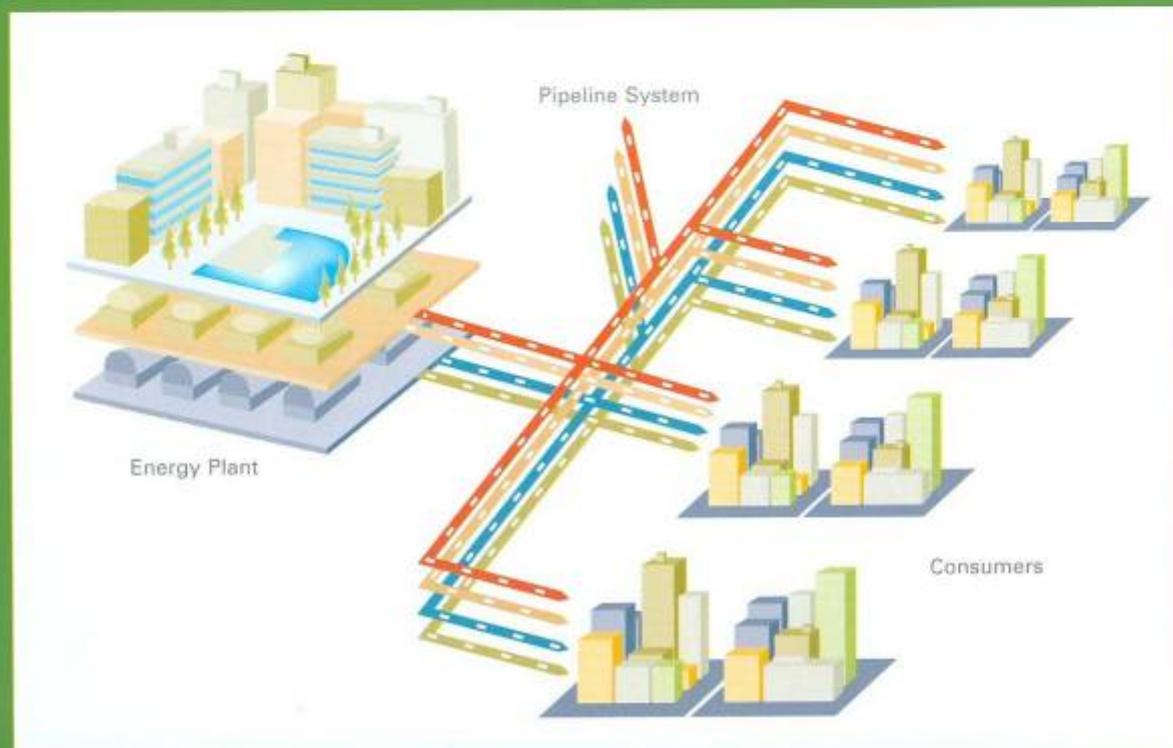


- Reduce the use of Chlorofluorocarbon as a cooling agent in cooling system by using electricity, which helps improve the environment.
- Natural gas is environmentally friendly. It can replace the use of high-grade fuel oil and diesel in producing steam for hotel and hospital.
- Decrease transportation problems and cost as the natural gas is transported through pipeline. The sale gas is measured by standardized meter. Though, customers do not have to store fuel and problem of transmission management is eliminated.
- Reduce the users' safety risk caused by fuel storage.

Residential Gas Engine Co-generation System



Gas District Cooling Diagram





Benefits of Using Natural Gas as Fuel



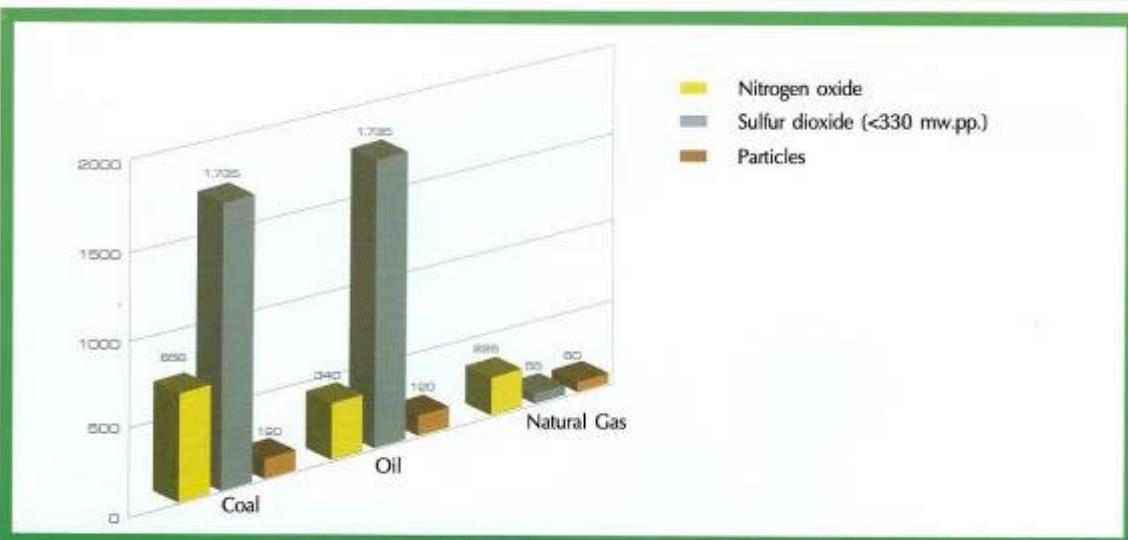
- Natural gas is a fossil fuel with high efficiency and cleaning burning.
 - Natural gas reduces greenhouse effect which is a main cause of global warming.
 - Natural gas has high safety as it is lighter than air and disperses upward when leaked.
- Natural gas is cheaper than other types of fuel e.g. fuel oil and LPG.
 - Natural gas can add value and drive economy.
 - As most of the gas is procured domestically, it thus helps reduce energy import and save foreign currency.



Precaution on Natural Gas Use

- Normally, the natural gas is non toxic. However, if having high content of hydrogen sulfide; the gas can harm people whom inhale the gas. It can irritate skin, eyes, the respiratory tract and lung.
- Fire and explosion. Natural gas can be flammable when it leaks and mixes with air, cause fire at a right proportion of air and natural gas and there is a source of ignition or a flame. It can cause explosion if it accumulates in a confined space such as in the building where there is not enough ventilation.

Emission from power plant comparing various types of fuel.



Source : Notification of Ministry of Industry



Differences between Natural Gas and LPG

Cooking gas has a commercial name as liquefied petroleum gas or LPG which is a product from the oil refineries or the gas separation plants. LPG is a mixture of two hydrocarbon gases: propane and butane. It can be in any ratio or purely propane or butane. In Thailand, most LPG comes from the gas separation plants which have a ratio of propane and butane of 70:30. As the gas provides high heating value, the user can thus save the time and energy cost.

Like natural gas, LPG can be used as fuel for household, industry and transportation. However, natural gas has not been directly used in household. Due to the flammable nature of natural gas and LPG, the users should be cautious and strictly follow safety practices and regulations.

Comparison of characteristics between Natural Gas and LPG

Features	Natural Gas	LPG
Safety	Very safe as it is lighter than air, when leaked it will dissipate quickly.	Less safe, as it is heavier than air, when leaked it will pool on the ground.
Readiness for use	Ready to use as it is in gas form	It is in a liquid form, when use, it need to be converted to gas
Burning quality	Complete burning	Complete burning
Properties	Colorless and odorless, sootless burning and sulfurless	Colorless and odorless but odor is normally added for safety reason
Expense	Storage tank is not needed	Storage tank and advance ordering are needed