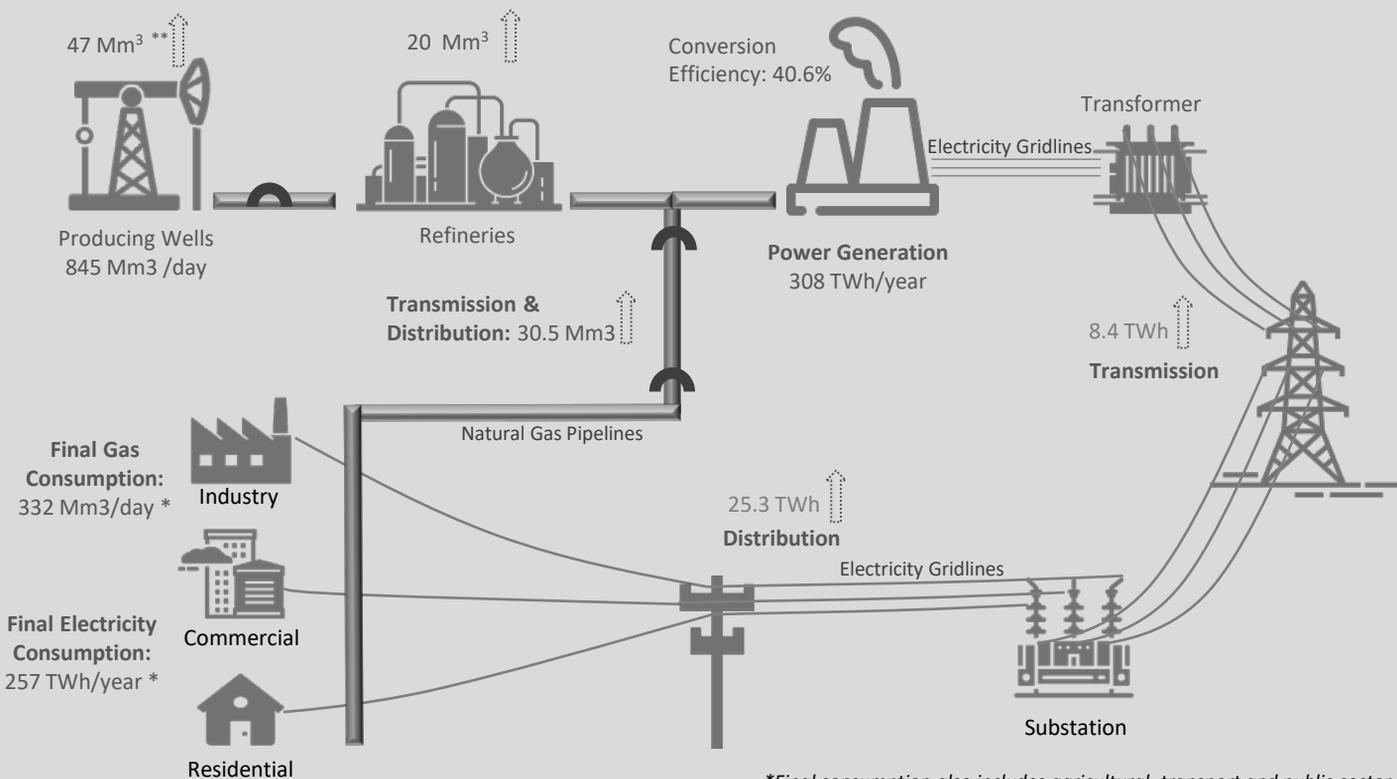




Supporting Iran in implementation of an integrated energy efficiency market

Inefficiencies in Iran's Energy Supply System

Figure 1- Energy losses in natural gas (Mm³ per day) and electricity (TWh per year) supply chain in Iran (2017)



*Final consumption also includes agricultural, transport and public sector.

**Mm³ denotes million m³.

Source of data: National Energy Balance, 2017

Natural gas supply system and its inefficiencies

Iran is an energy independent state with more than 70 per cent of primary energy supply coming from natural gas. According to the 2017 national energy balance, 88% of electricity was produced using natural gas as fuel.

On the one hand, natural gas is a relatively clean source of energy compared to coal and petroleum: burning natural gas results in fewer emissions of nearly all types of air pollutants and carbon dioxide (CO₂). On the other hand, natural gas consists primarily of methane - a strong greenhouse gas with 25 times higher global warming potential (GWP) than CO₂. Alarmingly, in Iran, a significant proportion of natural

gas leaks into the atmosphere from oil and natural gas wells, storage tanks, pipelines, processing plants, distribution regulators, compressors and pressure reduction units (see figure 1).

According to the latest national energy balance in 2017, 845 Mm³ (million m³) of rich natural gas is produced per day, out of which 5 Mm³ are consumed internally by production platforms, 25 Mm³ are injected into oil fields and 87 Mm³ are delivered to liquid gas and petrochemical industries. The majority of 677 Mm³ is transferred to refineries to produce what is known as "pipeline quality dry natural gas". While 31 Mm³ of natural gas are consumed internally

by refineries per day and 7 Mm³ are stored, 232 Mm³ are transferred to the energy sector and 332 Mm³ are consumed in the various sectors of the Iranian economy (industry, commercial, residential, agriculture, transport and public sector). Finally, net exports of natural gas amount to 25.5 Mm³. Natural gas is lost at various stages of the supply process. At producing wells, 47 Mm³ out of 845 Mm³ (5.6%) are lost due to gas flaring. Around 3 Mm³ are lost in the conversion to liquid gas and 20 Mm³ are wasted in the processing to pipeline quality gas at refineries. In the distribution of natural gas to the various sector for final consumption, 0.5 Mm³ are lost, while an additional loss of 30 Mm³ cannot be specified, but might be due to unmeasured leakages in the distribution or metering errors. In total, out of a primary energy supply of 845 Mm³ of natural gas, 100.5 Mm³ (11.9%) are lost in the processing, conversion and distribution of the gas.

Losses in the Electricity Supply System

In 2017, the power sector used 69.4 billion m³ natural gas, 4.8 billion liter diesel and 3.7 billion liter mazut to generate 308 TWh of electricity. In total, the conversion efficiency of the Iranian power sector was 40.6% in 2017. In thermal power plants, which produce 95% of electricity in Iran, the efficiency of energy conversion was 37.6%. It is worth noting that the efficiency of private power plants was 38.9%, while the efficiency of the state-owned ones and electricity generation units in large industries were 36.5 and 29.2% respectively.

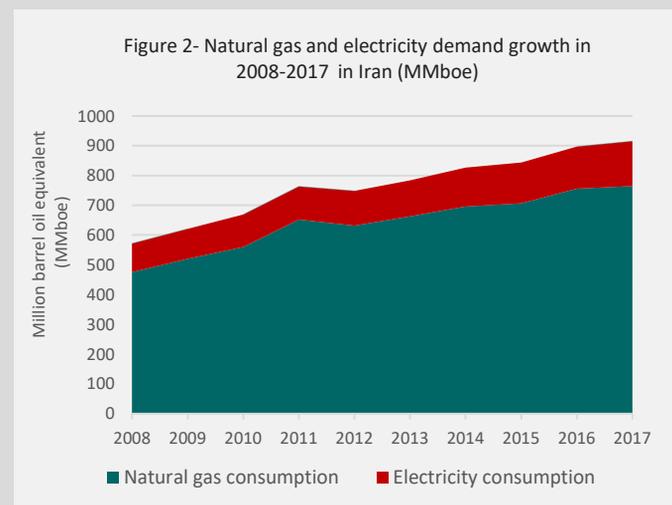
The electricity produced in power plants is transferred via transmission lines to the distribution network and then delivered to the final consumers. 8.4 TWh of the electricity are lost in transmission and 25.3 TWh are lost in the distribution system (see figure 1). Out of a total 308 TWh of electricity generated, 257 TWh are consumed in the various sectors of the economy, 13 TWh are consumed internally in the power sector, net exports are 4 TWh and around 34 TWh (10.9%) are lost in the transmission and distribution network.

Obsolete and outdated technology, low energy prices and limited access to finance and new technologies due to sanctions are among the main reasons for the low efficiency in Iran's energy supply system. For example, 43% of the gridlines and 30% of the substations are more than 20 years old.

Reducing Inefficiencies in Iran's Energy Supply System

Electricity and natural gas demand have been increasing in recent years and are anticipated to continue to do so in the future (see figure 2). If energy supply increases along with energy demand, increasing energy losses are inevitable given Iran's inefficient energy supply system. Plans and programs are in place to reduce losses. In power generation plants, programs of increasing the number of combined cycle power plants and recovering of waste heat are pursued. Furthermore, the electricity grid is improved by renovating electricity lines, transformers and substations.

In the natural gas supply system, flaring is the major source of energy loss. Iran is consistently among the top four gas-flaring countries in the world. Article 12 and the M3E (see newsletter September 2019) provide economic incentives for the reduction of energy losses in Iran through certifying the saved energy and creating a platform which allows energy savers to sell energy savings to consumers with higher tariffs. Flare reduction and flare gas recovery options are being studied to be included in the M3E as part of the IREEMA project.



Source of data: National Energy Balance, 2017

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