



## Facts and Trends

### NATURAL GAS

(IN ELECTRICITY GENERATION)

#### CONTEXT

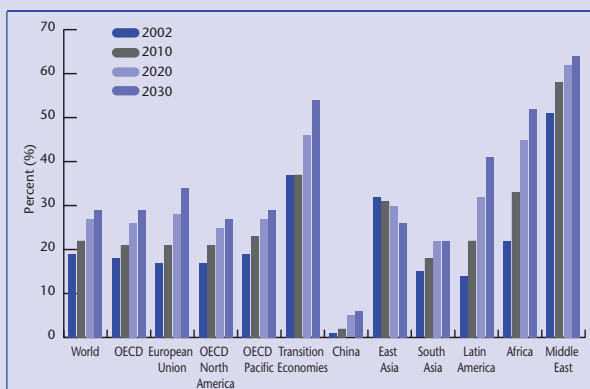
- Natural gas' share of global electricity generation has grown rapidly and is projected to increase from 19% in 2002 to 30% by 2030.
- The share of power generation is projected to be over 50% in certain countries by 2030. Countries that are net importers will have security of supply concerns.
- Natural gas technologies are available in all sizes to generate electricity, from a few kilowatts (kW) to hundreds of megawatts (MW). Electricity generation is dominated by high-efficiency CCGT (combined cycle gas turbines).
- There are proven reserves worldwide for at least 60 years at current production rates. Two-thirds of these reserves are in Russia, Iran and Qatar. Exploiting reserves will require major

investments in capital-intensive production, terminals and transport facilities. Natural gas demand is likely to peak at some point in the 21st century. If this is the case, natural gas should be seen as a transitional resource.

#### ISSUES

- Capital costs and project lead times for CCGTs are significantly lower than for other large-scale generation technologies. Low up-front financing costs make CCGT attractive to investors, particularly in deregulated markets. Fuel costs are responsible for 65-90% of CCGT electricity generation costs. Increasing gas generation requires the expansion of gas availability at competitive prices. In the 1990s, gas supply outstripped demand, and much of the necessary, capital-intensive infrastructure was already in place. Gas prices tend to track oil prices and are now considerably higher, forcing many potential investors to reconsider their options.
- CO<sub>2</sub> emissions per unit of electricity generation using current technologies are approximately 50% lower than those from coal plants. CO<sub>2</sub> emissions from gas-fired generation represented 7.8% of total CO<sub>2</sub> emissions from fuel combustion in 2002. Carbon capture and storage from gas power plants is possible but likely to be more expensive per metric ton of CO<sub>2</sub> avoided than from coal-based generation.

#### Share of electricity generation: Natural gas



Source: International Energy Agency. *World Energy Outlook 2004*.



- Natural gas is easily the cleanest fossil fuel: SOx and particulate emissions are negligible; only coal plants with the best available emissions reduction technologies can match the NOx emissions per unit of electricity generation from gas.
- The safety record of natural gas distribution (including the transport of liquefied natural gas (LNG)) and generation has been excellent. However, some communities have expressed strong opposition to the construction of LNG receiving terminals on their coastlines.

### THE WAY FORWARD

- Demand for natural gas is projected to double over the next 30 years, with power increasing its share in gas use from its current 35%. Meeting the projected increased demand will require trade between regions at five times today's levels by 2030; this trade will serve to create more homogenous prices globally. Much of it will be via ships using LNG, requiring capital-intensive infrastructure.
- Higher gas prices will make it more and more important to use combined heat and power (CHP) potential wherever feasible (see box, as well as the section on decentralized generation).

- R&D aims to bring CCGT efficiencies up to their technical limit (over 60%) while controlling NOx emissions, to reduce costs of smaller units (engines and turbines) and to develop fuel cells. All fuel cells require hydrogen, but certain types (molten carbonate fuel cells (MCFC), solid oxide fuel cells (SOFC)) can form this directly from gas. Their efficiencies could be 10% higher than conventional CCGT. The availability of gas distribution networks would be a major advantage in marketing fuel cells.

### COOPERATION WITH INDUSTRY

An important element of cooperation between electricity utilities and energy users are industrial CHP schemes. In order to achieve overall efficiency at minimum loss of electricity generation efficiency, utilities can supply high-temperature process steam from the steam circuit of a thermal power station (see picture). The key is that the generation and industrial site are located close to each other, making the transport of heat economical.



Yokohama LNG-fired Combined Cycle Thermal Power Station (TEPCO) and neighboring industries

