

Prospects for coal and clean coal technologies in Turkey

Turkey has one of the world's fastest growing economies, currently the 6th largest in Europe and the 16th largest in the world. In recent years, annual economic growth has been between 9% and 11%. Rapid economic expansion, growing population, and increasing industrialisation have triggered a general increase in energy demand. During the last decade, the rate of increase in demand for natural gas and electricity has been only second after China. In the next decade, the current level of energy demand is expected to double.

Like many countries, Turkey faces a number of energy supply issues. Set against a background of growing demand and increasing dependence on expensive imports of oil and natural gas, these centre mainly on security of supply and achieving sustainable development. The cost of Turkey's imported energy is considerable, accounting for around a quarter of the country's overall annual import bill.

Around 72% of the country's primary energy needs are met by imported oil and gas, and a major government objective is to reduce this high import dependency. At the moment, >90% of Turkey's oil and 98% of its natural gas is imported, mainly from Iran and Russia. Much of the hard coal consumed is also imported. Turkey's indigenous energy resources are limited almost exclusively to lignite and smaller amounts of hard coal. The continuous rise in energy demand makes it important for the country to meet more of its energy needs from its own resources, in particular, lignite.

Lignite deposits are spread across much of the country, with reserves available in all geographical regions and in more than 40 provinces. Current estimates suggest that resources exceed 13 Gt (11.8 Gt of lignite and 1.3 Gt of hard coal). However, despite considerable progress over the past decade, large areas of the country have yet to be explored fully. In others, evaluation has only been carried out at relatively shallow depths. Potentially, hard coal and lignite reserves could be much greater than current estimates suggest. On-going exploration has so far added 5.8 Gt to Turkey's lignite reserves. Even though often of poor quality, it remains the country's most important indigenous energy resource. Lignite-fired power plants have a strong competitive advantage in terms of price, supply, investment and operating costs.

Nearly 90% of lignite reserves are owned and/or operated by public sector organisations (TKI, EÜAŞ and MTA). Two of these are lignite producers; in 2011, TKI produced 33.4 Mt, and EÜAŞ, 31.6 Mt. In a typical year, the private sector produces ~7 Mt. The greatest concentration of lignite mines is in the northwest region around the towns of Soma, Seyitömer and Çan. As part of the on-going national privatisation process, some mines are being sold, packaged with specific power plants. During the last decade, Turkish energy markets have been undergoing tremendous changes. These have included liberalisation, opening up to private participation, and restructuring to establish a competitive market. Increasingly, state-owned power generation assets and coalfields are being sold to the private sector.

Unlike lignite, hard coal deposits and commercial production is limited to a single region, the Zonguldak basin in the north-west of the country. Coal resources in the basin are estimated to amount to 1.316 Gt, of which 530 Mt is considered proven. Turkish Hardcoal Enterprise (TTK) is responsible for the country's hard coal and is the main producer. Total annual production is ~3 Mt/y. However, this meets only a tenth of the annual demand and there is a target to increase output to 12 Mt/y by 2023 (the centennial foundation of the Republic). The current deficit is met by imports of around 30 Mt/y. This is used for power generation (see photograph below), coke production, by industrial users, and for domestic heating. In the near term, imports are expected to increase by 2–2.5 Mt/y as new thermal power plants come on line and iron and steel production expands.

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Recent years have seen Turkey's electricity demand increase by up to 8.5%/y. Much of this increase has been met by new natural gas-fired power plants, although as these rely mainly on imported gas, this has serious repercussions on the national trade balance. As part of a move to reduce imports, a coal strategy has been adopted, aimed at increasing the use of indigenous hard coal and lignite for power generation, with an emphasis on the adoption of clean coal technologies. 2012 was designated 'domestic coal year', backed by a government policy initiative that gave increased priority to the use of domestic lignite. Strategies and action plans have since been developed and project applications started. A significant number of coal-based power projects have been proposed or are under development or construction. In order to meet the increasing electricity demand, large investments will be required. Additional generating capacity will be needed to meet the country's growing needs and there is a goal of achieving an extra 18 GW of coal-based installed capacity within the next decade.

Thermal and hydroelectric generation currently provides most of Turkey's electricity. In 2012, gas-fired plants generated 43.6%, followed by hydro (24.2%). Domestic lignite and hard coal provided 16.2%, with imported hard coal providing a further 12.2%. However, there are plans to add nuclear power to the mix. By 2023, a government goal is for ~30% of the country's electricity to be produced from lignite/hard coal, 30% from gas, 30% from hydro and other renewables, and 10% from nuclear. There is an ambitious target for the country to have between 112 and 125 GW of installed generating capacity by 2023.

The commercial-scale deployment of clean coal technologies in Turkey encompasses mainly fluidised bed boilers, supercritical pulverised coal boilers, various environmental control technologies (such as FGD and SCR units), and a number of coal cleaning systems. However, as the national focus shifts towards the greater use of indigenous lignite and hard coal, interest in the wider use of CCTs is increasing. This has now reached ministerial level and their increased deployment is being encouraged by various means.



The 1320 MW Sugozu power plant. The plant consumes up to 30 kt/d of imported hard coal delivered via one of the world's largest floating coal trans-shipment terminals. This handles 3 Mt/y of coal, delivered mainly by Capesize vessels from Colombia and South Africa (photograph courtesy of STEAG)