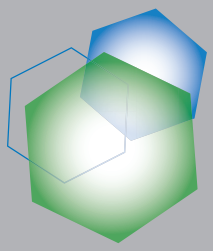

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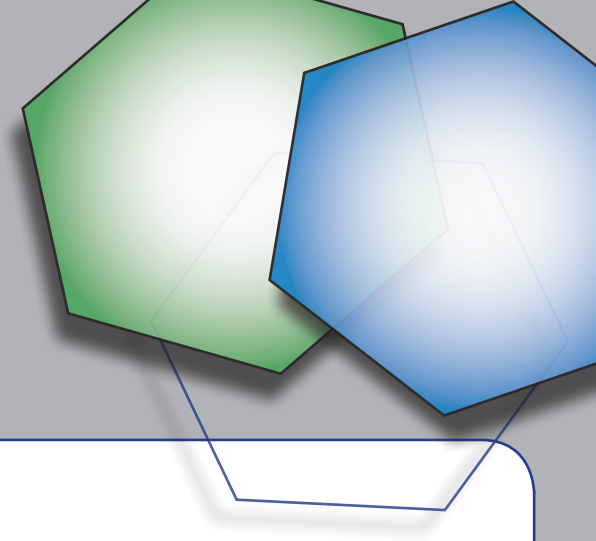

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THE CURRENT AND FUTURE IMPORTANCE OF COAL IN THE WORLD ENERGY ECONOMY

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The Energy Policy Institute of Australia is an independent and apolitical energy policy body.

The Institute advocates that Australia must maintain a secure investment climate and be internationally competitive, whilst moving towards and contributing as much as it can to global efforts to build a low-carbon society.

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Key Points:

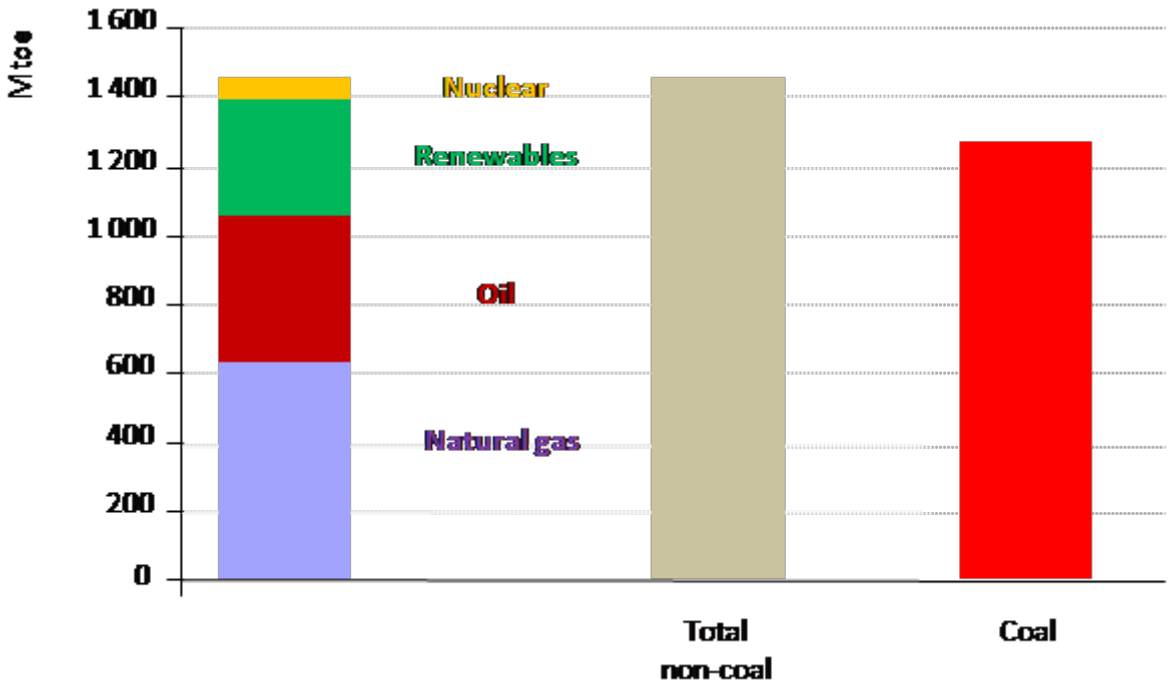
- Coal is the most important source of power generation globally, accounting for some 41% of global power generation in 2011.
- In non-OECD countries, it accounts for almost half of power output.
- The role of coal in the future will be largely determined by energy policy developments in non-OECD countries.
- Despite all endeavours to diversify energy sources, coal will remain the dominant power sector fuel for at least the next quarter century, as coal fired power generation is projected to increase by more than 70%.
- Increasing the efficiency of coal-fired power plants and the development and gradual utilisation of CCS technology will be essential to reconcile the ongoing importance of coal fired power with the global environmental objectives.

The Current Role of Coal

The importance of coal in the global energy mix is now the highest since 1971. It remains the backbone of electricity generation and has been the fuel underpinning the rapid industrialisation of emerging economies, helping to lift hundreds of millions of people out of energy poverty.

Global coal use has grown rapidly since 2000, by more than 50%, alone nearly matching the aggregate growth seen across gas, oil, nuclear and all forms of renewables (including hydro, wind biofuels, solar, etc) (Figure 1). Even in percentage terms, growth in coal use over the decade outpaced growth in renewables, although this was a time of take-off for a number of renewable energy sources and they started from a low base.

Figure 1: Growth in world energy demand, 2000-2010



Source: World Energy Outlook 2011

Behind the rapid growth in coal use over the last decade, a clear and growing dichotomy between OECD and non-OECD countries can be clearly seen. In OECD, even as power demand grew over the last decade, coal use in the sector fell from 42% to 38% of the sector's total energy use. While coal remains the backbone of the power sector, gas is clearly gaining market share, and is one of the main reasons for the improving environmental performance of some OECD countries, notably the United States. Meanwhile in non-OECD countries, especially in China and India, coal has driven a major revolution in power and industry. Energy demand in the power sector has expanded by 60% in the last decade in these countries, with coal use doubling. In China and India alone, coal fired power output increased by 2500 Twh over the decade, equivalent to ten times total Australian power production.

On the back of these expansions, both China and India have made notable progress in improving access to electricity, and reducing the numbers of people relying on traditional biomass for cooking. China is a great success story, with 500 million people in rural areas gaining access to electricity since 1990, and universal electrification expected to be achieved within a few years. Other Asian countries have seen electricity rise from a few percentage points to almost total availability in recent decades. Such access to electricity is crucial to economic growth; it means food can be stored in refrigerators, children can do their homework, small businesses can function. And overwhelmingly, this electricity has come from coal.

Despite these major advances, per capita power use in non-OECD countries is on average less than one fifth of the OECD.

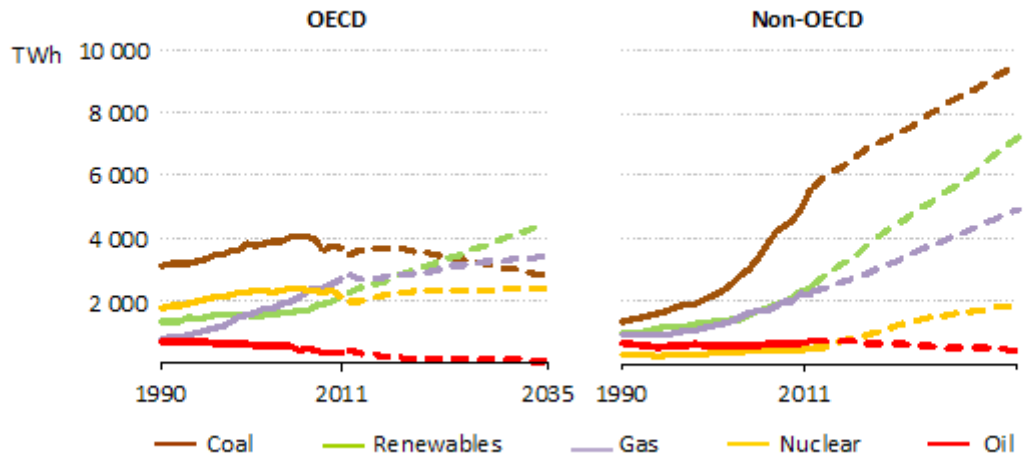
The Future of Coal

The current economic outlook remains very clouded, with many regions either stagnant or seeing slower economic growth. This will naturally impact heavily on global power use and coal consumption. However, most forecasters remain confident that, over the longer term, energy demand growth in non-OECD countries, the key determinant of coal demand growth, will be strong.

A longer-term concern relates to the environmental impacts of large-scale coal use, especially its climate consequences. Coal is a carbon-intensive fuel and the environmental consequences of its use can be significant, especially if it is used inefficiently and without effective emissions and waste control technologies. Such environmental consequences include emissions of pollutants such as sulphur and nitrogen oxides, particulates, mercury, and carbon dioxide, the main greenhouse gas. Indeed coal-sourced pollution remains the largest source of greenhouse gas emissions from fossil fuel combustion. Hence most forecasts show a very wide range of future coal demand, based on differing degrees of environmental policy implementation.

The International Energy Agency (IEA) reflected these factors in its three major scenarios in the World Energy Outlook 2011, with a very wide range of future coal demand levels. It is worth observing that the IEA's Current Policies Scenario, essentially a business as usual scenario, has global levels of coal demand more than 20% above the central scenario, in which a range of climate policies are cautiously implemented. The power sector is clearly the key coal market, but this sector must also be the focus of any successful climate change mitigation efforts. The outlook to 2035 for the future global power mix is shown in figure 2, based on the IEA's World Energy Outlook central scenario, Immediately apparent from figure 2 is that the evolution of the power mix in OECD countries will differ sharply from that of countries outside the OECD.Non-OECD countries make up an ever-increasing share of global power, while OECD countries see at best only modest growth in total power use, as energy efficiency and saturation effects take effect. In the OECD a strong shift to low carbon power can be expected, as renewables grow quickly, while coal declines by around one-quarter.

Figure 2: Growth in world energy electricity output demand, 1990-2035

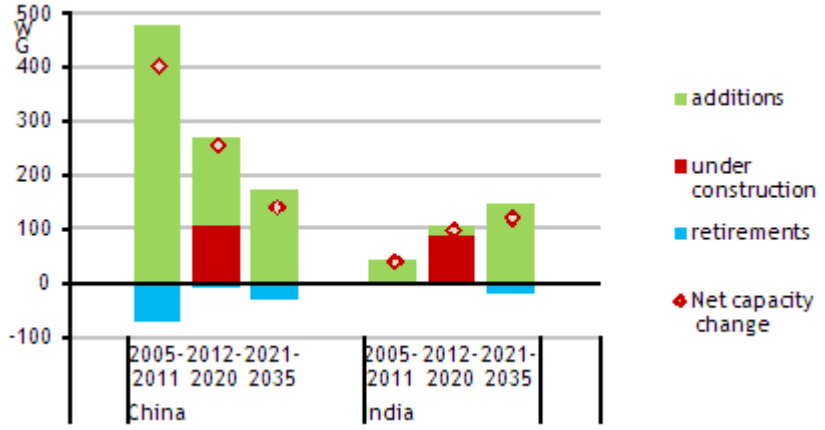


In stark contrast, non-OECD countries see power output growing strongly, as per capita use surges, firstly in China, then later in the forecast period, in India and ASEAN countries.

While renewables, including hydro, are easily the fastest growing source of power, coal continues to be the largest source of generation, growing by around two thirds in absolute terms, and meeting around one-third of incremental demand. In non-OECD Asian countries, the situation is even clearer, with coal-fired power growing by almost 80%, although its share in the power mix falls from the current 70% to 53%.

Massive new investments will be needed in power generation, transmission and distribution. In both China and India, some hundreds of gigawatts of new coal-fired power plants are under construction, adding to the massive investments already built in the last decade or so (figure 3). Similar trends can be seen in a number of ASEAN countries. By 2020, around three quarters of global coal use will be in non-OECD countries.

Figure 3: Coal fired plant built, under construction or planned



China, as the world's largest coal user, deserves special attention. Currently, the Chinese Government is making strong efforts to diversify the energy and power mix. Nearly half the new power plants being built globally (and it stands at a high level of more than 60) are being built in China. Strong efforts are being made on nuclear and renewable generation, including conventional hydro, but also wind, solar and other new technologies. Measures are being taken to bring more natural gas into the energy mix; gas currently supplies less than 2% of Chinese power, whereas in many western nations its role is ten times bigger. More efficient power production technologies are also being deployed, enabling more power to be produced with lower coal use, and permitting the retirement of older, smaller, less efficient and more polluting power stations. And of course, greater energy efficiency in using electricity itself—through, for example, more efficient industrial processes and appliances that use less power, in which China has made great strides in recent years, will be central to how power demand evolves over coming decades. The decade to 2011 saw massive growth in coal-fired power. While coal will continue to grow significantly, incremental power demand will be met from a wider variety of sources. Even so, by 2020, China will be generating some 4,500 Twh from coal, around four times Japan's total power use.

Coal and the Environment

Environmental policy will play a decisive role in future coal consumption. In some countries, coal use may be encouraged for economic, social or energy security reasons. If action were taken to provide electricity access by 2030 to the 1.3 billion people in the world without it today (almost all in non-OECD countries), coal could be expected to account for more than half of the fuel required to provide additional on-grid connections. In other countries, policies may encourage switching away from coal to more environmentally benign or lower carbon sources. While a global agreement on carbon pricing has been elusive, a growing number of countries are taking steps to put a price on carbon emissions, including in China where there are several pilot schemes underway, although current pricing levels seen for example in Europe, are too low to materially affect energy choices .

In terms of technology, the widespread deployment of more efficient coal-fired power plants is an essential first stage in providing for the continuing utilisation of coal as an affordable fuel. If the global average level of efficiency of coal-fired power plants were to be 5% higher at present, this would lower global carbon dioxide emissions from the power sector by 8%. In reality, the penetration of the most efficient coal-fired power generation technologies is constrained by technical considerations, additional costs and the absence of a global price on carbon.

In the longer term, the deployment of carbon capture and storage (CCS) technology on a significant scale may be a "game-changer" for coal. If sufficiently widely deployed, CCS technology could potentially reconcile the continued widespread use of coal with the need to reduce carbon dioxide emissions. While the technology exists to capture, transport and permanently store these emissions in geological formations, and much encouraging progress has been made in developing and proving these individual parts of the CCS process, including in China, CCS has yet to be demonstrated on a large scale in an integrated fashion in the power and industrial sectors, and so costs remain uncertain. Two projects coming on line soon in North America will help address this.

Together, the widespread adoption of more efficient coal power plants and of CCS would secure the continuing availability of coal in the future energy mix and make an important contribution to tackling climate change. The success of governments globally in encouraging greater energy diversity, improved efficiency, and the development and deployment of clean coal technologies will have a profound bearing on the role of coal in the longer term. But, in almost any conceivable scenario, coal will remain a critical part of the power sector in both OECD, and increasingly, non-OECD countries.

Author ...

Ian Cronshaw is a Canberra and Paris-based energy analyst. For six years he was Division Head at the International Energy Agency (IEA) in Paris in charge of global gas, coal and power markets.

In 2013 he was responsible for the gas and coal chapters of the IEA's seminal publication the World Energy Outlook.

Ian previously worked for the Australian Government in Canberra and has over 40 years experience in energy policy, resource development and taxation.