

2nd Edition



**COAL**

**Hard Facts**



# COAL

## Hard Facts

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**JOBS**

**41,100**

Direct employment in the coal industry



**\$6b**

**WAGES**

Paid in 2013-14 by the coal industry



**\$37.8b**

**COMPANY TAX & ROYALTIES**

Paid by the coal industry between 2007-08 and 2013-14



**71%**

**ELECTRICITY**

Grid electricity in Australia provided by black and brown coal



**65Mt ▲**

**EXPORT VOLUME**

Australia's projected increase in coal export volume between 2015-2020



**0.1%**

**ASSISTANCE**

Effective rate of government assistance to all mining



**53**

**PROJECTS**

Proposed coal mine developments



**120Mt**

**JAPAN**

The primary destination for Australia's coal exports in 2014



**13%**

**COAL EXPORTS**

Coal has averaged more than 13 per cent of Australia's total exports over the last five years



**\$300m**

**INDUSTRY FUND**

Total committed to date to the COAL21 fund supporting low emissions technologies



**40% ▼**

**CO<sub>2</sub> REDUCTION WITH HELE**

CO<sub>2</sub> reduction from high-efficiency, low-emissions coal power plants



**90% ▼**

**CO<sub>2</sub> REDUCTION WITH CCS**

CO<sub>2</sub> reduction from carbon capture and storage

# COAL BENEFITS ALL AUSTRALIANS

AUSTRALIA IS FORTUNATE TO BE RICHLY ENDOWED WITH A COMMODITY THAT IS INDISPENSABLE TO MODERN LIFE: COAL.

Thermal coal fuels 41 per cent of global electricity generation because it is reliable and affordable.<sup>1</sup> Metallurgical coal is an essential ingredient in the manufacture of steel.

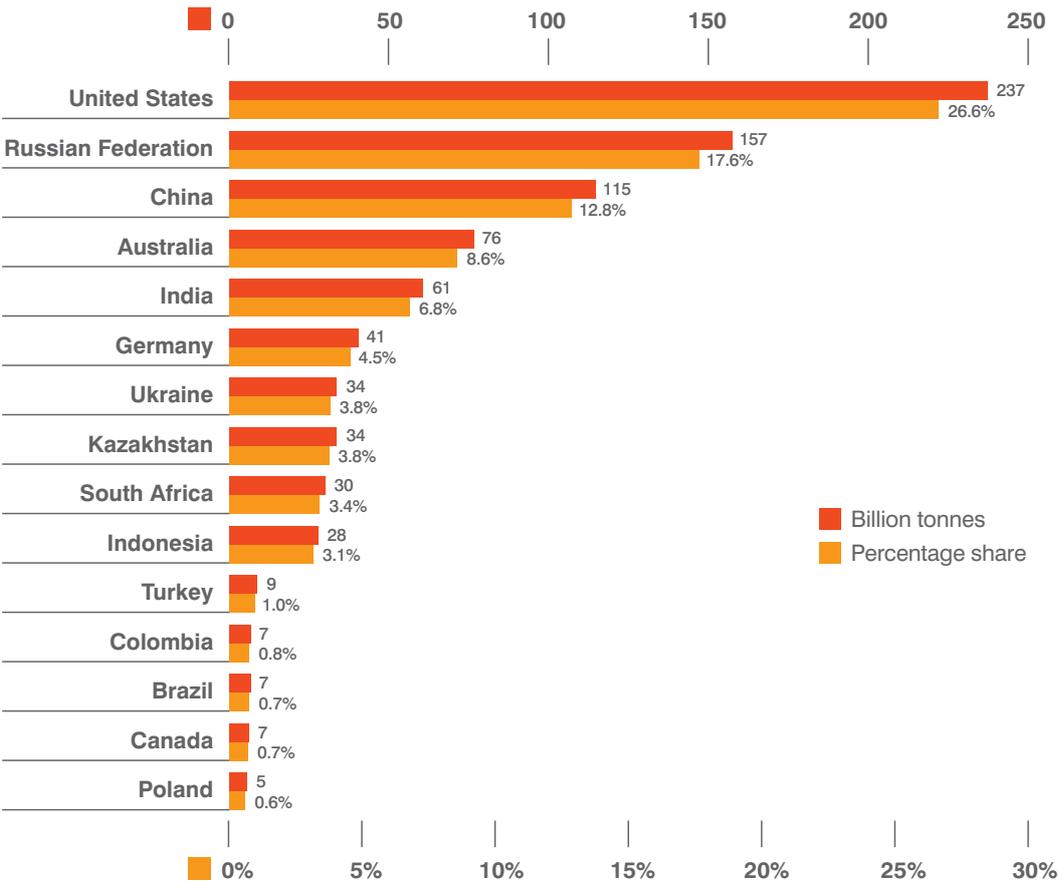
Australia has the fourth-largest share of coal reserves in the world (Chart 1). Australia has more than 100 years of production for black coal and approximately 465 years for lignite (brown coal).<sup>2</sup>

Coal benefits all Australians through its contribution to exports, wages, investment and tax revenue. It is Australia's comparative advantage in coal – together with iron ore – that has helped to sustain the longest period of continuous economic growth in the nation's history.

Notwithstanding a cyclical downturn in prices, developing economies – particularly in Asia – will continue to drive robust coal demand for decades to come.

CHART 1 National shares of proven world coal reserves (December 2014)<sup>3</sup>

Source: BP Statistical Review of World Energy 2015

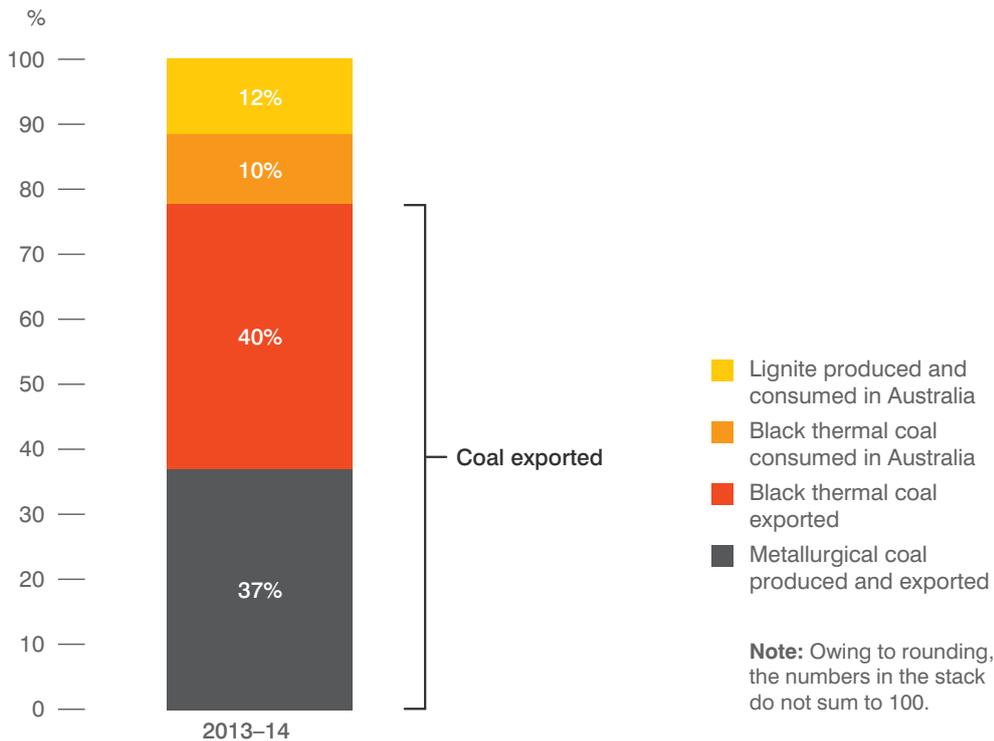


**FACT**

COAL HAS HELPED TO SUSTAIN THE LONGEST PERIOD OF CONTINUOUS ECONOMIC GROWTH IN THE NATION'S HISTORY.

CHART 2 Share of total Australian coal production exported (2013–14)<sup>4</sup>

Source: Department of Industry and Science; Victorian Department of Economic Development, Jobs, Transport and Resources



### Coal exports boost national income

Most Australian coal is exported. 77 per cent of the nation’s coal production was shipped overseas in 2013-14 (Chart 2).

Australia is a major supplier of high quality coal to both mature and emerging markets (Chart 3).

Coal is Australia’s second largest export and the biggest export industry in both Queensland and New South Wales. Coal boosted national income by \$40 billion in 2013-14 and will contribute a further \$250 billion between 2014-15 and 2019-20 (Chart 4).<sup>6</sup>

Metallurgical (steel-making) coal accounts for 58 per cent of the **value** of Australia’s total coal exports, while thermal (energy) coal accounts for 42 per cent.<sup>7</sup>

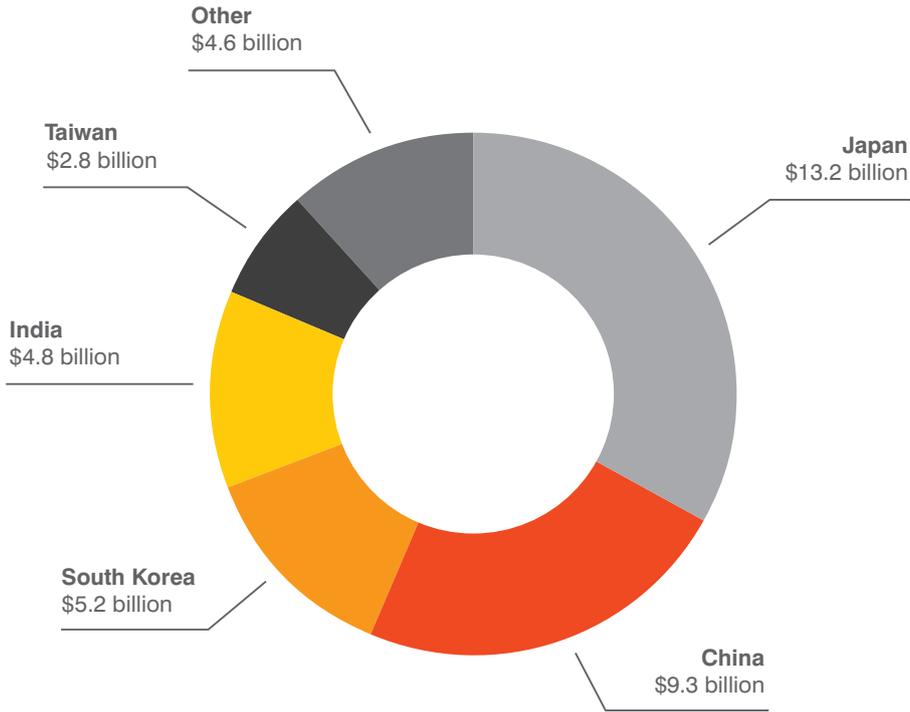
Conversely, thermal coal accounts for 52 per cent of the **volume** of Australia’s total exports (195 million tonnes in 2013-14) while metallurgical coal accounts for 48 per cent (180 million tonnes in 2013-14).<sup>8</sup>

The Department of Industry and Science projects that Australia’s coal export **volumes** will increase from 387 million tonnes in 2014-15 to 438 million in 2019-20, at a cumulative annual growth rate of 2.3 per cent.<sup>10</sup>

The Department of Industry and Science projects that Australia’s coal export **values** will increase from \$37 billion in 2014-15 to \$47 billion in 2019-20, at a cumulative annual growth rate of 4.8 per cent.<sup>11</sup>

CHART 3 Australia’s major coal export markets (2013–14)<sup>5</sup>

Source: Department of Industry and Science



AUSTRALIA WILL OVERTAKE INDONESIA AS THE WORLD’S BIGGEST COAL EXPORTER BY 2017.

Source: Department of Industry and Science



**+65Mt**  
**Australia**

Projected increase in coal export volume between 2015 and 2020

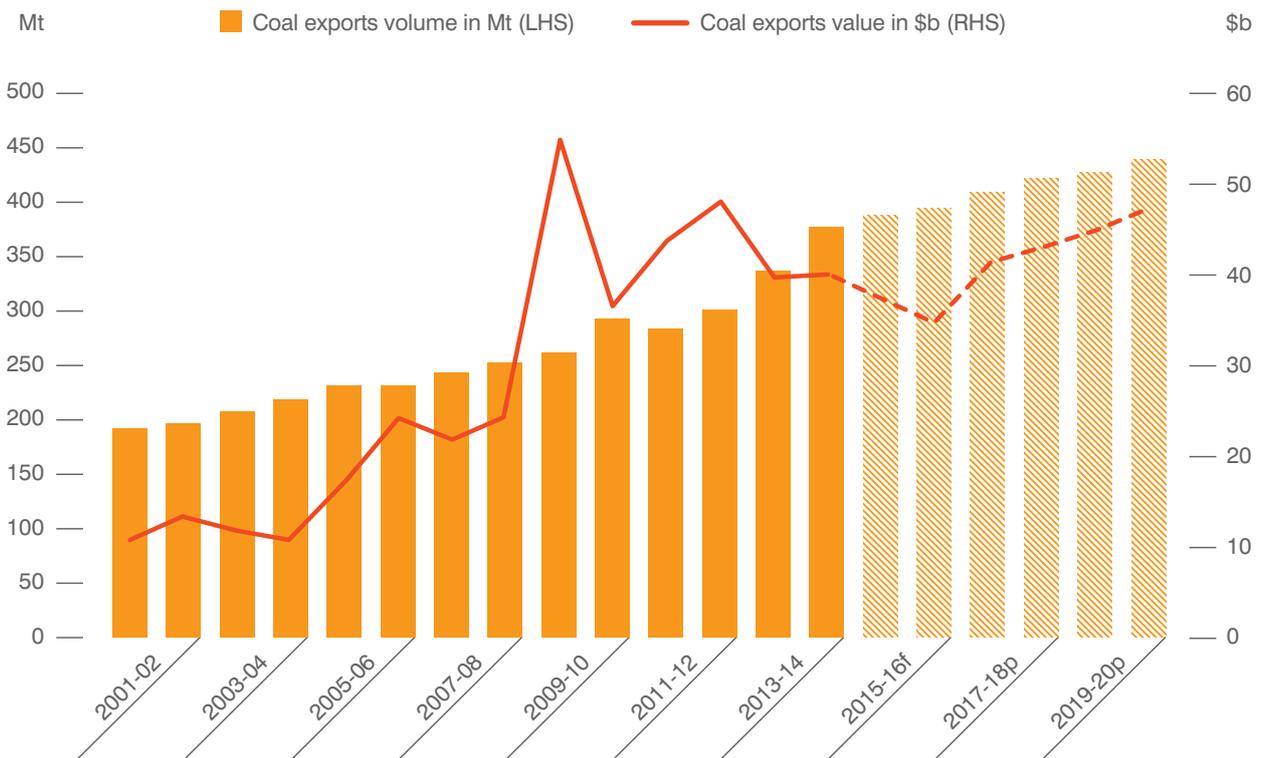


**-18Mt**  
**Indonesia**

Projected decrease in coal export volume between 2015 and 2020

CHART 4 **Australia's coal exports by volume and value (2000-01 to 2019-20)<sup>9</sup>**

Source: Department of Industry and Science

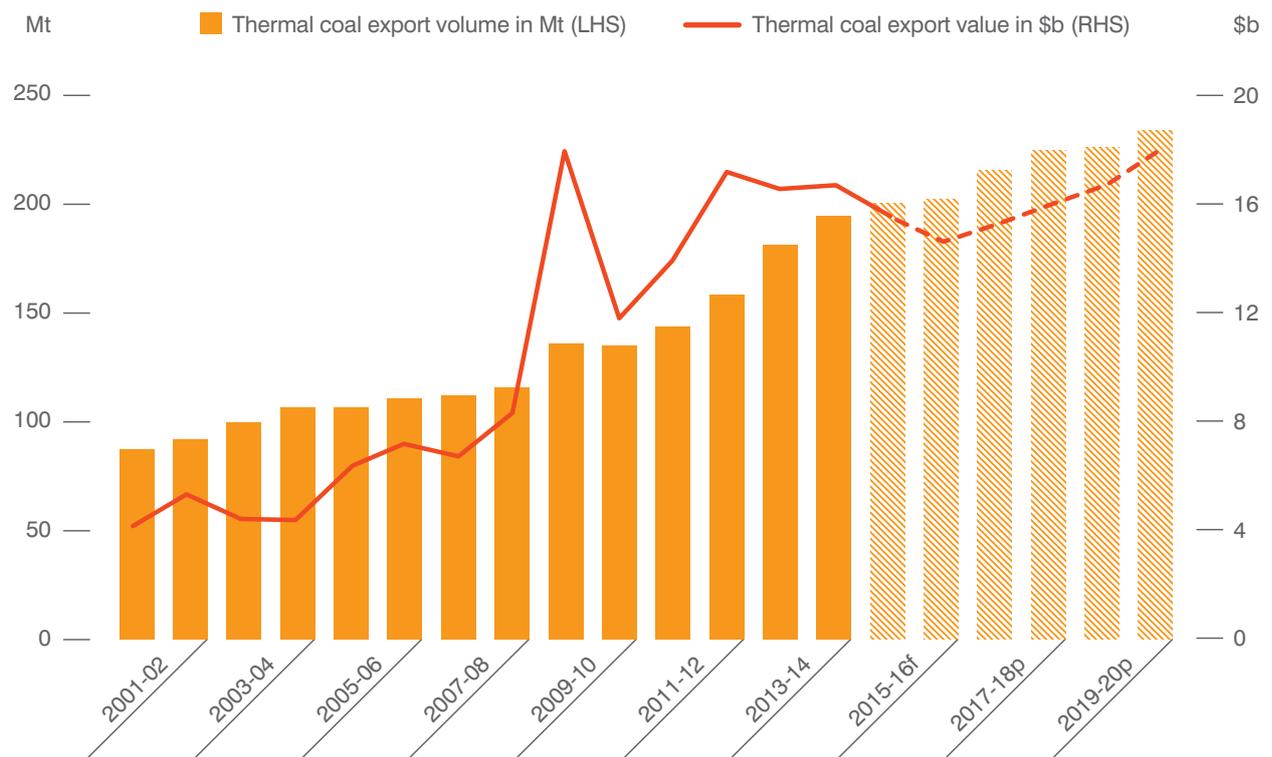


**FACT**

EXPORT VALUES WILL INCREASE FROM \$37 BILLION IN 2014-15 TO \$47 BILLION IN 2019-20.

CHART 5 Australia's thermal coal exports by volume and value (2000–01 to 2019–20)<sup>15</sup>

Source: Department of Industry and Science



### Outlook for thermal coal exports

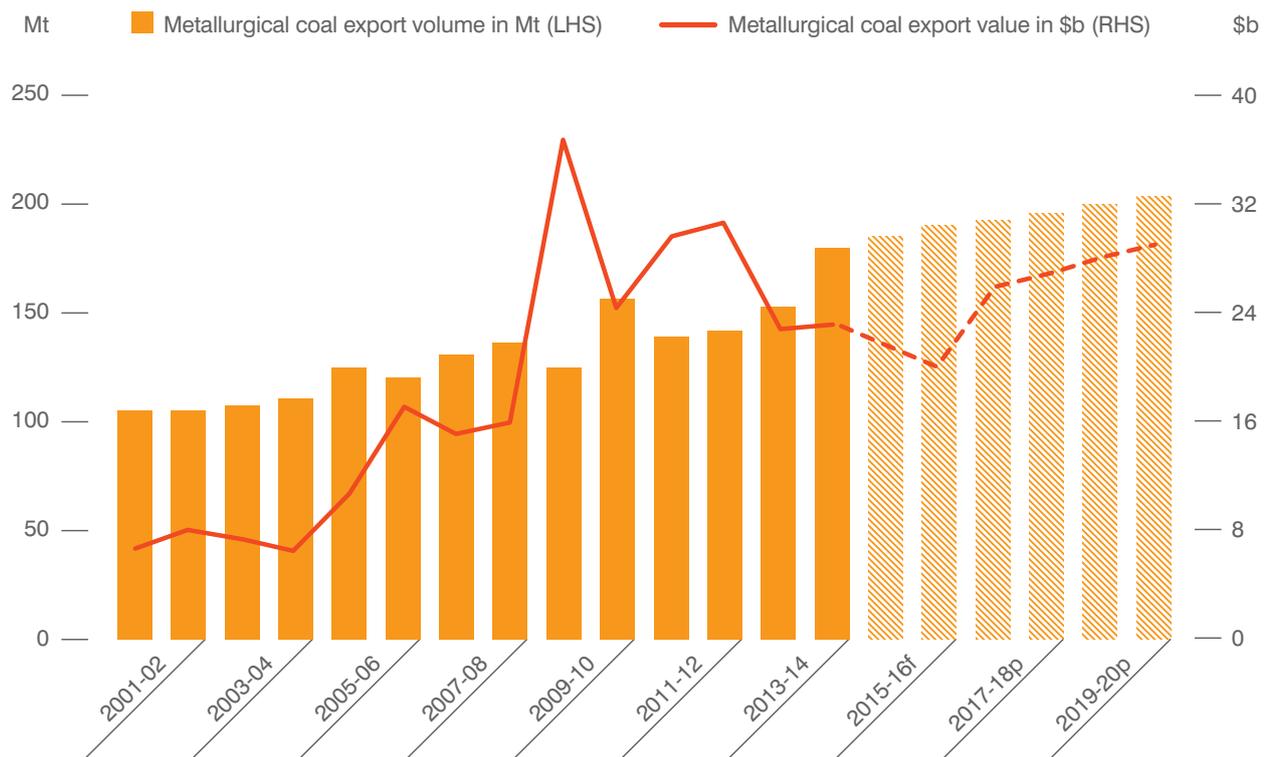
The Department of Industry and Science forecasts that world trade in thermal coal will slow in 2015 but recover in 2016 (increasing by 2.6 per cent to 1036 million tonnes).<sup>12</sup>

Australia's thermal coal production is forecast to rise by 1.4 per cent to 249 million tonnes in 2015-16.<sup>13</sup>

The Department of Industry and Science notes that Australian exports have remained resilient despite a challenging operating environment for producers. Australia's thermal coal exports are projected to increase from 201 million tonnes in 2014-15 to 234 million tonnes in 2019-20, at a cumulative annual growth rate of 3.1 per cent (Chart 5).<sup>14</sup>

CHART 6 Australia's metallurgical coal exports by volume and value (2000–01 to 2019–20)<sup>20</sup>

Source: Department of Industry and Science



### Outlook for metallurgical coal exports

World trade in metallurgical coal is also expected to decline in 2015 but rebound in 2016. While lower import demand from China will induce a 2.9 per cent fall in 2015 to 301 million tonnes, world trade is forecast to rise in 2016 by 1.4 per cent to 305 million tonnes.<sup>16</sup>

The Department of Industry and Science says that the China-Australia Free Trade Agreement is likely to improve the competitiveness of Australian coal, as it removes a 3 per cent tariff on metallurgical coal imports from Australia.<sup>17</sup>

While lower prices have prompted some Australian producers to decrease output in 2015, the consequent loss of production is expected to be more than offset by increased output from new projects such as Maules Creek.<sup>18</sup>

The Department of Industry and Science projects that Australia's metallurgical coal exports will increase from 186 million tonnes in 2014-15 to 204 million tonnes in 2019-20, at a cumulative average growth rate of 1.9 per cent (Chart 6).<sup>19</sup>

## Coal investment pipeline



### FACT

THE COAL INVESTMENT PIPELINE CURRENTLY CONSISTS OF 63 PROJECTS WORTH APPROXIMATELY \$83 BILLION.



## More coal projects in the pipeline

The Department of Industry and Science reports that the coal investment pipeline (including both mines and infrastructure projects) currently consists of 63 projects worth approximately \$83 billion. The department provides employment estimates for 44 of these projects, which collectively could generate up to 58,500 direct jobs (33,000 in construction and 25,500 ongoing in operations).<sup>27</sup>

As at April 2015, 40 coal mining projects were under feasibility examination with a combined value of \$58 billion. There are more coal projects at the feasibility stage than any other commodity.<sup>28</sup>

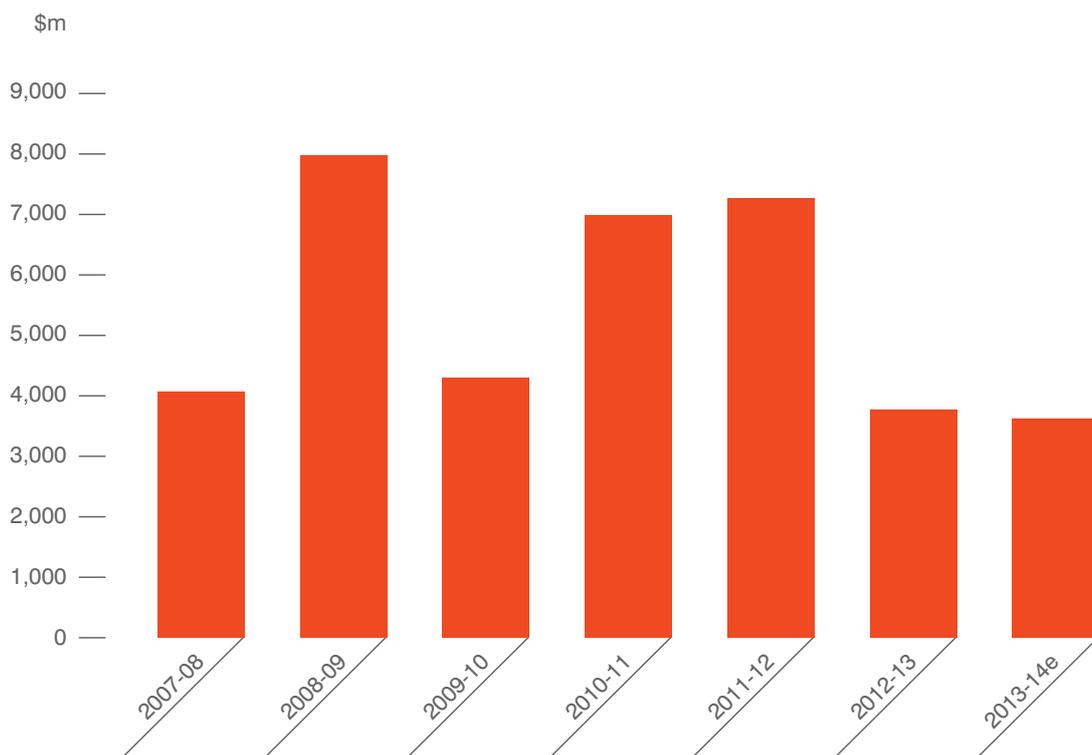
Queensland is the primary location for proposed coal mine developments, accounting for 27 of the 40 coal mining projects at the feasibility stage. By value, almost 90 per cent of all coal projects at the feasibility stage are in Queensland, owing to large greenfield projects in the Galilee Basin.<sup>29</sup>

New South Wales has 11 coal projects at the feasibility stage with a total value of \$5.8 billion.<sup>30</sup>

The department's data reveal that despite tough operating conditions, 15 coal mining projects were completed in the two years to April 2015, adding a production capacity of about 57 million tonnes.<sup>31</sup>

CHART 7 Coal royalties and company tax

Source: Deloitte Access Economics



### The coal industry pays its fair share of tax

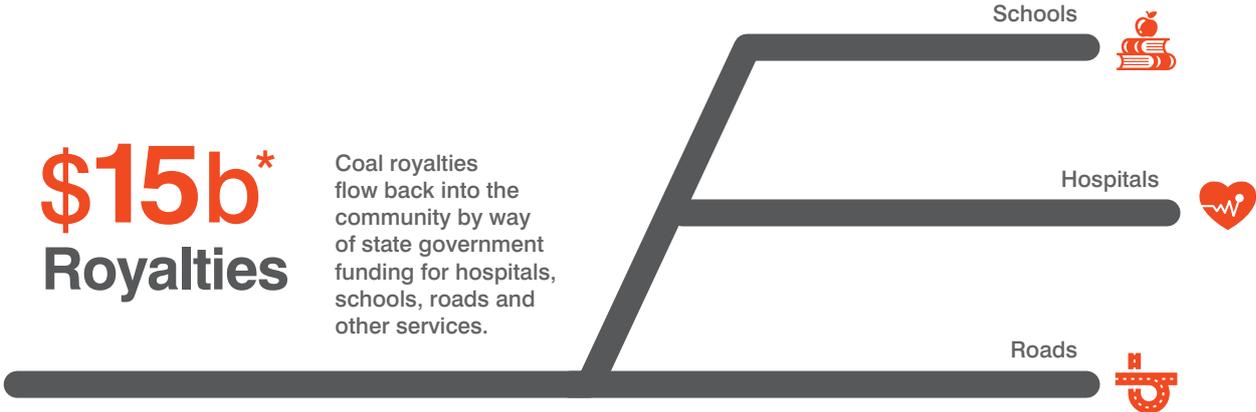
The Australian coal industry makes a significant contribution to federal and state governments every year in the form of taxes, royalties and charges, including company tax, stamp duties, payroll tax, land taxes and charges for transport and port services.

In 2014-15, black coal and lignite generated an estimated \$2.9 billion in royalties for Queensland, New South Wales and Victoria – almost double the royalty payments made in 2007-08 (\$1.5 billion). Over the four years 2015-16 to 2018-19, total coal royalties are projected to sum to \$15 billion.<sup>22</sup> Royalties have consistently accounted for a larger share of the tax

rate on coal compared with other major mineral commodities. The tax ratio is likely to increase further owing to falls in commodity prices (royalties are not linked to profits) and increases in state royalty rates.

The MCA's 2014 annual tax survey, conducted with Deloitte Access Economics, showed that the minerals industry's tax burden increased for the third consecutive year and showed the highest recorded tax ratio since the survey began in 2011.<sup>23</sup> Based on additional Deloitte Access Economics estimates in March 2015, the minerals industry's combined tax and royalty ratio (company tax and royalties as a share of pre-taxable

Coal royalties benefit everyone



\* Total expected coal royalties to be paid from Queensland, New South Wales and Victoria over the next four financial years.



**FACT**

ROYALTIES  
ACCOUNT FOR A  
LARGER SHARE OF  
THE TAX RATE ON  
COAL THAN OTHER  
MAJOR MINERAL  
COMMODITIES.

income) in 2012-13 was 53 per cent.<sup>24</sup> In other words, more than half of every dollar of profit made was paid to government via company tax and royalties.

Deloitte Access Economics was also asked to make industry-wide estimates for coal’s contribution from company tax and royalties. These estimates show that the coal industry contributed a total of around \$38 billion from these two instruments between 2007-08 and 2013-14.<sup>25</sup> This is approximately the same amount the commonwealth and state governments spent on public hospitals in 2012-13 and the same amount spent on schools in 2012.<sup>26</sup>

## A high skilled, high paid, regional coal workforce

The Australian coal industry employs approximately 41,100 people directly and pays wages and salaries worth around \$6 billion a year (Table 1). Direct employment in the coal sector is nearly double what it was 10 years ago. Moreover, the industry employs a highly skilled well paid workforce including mine operators, engineers, geologists, environmental scientists and skilled tradespeople.

The Australian coal industry employs a further 111,000 people in industries directly associated with coal, such as power generation, coal transport and shipping, as well as a range of service and contracting industries.

TABLE 1 **Coal employment and wages<sup>21</sup>**  
Average year to May, A\$m

*Source: Australian Bureau of Statistics and MCA estimates based on employment multiplier derived by Sinclair Davidson and Ashton de Silva*

	2005	2015	% change
Direct employment	22,400	41,100	
Indirect employment	60,500	111,000	
<b>Total employment</b>	<b>82,900</b>	<b>152,100</b>	<b>84</b>

	2003–04	2013–14	% change
Wages and salaries	\$1,926m	\$5,972m	210





# COAL PROVIDES RELIABLE AND AFFORDABLE POWER

AUSTRALIAN COAL PROVIDES RELIABLE AND AFFORDABLE ELECTRICITY FOR HOUSEHOLDS AND BUSINESSES.

Low cost and reliable energy has been a critical element of the international competitiveness of Australian industry and the living standards of Australian households for 100 years. Supplementary technologies such as wind and rooftop solar depend upon baseload power to guarantee consistent supply.<sup>32</sup>

Black coal and lignite account for 34 per cent of Australia's primary energy use and 71 per cent of grid electricity. Black coal fuels 87 per cent of grid electricity in New South Wales and 75 per cent in Queensland, while lignite generates 86 per cent of electricity in Victoria (Chart 8).<sup>33</sup>



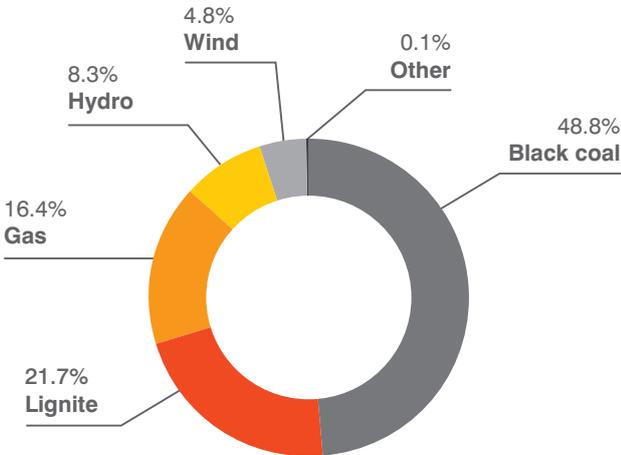
**FACT**

BLACK COAL AND LIGNITE ACCOUNT FOR 71 PER CENT OF GRID ELECTRICITY.

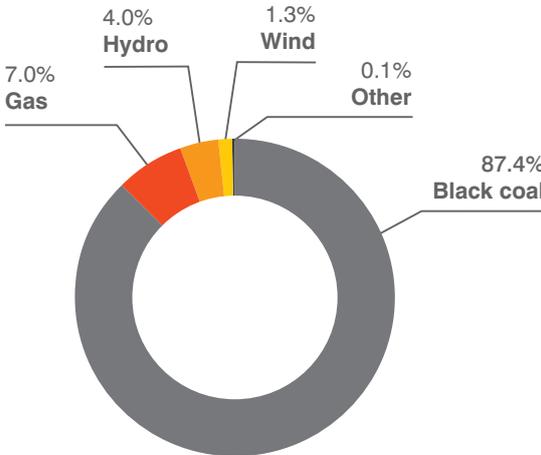
**CHART 8**      **Grid electricity generation by fuel (2013–14)**  
Australia and selected states

Source: Energy Supply Association of Australia, Electricity Gas Australia 2013

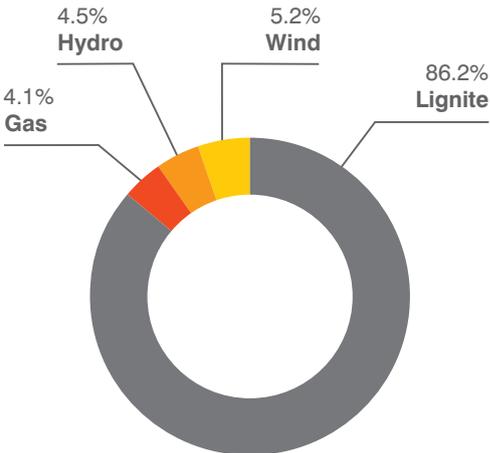
**Australia**



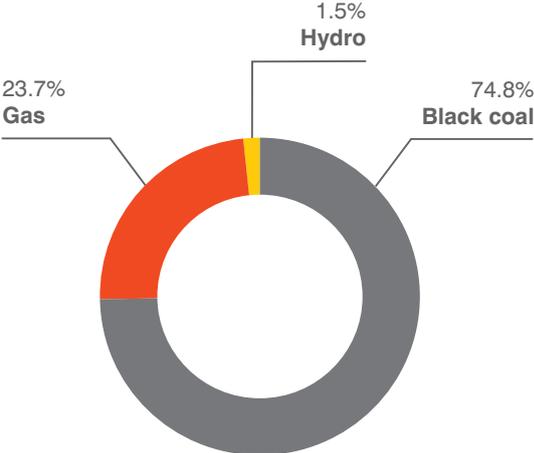
**NSW & ACT**



**Victoria**

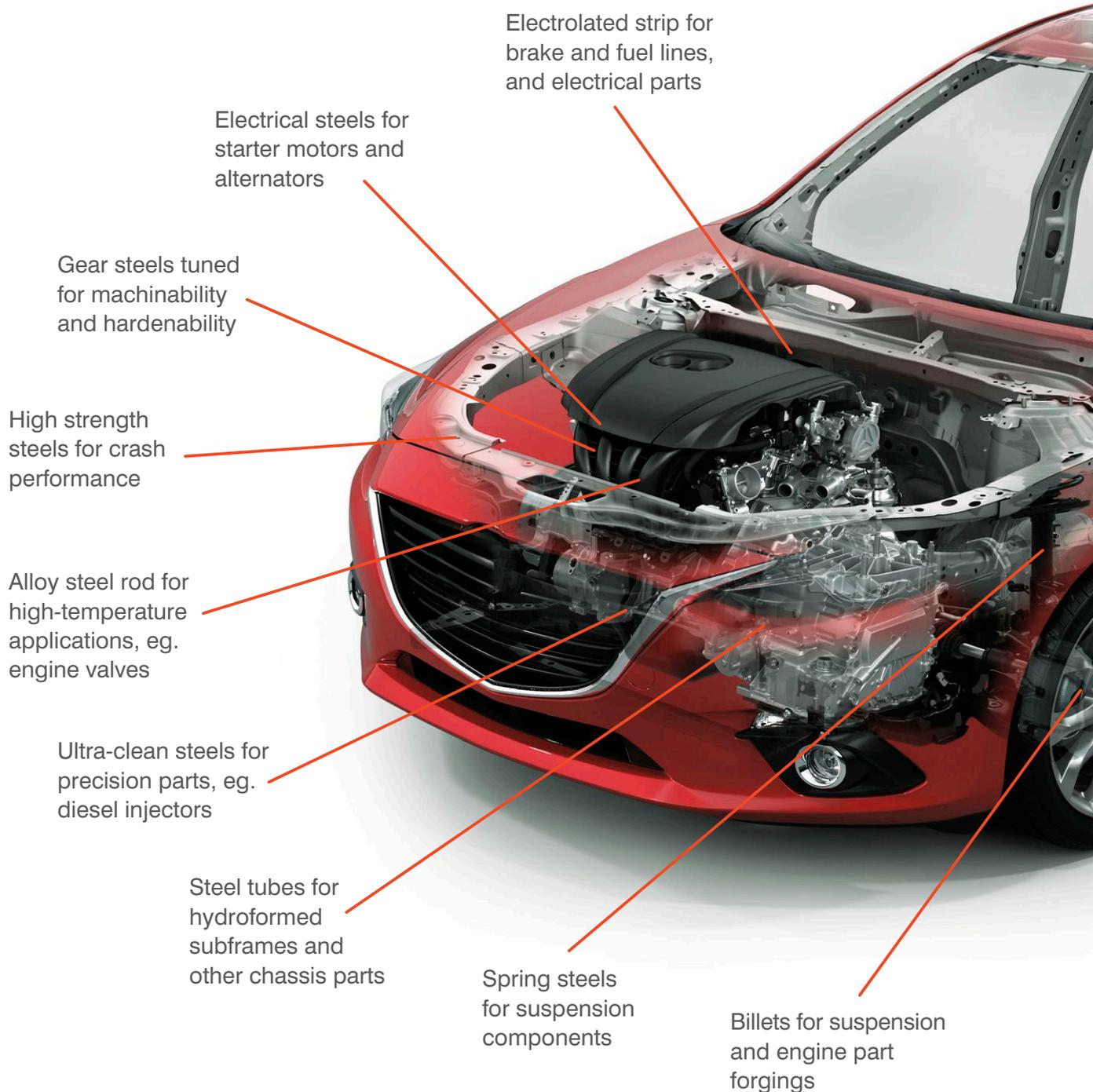


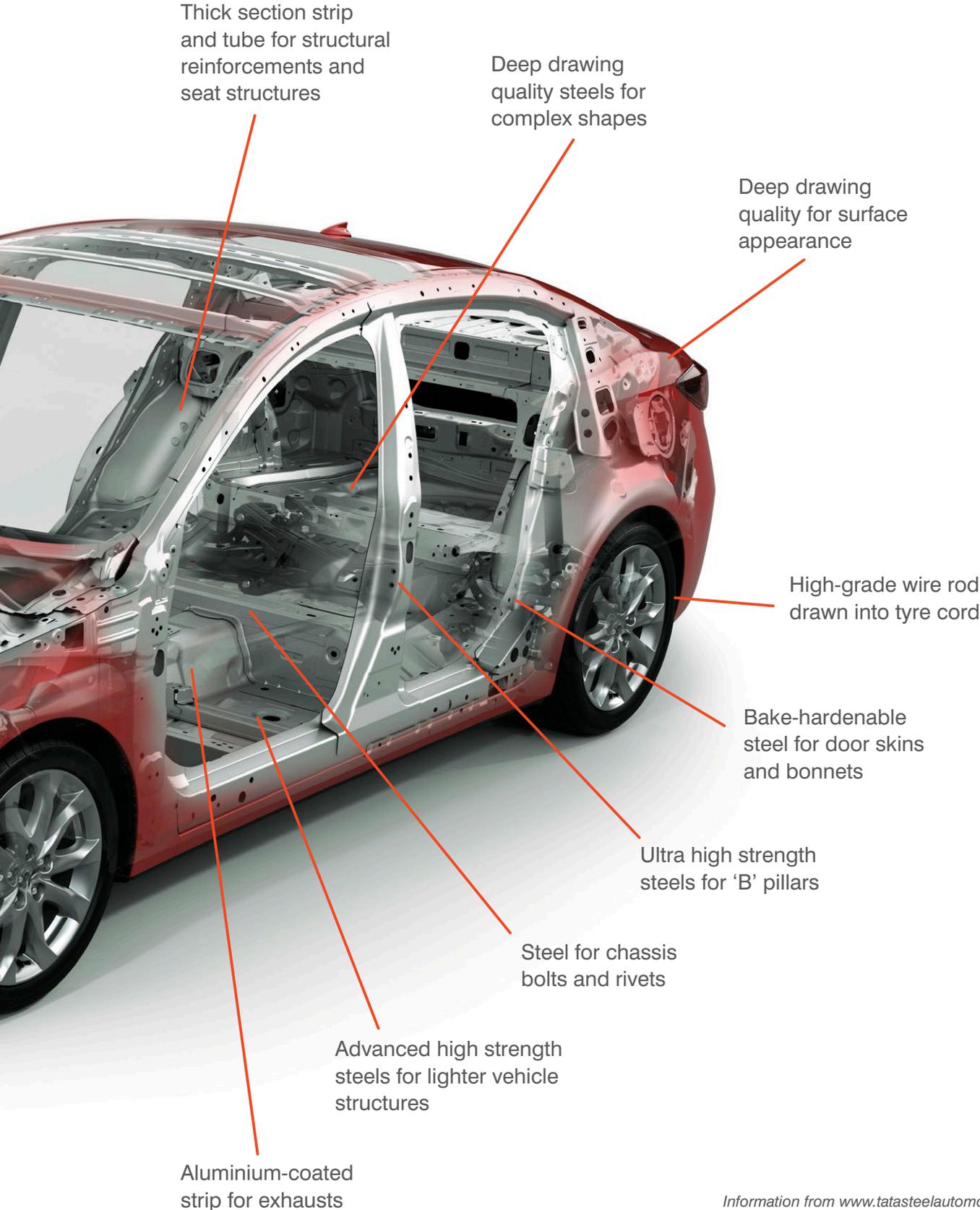
**Queensland**



# CARS = COAL

**New steel is the product of iron ore and coking coal.  
Every tonne of steel needs about 800 kilograms of coal.  
That means every car on the road is a product of the coal industry.**





# LIGNITE: NEW OPPORTUNITIES FOR OLD FAITHFUL

AUSTRALIA HAS THE SECOND LARGEST RESERVES OF LIGNITE IN THE WORLD (AFTER GERMANY) WITH AN ESTIMATED 465 YEARS OF PRODUCTION.

All of Australia's recoverable lignite reserves are located in Victoria with approximately 93 per cent in the Latrobe Valley.<sup>34</sup>

In 2013-14, Victoria produced 58 million tonnes of lignite, which generated 86 per cent of grid electricity and approximately \$36 million in royalties for the state. Between 2014-15 and 2018-19, the lignite industry is expected to contribute a further \$180 million in royalties.<sup>35</sup>

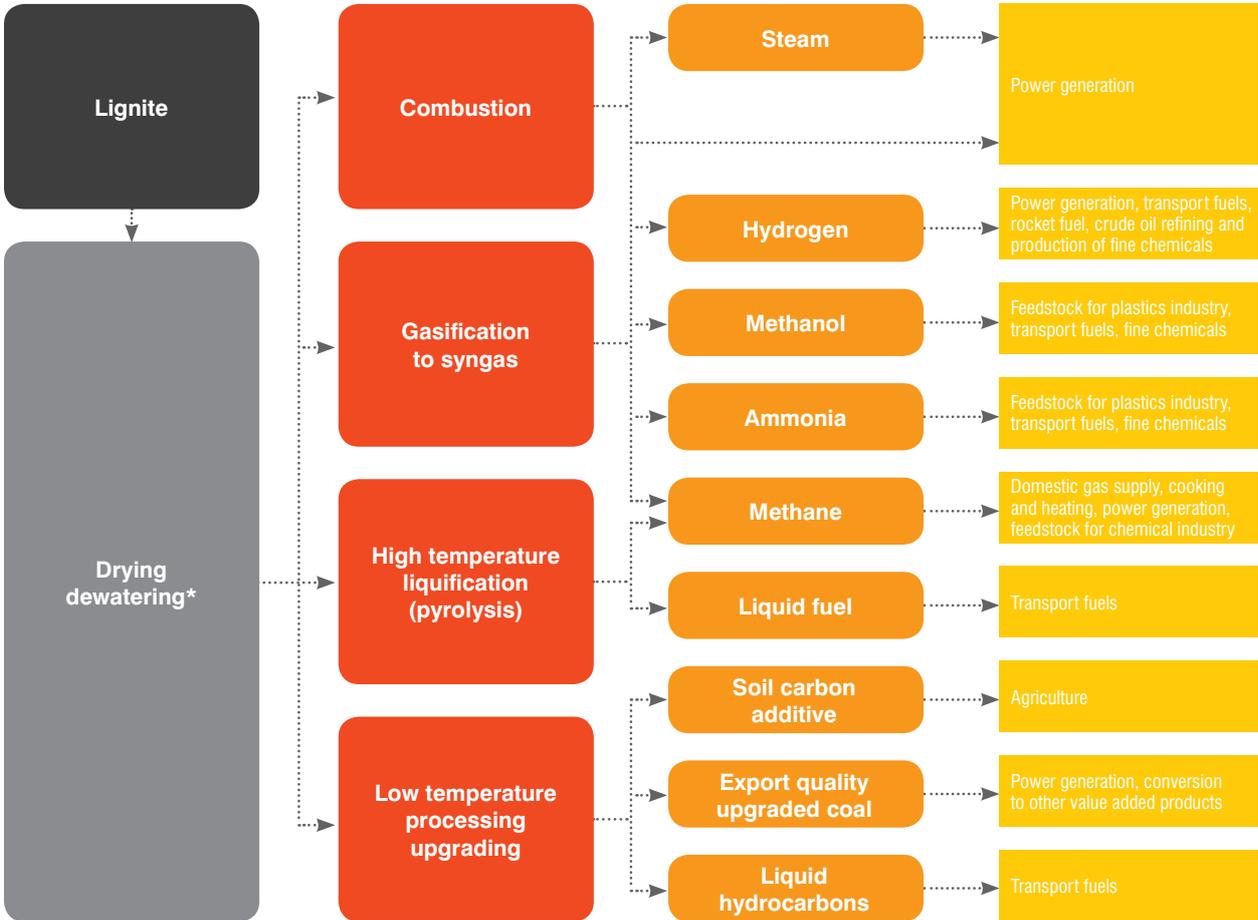
Ongoing innovation will ensure that lignite remains a key comparative advantage for Victoria (Box 1). The opportunities for lignite are many.



## FACT

ONGOING INNOVATION WILL ENSURE THAT LIGNITE REMAINS A KEY COMPARATIVE ADVANTAGE FOR VICTORIA.

### The opportunities for lignite



\*Pre-requisite for most but not all processing of lignite

Source: Victorian Department of State Development and innovation<sup>37</sup>

# The long view for Victorian coal

Minister for Trade and Investment Andrew Robb addresses the ongoing role of lignite in Victoria during a speech to the International Mining and Resources Conference in September 2014.

“The provision of affordable electricity was a foundation stone of Victoria’s manufacturing-led prosperity in the 20th century.

Yet despite the critical part played by the coal of the La Trobe Valley, it is a resource that is often demonised, particularly by those who oppose growth and development.

They say that demand for cleaner forms of energy will eclipse coal. The implication here is that coal is a commodity of the past, not the future.

This is an unduly pessimistic and indeed naïve view of the role of coal, now and into the future. If we’ve learned anything in the mining industry through all its cycles, it’s that you can never be sure whether a resource has had it or not...

Resources only become *technically* viable to develop when innovation-driven supply-side opportunity meets the right demand-side driven pricing. And they only become *economically* viable when this occurs in an environment that positively encourages investment and growth...

No one can rule out the discovery of innovative technologies that will make for cleaner or clean burning of coal – billions of dollars around the world is being spent trying to develop a commercially viable use of CO<sub>2</sub>.

CSIRO has already published research showing that the potential exists to reduce emissions from Victorian brown coal by between 30 to 50 per cent.

Nothing would do more to reduce Australia’s emissions than such a technology as the Direct Injection Carbon Engine. Nothing would be more in line with the long Australian tradition of using new technology to make the most of our resources.

No one can rule out policy changes that may favour our resources over others, such as China’s moves to preference lower sulphur, lower ash coals – something that will relatively advantage Australia compared to rival coal exporters.

We also have to recognise that demand for affordable energy in developing economies like India and China will continue...

NOTHING WOULD BE  
MORE IN LINE WITH  
THE LONG AUSTRALIAN  
TRADITION OF USING  
NEW TECHNOLOGY TO  
MAKE THE MOST OF  
OUR RESOURCES.

It is important to be patient and take a long-term view because the utility of our large resource deposits changes over time. It would be unwise to foreclose on the possibility of novel applications by locking away an important reserve now. This would preclude generations to come from using it in a way that suits the economy at that time.

Instead of thinking brown coal’s day has passed, we need to bear in mind its potential to support new industries and jobs in the future.”

# ENDING ENERGY POVERTY: THE FACTS

## FACT 1

### Access to energy is fundamental to reducing poverty and improving health

The IEA argues that access to ‘affordable and reliable energy’ is a ‘critical enabler’ of human development and wellbeing:

Modern energy services enhance the life of the poor in countless ways. Electricity provides the best and most efficient form of lighting, extending the day and providing extra hours to study or work. Household appliances also require it, opening up new possibilities for communication, entertainment, heating etc. It enables water to be pumped for crops, and foods and medicines to be refrigerated. Modern cooking facilities have the potential to significantly reduce the daily exposure of households (particularly women and children) to noxious cooking fumes – helping to avoid premature deaths caused by indoor air pollution. They can also help remove the burden of spending hours every day travelling long distances to gather fuelwood.<sup>38</sup>

According to the World Health Organization, 4.3 million premature deaths each year can be attributed to household air pollution resulting from

the inefficient use of traditional biomass such as wood, charcoal and animal waste.<sup>39</sup>

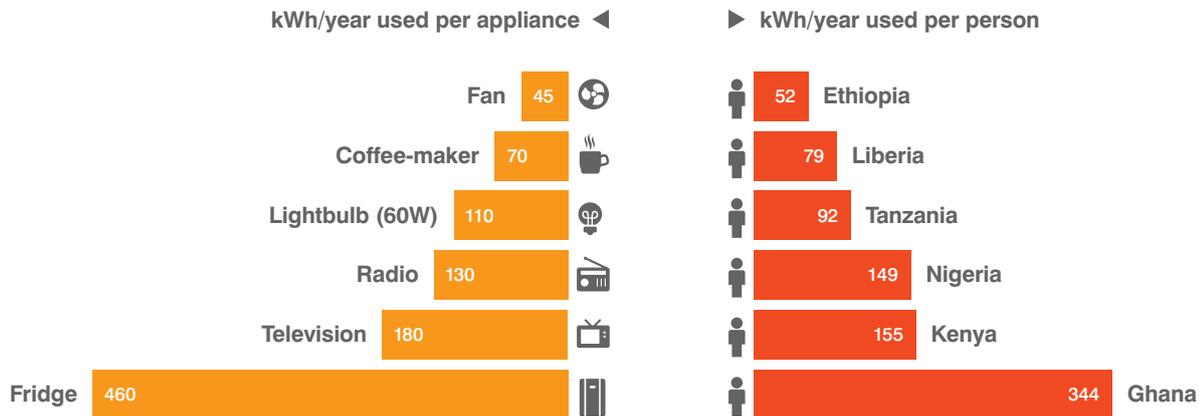
Australia’s official energy forecaster has pointed out that there is a strong relationship between economic growth and electricity consumption. Since electricity is essential to the provision of basic health and education services, increased availability of electricity is closely linked to an improved standard of living as measured by the United Nation’s human development index. Those countries that have a higher rate of electricity consumption per person enjoy an improved quality of life.<sup>40</sup>

For developing economies, access to low-cost electricity is fundamental to establishing a globally competitive manufacturing base. Since developing economies tend to have relatively low rates of electricity consumption per person, but relatively large populations, even small increases in per capita electricity use will generate large absolute increases in total consumption.<sup>41</sup>

AVERAGE ELECTRICITY CONSUMPTION PER CAPITA IN SUB-SAHARAN AFRICA IS NOT ENOUGH TO POWER A SINGLE LIGHT BULB CONTINUOUSLY.

CHART 9 Annual electricity consumption per person in selected African nations<sup>44</sup>

Source: Center for Global Development; World Bank; Energy Supply Association of Australia



**FACT 2**

**Over half the world’s population has limited or no access to modern energy**

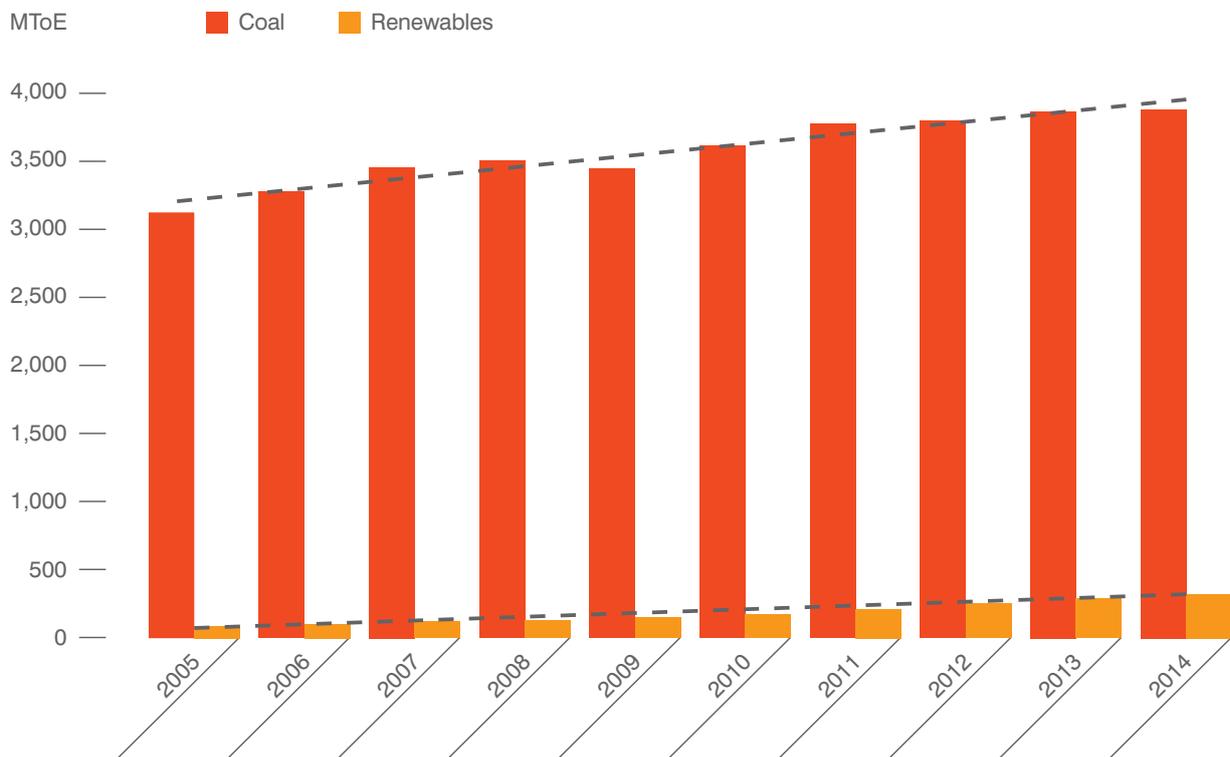
The IEA affirms that it is ‘an alarming fact’ that today billions of people lack access to the most basic energy services. Nearly 1.3 billion people are without access to electricity and 2.7 billion people are without clean and safe cooking facilities. These people are concentrated in developing Asia, sub-Saharan Africa and in rural areas.<sup>42</sup>

More than 620 million people in sub-Saharan Africa live without electricity and nearly 730 million people rely on dangerous, inefficient forms of cooking. The use of solid biomass (mainly wood and charcoal) outweighs that of all other fuels combined, and average electricity consumption per capita is not enough to power a single light bulb continuously (Chart 9).<sup>43</sup>

Australia’s official energy forecaster has observed that the scale of the energy poverty challenge is ‘often underestimated’. It notes that after China and India, six of the next eight most populous countries are developing economies, which together contain almost 270 million people without adequate access to electricity. Other fast-growing economies in Southeast Asia will also contribute to increasing world electricity demand.<sup>45</sup>

CHART 10 **Global consumption of coal vs renewables (2005–2014)**<sup>47</sup>  
Millions of tonnes of oil equivalent

Source: BP Statistical Review of World Energy 2015



**Note:** Renewables exclude hydro

## FACT 3

### Coal is fuelling economic development because it is affordable and reliable

Leading energy forecasters agree that the continued industrialisation and urbanisation of the developing world will underpin robust and enduring demand for coal. The Chief Economist of the IEA, Fatih Birol, has observed that:

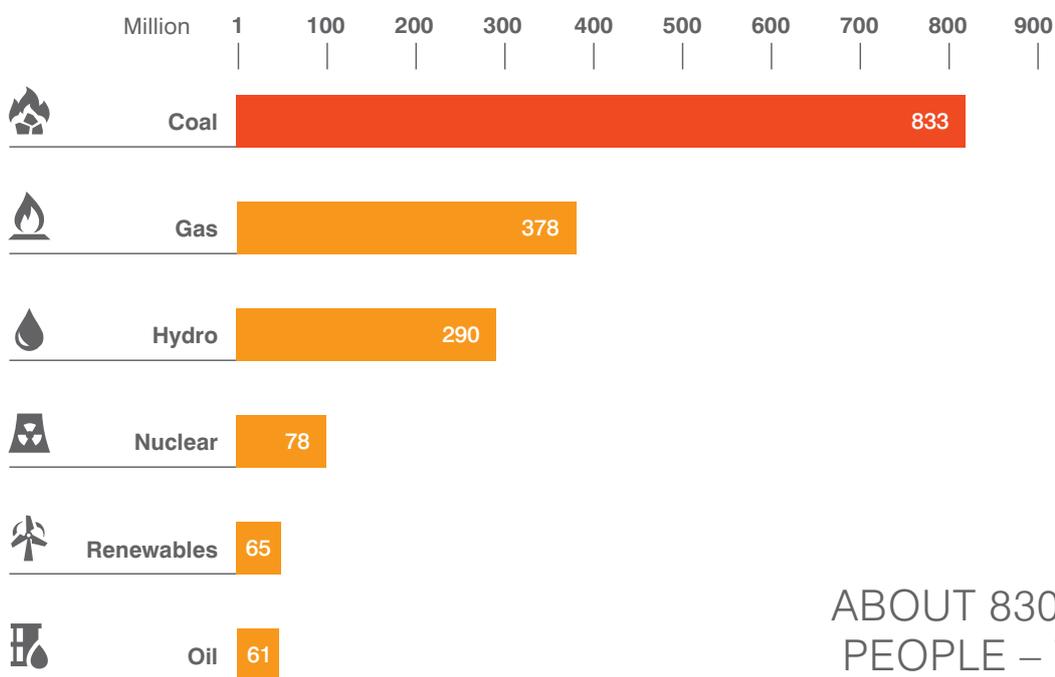
The importance of coal in the global energy mix is now the highest since 1971. It remains the backbone of electricity generation and has been the fuel underpinning the rapid industrialization of emerging economies, helping to raise living standards and lift hundreds of millions of people out of energy poverty.<sup>46</sup>

Between 1990 and 2010 about 830 million people – the vast majority in developing countries – gained access to electricity thanks to coal-fired generation. For every one person that gained access through wind or solar, 13 gained access through coal.<sup>48</sup>

This trend will persist over coming decades. There is more coal-fired electricity capacity in the investment pipeline than any other type and the IEA projects that coal will remain the largest single source of electricity generation. In 2030, coal is expected to fuel 10,253 terrawatt hours of electricity (31 per cent of global generation) – nearly twice as much as hydro, four times more than wind and eight times more than solar.<sup>50</sup>

CHART 11 **Energy poverty alleviation by fuel (1990–2010)**  
Millions of people

Source: Manhattan Institute<sup>49</sup>



ABOUT 830 MILLION  
PEOPLE – THE VAST  
MAJORITY IN DEVELOPING  
COUNTRIES – GAINED  
ACCESS TO ELECTRICITY  
THANKS TO COAL-FIRED  
GENERATION.

**FACT 4****Restricting coal use in developing economies will punish the world's poor**

Australia's official energy forecaster has affirmed that basic access to electricity is not enough to alleviate poverty; the cost of supply is essential:

Perhaps one of the most important factors ... is affordability. High electricity prices can also contribute to energy poverty. If the cost of electricity is too high, it could potentially remove access for the poorest parts of the population even if the electricity is there to be consumed. Electricity prices have increased in many countries in response to high fuel input costs and increased adoption of higher-cost energy sources such as renewables.<sup>51</sup>

Renewable energy is more expensive than existing base-load coal-fired power generation. In Australia, the cost of building and running wind power averages between \$80 and \$120 per megawatt hour (Mwh) compared with about running and maintenance costs of \$38/Mwh for existing coal plant.<sup>52</sup> Solar costs about \$300/Mwh at present.<sup>53</sup>

Studies in the US compare existing coal and nuclear plants with wind farms (supplemented by gas when wind cannot supply): coal (at US\$38/Mwh) and nuclear (at US\$29.6/Mwh) is more efficient than wind/gas at (US\$96.2/Mwh).<sup>54</sup>

Bill Gates stresses that poor countries cannot afford to wait for renewables to become as cheap as fossil fuels:

[E]ven as we push to get serious about confronting climate change, we should not try to solve the problem on the backs of the poor. For one thing, poor countries represent a small part of the carbon-emissions problem. And they desperately need cheap sources of energy now to fuel the economic growth that lifts families out of poverty. They can't afford today's expensive clean energy solutions, and we can't expect them wait for the technology to get cheaper.<sup>55</sup>

African leaders have pleaded with developed country donors not to deny them access to funding support for coal projects. The Nigerian Energy Minister Chinedu Ositadinma Nebo has said:

I think Africa should be allowed to develop its coal potential. This is very critical. There are so many areas in Africa that will help to generate power for the over 60 percent of Africans that have no access to energy at all.<sup>56</sup>

**FACT 5****Renewables can't do it alone**

Australia's official energy forecaster has reasoned that: 'There is no single energy option that will allow a country to meet all of its growth and environmental objectives'.<sup>57</sup> While the trend towards greater technological diversity will continue,

it is important to recognise the central role of baseload power sources – including coal and uranium – in meeting the growing global demand for energy (Box 2).

# What would it take to replace

To replace the 4,030,000 MW fossil fuels power plants

## Solar technology



### Capacity

**13,700,000 MW**

100 times the current installed capacity of 140,000 MW.



### Installation

**470 years**

Installation would have to increase 20-fold to implement replacement by 2030.

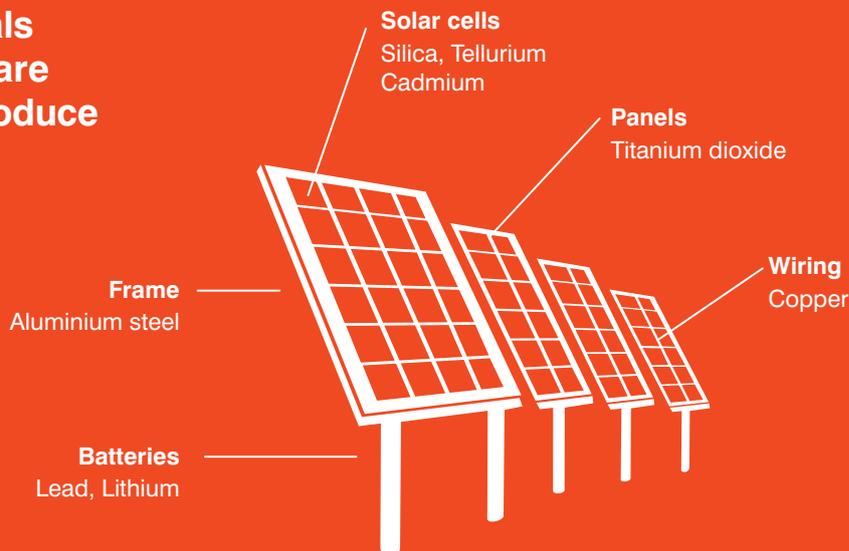


### Scale

**95,900km<sup>2</sup>**

of panels – that's more than the entire surface of Ireland and just less than South Korea.

**16 mined metals and minerals are required to produce a solar panel.**



## Hydropower

THE SCALE OF HYDROPOWER WOULD BE SIMILARLY PROHIBITIVE – 13 TIMES CURRENT CAPACITY AT A RATE OF 310 DAMS A YEAR.

# fossil fuels?

operating today would require:

## Wind generation



### Capacity

**10,400,000 MW**

35 times the current installed capacity of 283,000 MW.



### Installation

**230 years**

Installation would have to increase 15-fold to implement replacement by 2030.



### Scale

**1,047,000 km<sup>2</sup>**

of turbines – that's an area greater than the size of South Australia dotted with 3,460,000 new 3 MW turbines.

Every part of a wind turbine depends on steel.

70% of global steel is made from coal.



**FACT**

There is more than 220 tonnes of coal in every wind turbine.



# DEVELOPING ECONOMIES WILL DRIVE ROBUST COAL DEMAND FOR DECADES

HIGHLY POPULATED EMERGING ECONOMIES ARE URBANISING AND INDUSTRIALISING.

The United Nations expects the world's urban population to increase by 2.4 billion by 2050; that is, by around 68 million people a year. Approximately 95 per cent of that growth is set to occur in less developed regions and 83 per cent in less developed regions excluding China.<sup>59</sup> The United Nations projects that the largest urban growth will take place in India (11 million people urbanised a year), followed by China (8 million) and Nigeria (6 million).

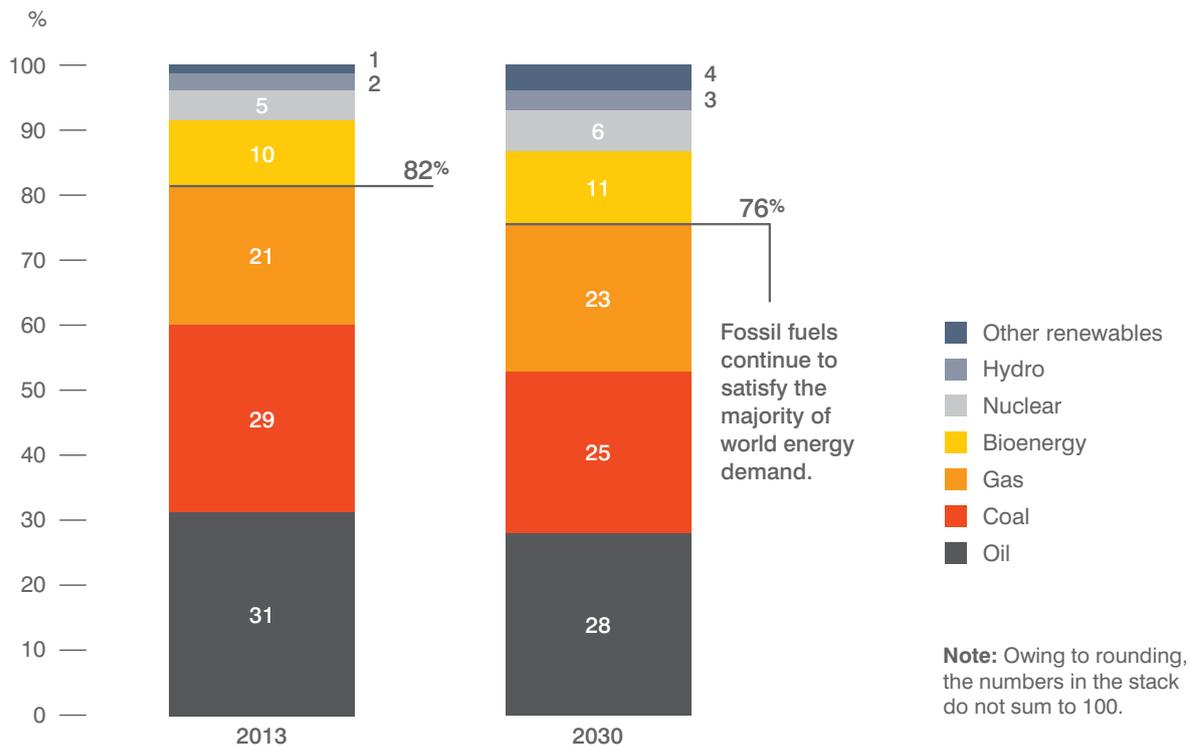
In 1990, there were ten 'mega-cities' with 10 million inhabitants or more. In 2014, there were 28 mega-cities worldwide. The United Nations expects that number to rise to 41 by 2030, with mega-cities in developing countries becoming more prominent.<sup>60</sup>

Economic development drives demand for minerals and energy commodities used in the construction of housing, buildings, bridges and transport systems, as well as a range of consumer goods.<sup>61</sup>

Demand for energy rises with income growth until high levels of per capita GDP.<sup>62</sup>

CHART 12 **World primary energy demand by fuel (2013 and 2030)<sup>65</sup>**  
IEA core scenario

Source: International Energy Agency



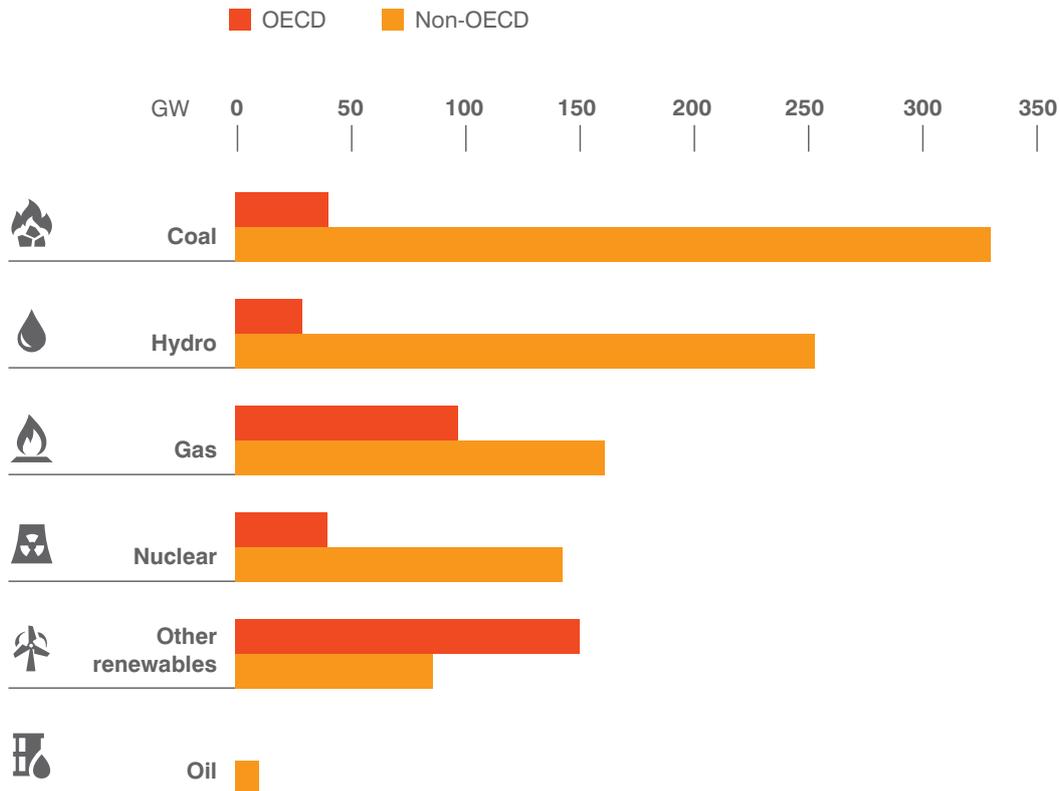
While energy and steel consumption in emerging economies have grown rapidly in the past decade, many of these countries still have considerably lower energy and steel usage rates compared with advanced economies. China's energy consumption per capita is currently equivalent to those levels seen in South Korea and Singapore in the late 1980s. McKinsey projects that by 2030 China will reach an energy intensity achieved by those economies in the late 1990s.<sup>63</sup>

The world's growing hunger for energy simply cannot be met without fossil fuels. The IEA projects that world primary energy demand will increase by 21 per cent between 2013 and 2030, with fossil fuels satisfying the bulk of global energy needs. Coal accounts for one-quarter of world energy consumption in 2030 (Chart 13).<sup>64</sup>

The world will use 1 billion tonnes more coal in 2019 than today – more than 9 billion tonnes a year.<sup>66</sup> There is more coal-fired electricity capacity in the investment pipeline than any other type (Chart 14) and the IEA projects that coal will remain the largest single source of electricity generation. In 2030, coal is expected to fuel 10,253 terrawatt hours of electricity (31 per cent of global generation) – nearly twice as much as hydro, four times more than wind and eight times more than solar.<sup>67</sup>

CHART 13 World electricity capacity under construction or approved, by fuel<sup>68</sup>

Source: Department of Industry and Science, derived by Enerdata



### China's coal demand

Some 56 per cent of China's population currently resides in cities and this share is projected to rise to 76 per cent by 2050.<sup>69</sup> While the pace of urbanisation will moderate, it will continue to lift demand for steel, energy and food.

According to the Department of Industry and Science:

[C]oal will remain an important part of China's energy mix, with 96 gigawatts of coal-fired capacity under construction or approved (almost twice Australia's total installed capacity for all fuel types) ...<sup>70</sup>

The department forecasts that China's imports will slow to 157 million tonnes in 2015, before recovering to 160 million tonnes in 2016.<sup>71</sup> The department also notes that a number of policies announced in 2014 will slow the growth of China's use of lower quality thermal coal, namely measures aimed at improving air quality by more efficient coal use, a cap on energy consumption growth of around 3.5 per cent a year to 2020, and the Sino-US agreement on climate change (under which

China intends to target peak emissions by 2030). Nevertheless, these policy announcements are unlikely to induce a rapid shift away from coal (Box 2).<sup>72</sup>

As with thermal coal, China's demand for metallurgical coal has a long way to run. The length of rail track in China is still one-third that of the United States and one-sixth of the European Union, with both a larger land mass and population.<sup>73</sup> Further, the steel intensity of Chinese construction has been increasing over time, owing to the building of taller structures with more features such as underground car parks. For example, a 50-floor building requires roughly double the amount of steel per square metre as a 15-floor building.<sup>74</sup>

Consumer demand will also become more steel-intensive. In particular, car ownership in China is only a small fraction of that in the United States, so as cities and incomes grow, demand for cars is likely to become an important source of steel demand.<sup>75</sup>



# Has China's coal demand peaked?

Some commentators claim that China is rapidly moving away from coal and that its demand for thermal coal in particular has peaked.<sup>76</sup> This view is not shared by leading energy forecasters.

The IEA forecasts that China's coal demand will increase by 2.6 per cent a year to 2019; that is, by more than 100 million tonnes a year.<sup>77</sup>

The IEA finds that Chinese coal demand could only peak before 2019 if one of the following unlikely changes occurred:

- China's GDP growth fell by more than half to 3 per cent from 2015 onwards. Since 1978, the lowest growth rate in China was 3.8 per cent in 1990
- China produces 2,500 TWh of additional power generation from renewables, gas or nuclear. This additional output is equivalent to four times global wind generation; or 18 times the world's solar photovoltaic generation in 2013; or a 250 per cent increase in China's consumption of natural gas; or the commissioning of 300 nuclear reactors to 2019, in addition to the 30 already expected.
- A dramatic reduction in the energy intensity of the Chinese economy.<sup>78</sup>

The IEA makes clear that any peak coal scenario for China necessitates significantly lower GDP growth or dramatic changes in power generation or energy intensity, and that 'nothing even close' to these developments has been observed in recent history. Rather, 'China will be the coal giant for many years in the future.'<sup>79</sup>

In its *World Energy Outlook 2015 Special Report*, the IEA says: 'China is, and is projected to remain, the world's largest consumer and producer of coal through to 2030'. While China's coal demand growth is expected to plateau in the 2020s, it shows 'no notable sign of decline by 2030'.<sup>80</sup>

This projection is consistent with the IEA's *World Energy Outlook 2014*, which saw China's imports in 2040 remaining above current levels and accounting for 18 per cent of world coal trade.<sup>81</sup>

Around 95 per cent of China's existing coal capacity is projected to still be in operation in 2030, and 345 gigawatts of net new coal-fired capacity is installed by that year – more than six times Australia's existing total capacity for all energy types.<sup>82</sup>

It is important to note that all these projections are made under the IEA's core scenario – which takes account of climate change policies adopted or announced – not a 'business-as-usual' scenario.<sup>83</sup>

Australia's official energy forecaster has made the same points as the IEA:

China is projected to remain a major coal consumer over the medium term, supported by the expected expansion of coal-fired capacity in regions in western and central China. Coal currently accounts for around 65 per cent of China's electricity generating capacity. Coal-fired assets typically have an operating life of 40–60 years. A large proportion of China's installed capacity is still relatively new and is unlikely to be closed before the end of its useful life. China's electricity generation is projected to increase over the medium term as the economy expands, particularly in the central and western regions, and household consumption increases with rising incomes.<sup>84</sup>



## FACT

BY 2030, COAL IS EXPECTED TO BECOME THE DOMINANT FUEL IN SOUTHEAST ASIA. BY 2040, COAL DEMAND ALMOST QUADRUPLES.

### India's coal demand

Australia's official energy forecaster has pointed out that most analyses of future coal demand – including the so-called 'stranded assets' argument – focus purely on China and overlook the impact of India. Yet India 'is a large market that will have a considerable effect on world energy developments' and its future 'appears heavily entrenched in coal' (Box 3).<sup>85</sup>

Consistent with the Department of Industry and Science, IEA figures show that the plateauing of Chinese coal demand in the 2020s is offset by the rapid expansion of Indian coal demand. India's coal-fired capacity grows by 70 per cent by 2030, even though it is assumed that the Indian government meets its ambitious renewable energy target of 175 gigawatts by 2022 (from around 65 gigawatts in early 2015).<sup>94</sup>

Since India's domestic coal production is expected to lag behind rising demand, India's coal imports continue their rising trend, more than tripling by 2040. Before 2025, India overtakes China as the largest world importer of coal. India's import dependency increases from 25 per cent in 2012 to 40 per cent in 2040.<sup>95</sup>

India's continued development will provide additional opportunities for Australia's metallurgical coal exports. The Department of Industry and Science observes that:

India's steel industry is primed for a period of expansion. The Indian Ministry of Steel is planning to increase steel production to 300 million tonnes by 2025, about 300 per cent higher than current production.<sup>96</sup>

India is currently Australia's third-largest market for metallurgical coal exports, after China and Japan.<sup>97</sup>

### Beyond China and India

The ten economies belonging to the Association of Southeast Asian Nations are embarking on the same process of coal-fired electrification as China and India. ASEAN represents the main source of coal consumption after China and India. The IEA forecasts that coal demand growth in ASEAN will average 8.3 per cent a year to 2019, with over 30 gigawatts of new coal power generation coming online.<sup>98</sup>

Malaysia, a net gas exporter, is diversifying away from oil and gas towards coal. By 2019, Malaysia will construct four new coal-fired power plants and coal will surpass gas the preferred fuel (accounting for 64 per cent of Malaysia's energy mix). All new coal power plants in Malaysia will employ supercritical and ultrasupercritical technology.<sup>99</sup>

By 2030, coal is expected to become the dominant fuel in Southeast Asia.<sup>100</sup> By 2040, coal demand in the region almost quadruples, overtaking the United States. Indonesia's coal use alone reaches that of the EU by 2040; and coal becomes the fuel of choice for Vietnam, Thailand and Malaysia. Coal demand to 2040 also expands in Eastern Europe and Eurasia (except Russia), Latin America and Africa.<sup>101</sup>



# More renewables and more coal: India

The Department of Industry and Science considers India ‘a likely candidate to be the next main driver of world energy consumption’ as it is both highly populated and positioned for economic growth.<sup>86</sup>

India’s electricity use per person is low compared to other emerging economies and around 300 million Indians – one-quarter of the population – have limited or no access to electricity.<sup>87</sup>

Coal is expected to play a major role in alleviating energy poverty in India. India’s installed coal-fired electricity capacity has doubled in just six years (2008 to 2014) and around 113 gigawatts of new capacity is under construction or approved – more than twice Australia’s existing total capacity for all energy types. India’s installed coal capacity is relatively new and has many years of operational life remaining.<sup>88</sup>

The department also affirms that investment in coal power is outstripping renewables:

While investment in renewable energy sources is undoubtedly on the rise in India, there is even greater investment already underway into coal-fired electricity generation which indicates that India’s coal consumption is likely to rise for some time ...

In 2012, India had a total installed electricity capacity of around 250 gigawatts. Around 60 per cent of this was coal-fired. Other renewables accounted for 13 per cent of India’s installed capacity, but only supplied 5 per cent of total generation, illustrating the relatively low utilisation and efficiency of these technologies.<sup>89</sup>

India commissioned its first supercritical (high efficiency, low emissions) coal-fired electricity plant in 2012.

From 2017, all new coal power projects will be required to use supercritical technology or better.<sup>90</sup> The department reasons that:

Electricity output from these generators will be optimised by using higher energy content coal with lower ash levels than most of India’s domestic mines produce. Australia is not unique in supplying world coal markets with higher grade coal, but the roll out of advanced coal generator technologies presents a significant long term opportunity for Australian coal producers.<sup>91</sup>

India’s energy minister has set an ambitious target for state-owned coal producers, equal to a doubling of output to nearly one billion tonnes a year by the end of this decade.<sup>92</sup> Yet owing to chronic domestic supply challenges, India’s imports are increasing rapidly to meet local demand:

India’s thermal coal imports in 2015 are forecast to increase by 11 per cent to 174 million tonnes, overtaking China as the world’s largest importer of thermal coal. In 2016, imports are forecast to increase by a further 8 per cent to 188 million tonnes.<sup>93</sup>

# AUSTRALIA HAS SUBSTANTIAL HIGH-QUALITY COAL RESOURCES

THE QUALITY OF COAL HAS A MAJOR INFLUENCE ON THE DESIGN OF POWER AND STEEL PLANTS, AS WELL AS THEIR OPERATION, PERFORMANCE AND EMISSIONS.

Australia has large deposits of high-energy, low ash coal that is suitable for use in advanced coal-generation technologies.<sup>104</sup> These thermal coals also contain lower levels of sulphur, mercury, selenium and other trace elements when compared with other internationally traded coals.<sup>105</sup> They produce fewer emissions per unit of electricity produced and command a higher price in export markets.

Australia's metallurgical coal is also highly sought after being among the best coals for steel making in the world. It typically produces strong cokes with low reactivity and low sulphur and phosphorus content.<sup>106</sup>



**FACT**

AUSTRALIA HAS LARGE DEPOSITS OF HIGH-ENERGY, LOW ASH COAL THAT IS SUITABLE FOR USE IN ADVANCED COAL-GENERATION TECHNOLOGIES.<sup>103</sup>

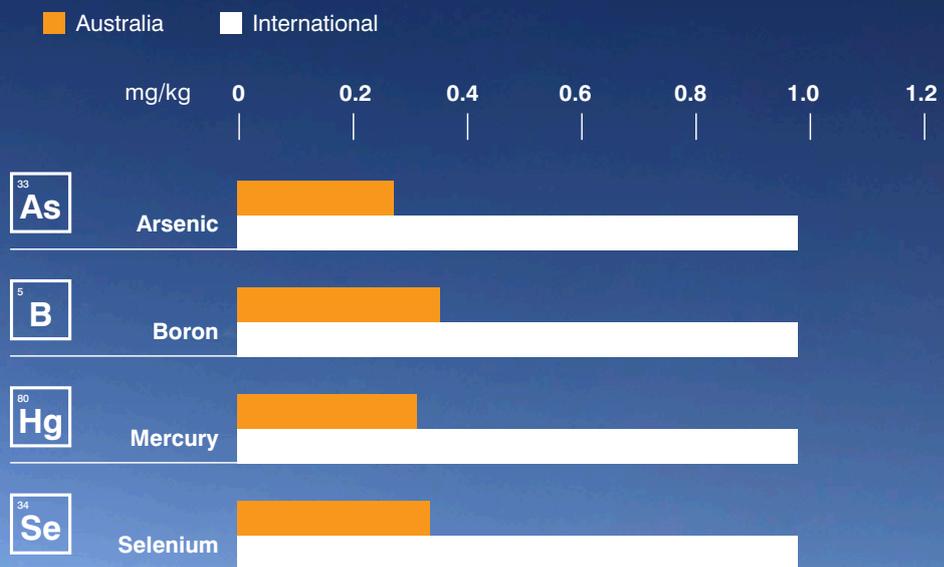
– DEPARTMENT OF INDUSTRY AND SCIENCE

Australia's substantial high-quality coal resources and reputation as a country with low sovereign and security risks has encouraged important investments in the coal industry by consumers in major import markets such as Japan, the Republic of Korea and, increasingly, China and India.<sup>102</sup>

– GEOSCIENCE AUSTRALIA

CHART 14 Trace elements in Australian and international coal  
Relative concentration

Source: CSIRO and ACARP



# THE DIVESTMENT DECEPTION

DIVESTMENT IS BASED ON THE FLAWED PREMISE THAT SELLING A SHARE WITHHOLDS CAPITAL. THIS IS WRONG.

## Divestment's false premise

The divestment movement pressures shareholders and financiers to stop investing in coal on the basis that future climate change policies will render coal resources and infrastructure 'stranded assets'.

This assertion is not borne out by the facts:

- Global financing for coal mining rose to US\$66 billion in 2014, up from US\$55 billion in 2013 and a 360 per cent increase from 2005 <sup>108</sup>
- All energy sources are required to meet the world's accelerating demand for energy – the IEA expects global demand for energy to increase 37 per cent by 2040 supporting an estimated 40 per cent increase in the global coal trade by 2040 <sup>109</sup>
- Rapid technological advances mean coal is not incompatible with a low emissions future.

Divestment is based on the flawed premise that selling a share withholds capital. Columbia University

Professor Andrew Ang has observed that it has no effect on companies because: 'You can't subtract from a company by selling a share, it's already committed capital, it's just ownership not the amount of capital.'<sup>110</sup> If a larger group of individual or institutional investors sought to offload equity it may subdue the sale price, but a willing buyer will always emerge.

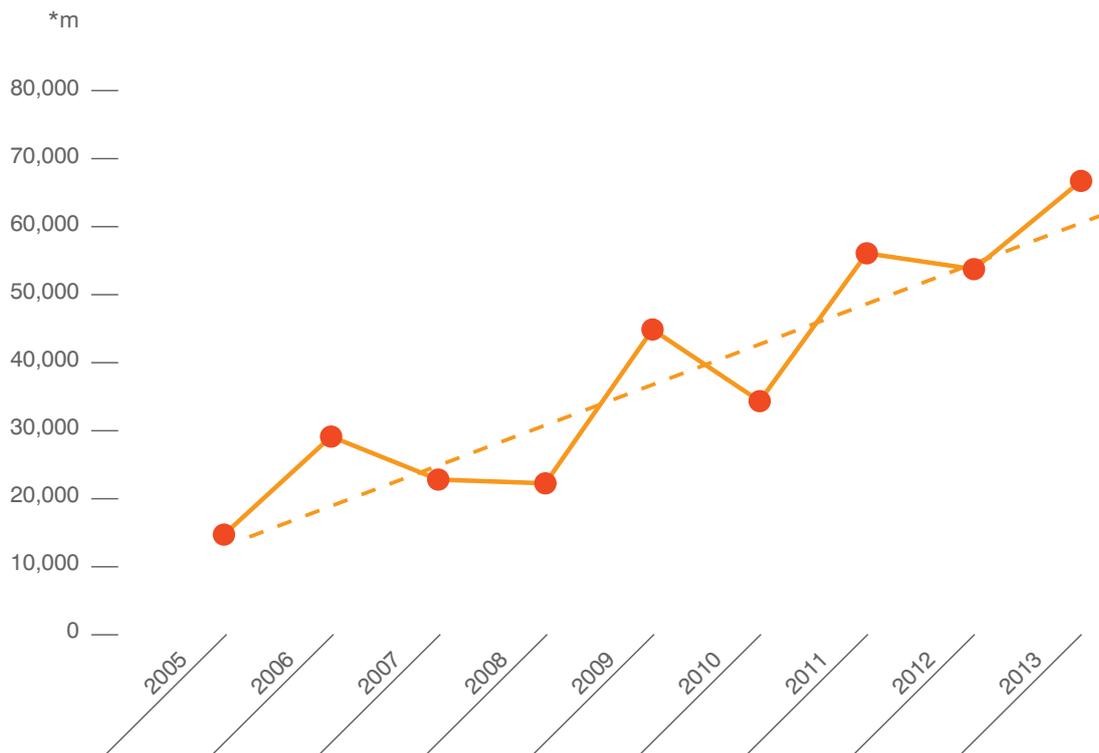
Columbia University, together with Cornell, the University of California and Harvard, is among the majority of prestigious tertiary institutions that reject divestment.

The president of Harvard which holds the world's largest endowment fund (US\$36.4 billion in 2013-14), Professor Drew Faust, reasons that Harvard's endowment advances academic aims, not any other purpose.

Professor Faust says that divestment 'would appear to position the University as a political actor rather than an academic institution' and that the use of the University's endowment as a political instrument would present

CHART 15 **Underwriting and loans by selected companies (2005–2013)**  
Million euros

Source: BankTrack



‘serious risks to the independence of the academic enterprise’.<sup>111</sup>

Professor Faust also warns that fossil fuel divestment carries a real financial cost: ‘Logic and experience indicate that barring investments in a major, integral sector of the global economy would – especially for a large endowment reliant on sophisticated investment techniques, pooled funds, and broad diversification – come at a substantial economic cost’.<sup>112</sup>

‘I also find a troubling inconsistency in the notion that, as an investor, we should boycott a whole class of companies at the same time that, as individuals and as a community, we are extensively relying on those companies’ products and services for so much of what we do every day’.<sup>120</sup>

‘The above graph shows the trend in coal financing for the 65 coal companies which we have financial data from 2005 to 2013. **This graph shows clearly that, despite falls in some years, the overall trend is rapid growth in commercial bank finance for coal.**<sup>1107</sup>

– BANKTRACK

## Divestment's logic trap



### The financial cost of divestment

Swarthmore College in the USA is considered to be the birthplace of the fossil fuel divestment movement. It chose not to divest on advice that it would cost US\$203 million over 10 years.<sup>113</sup>

In Australia, detailed analysis of superannuation options by Rice Warner Actuaries revealed that 'socially responsible' investment options – including those that screen out fossil fuels – tend to cost more and deliver less. For example, if a member aged 35 today earning \$75,000 had switched to a 'balanced' SRI option 10 years ago, the member's balance would be \$3,700 lower today. At retirement, the difference would amount to \$68,000 (in today's dollars).<sup>114</sup>

UniSuper has disclosed that the recent exclusion of fossil fuels from its two 'sustainable' investment options created 'potential problems from a diversification perspective.' It warned: 'Members should be aware that going forward there is a much greater chance that the performance of the sustainable options will significantly diverge from the performance of their respective mainstream equivalents.'<sup>115</sup>

The former President and Vice-Chancellor of the University of New South Wales, Professor Fred Hilmer, argues the university 'Will have greater impact in addressing climate change through partnerships [with industry and government] than via token political actions.'<sup>116</sup>

### Divestment's real agenda

By its own admission, the target of the divestment movement is coal's reputation – not its financing.

Divestment seeks to 'stigmatise' the Australian coal industry to delay and disrupt projects by eroding community and government support for coal.<sup>117</sup> Ben Caldecott, Director of the Stranded Assets Programme at the University of Oxford: has stated 'The divestment campaign could pose considerable reputational risk to fossil fuel companies even if its immediate direct effects are likely to be limited.'<sup>118</sup>

The anti-mining Australia Institute has noted that: 'Even if [global policy actions] are insufficient to reach the stated goal, policy action, market competition and political stigma still threaten stranded assets'.<sup>119</sup>

Divestment targets companies that are conducting lawful business, complying with environmental regulation, providing jobs, investing in regional communities and paying royalties and taxes.

There are few other examples where the intention of inflicting deliberate commercial damage and wider national economic harm is pursued so overtly.

Divestment is illogical and unethical. The divestment campaign argues that fossil fuels are no longer necessary to provide energy for the billions who live without it. This is not true. Fossil fuels, especially coal, remain the more affordable, versatile and widely available energy source. Restricting their use will delay energy access to the world's poorest people with attendant adverse impacts on life expectancy, health and education outcomes (see Chapter 4).

Australia does not have to choose between

# COAL AND A LOW EMISSIONS FUTURE

GLOBAL PRIMARY  
ENERGY DEMAND WILL  
INCREASE BY 21 PER  
CENT BETWEEN 2013  
AND 2030.<sup>121</sup>

The world will need all available energy options – both renewable and non-renewable – to meet this demand.

Coal is here to stay.

Substantial progress is being made reducing the carbon footprint of mining and coal-fired power generation. High efficiency, low emission (HELE) technologies are being employed throughout the world, including by some of the world's largest electricity producers in Japan, China and elsewhere in East Asia.

There are 22 large scale carbon capture and storage projects in operation or under construction globally with a combined capacity to capture up to 40 million tonnes of CO<sub>2</sub> per annum – a further 29 projects are in development planning with a combined capture capacity of around 50 million tonnes per annum.<sup>122</sup>

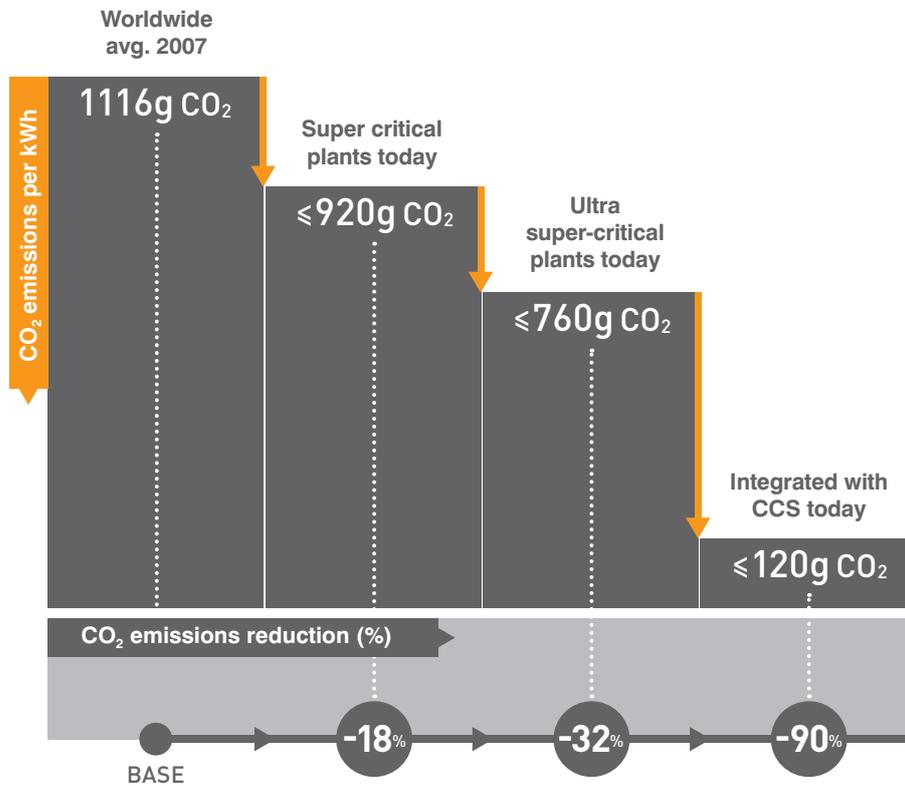
HELE coal-fired power stations integrated with CCS can reduce CO<sub>2</sub> emissions by around 90 per cent.<sup>123</sup>



FACT

HELE COAL-FIRED POWER STATIONS  
INTEGRATED WITH CCS CAN REDUCE CO<sub>2</sub>  
EMISSIONS BY AROUND 90 PER CENT.

CHART 16 Emission reduction with HELE



## STEP 1

### High efficiency, low emission technologies (HELE)

HELE technologies allow power generators to operate at higher temperatures and greater pressure. HELE supercritical and ultrasupercritical plants in North America, Europe, Japan, China and elsewhere in East Asia are delivering electricity at a far higher efficiency while reducing by up to 40 per cent emissions generated per watt of electricity.<sup>124</sup> New technologies under testing promise to reduce these emissions even further.<sup>125</sup>

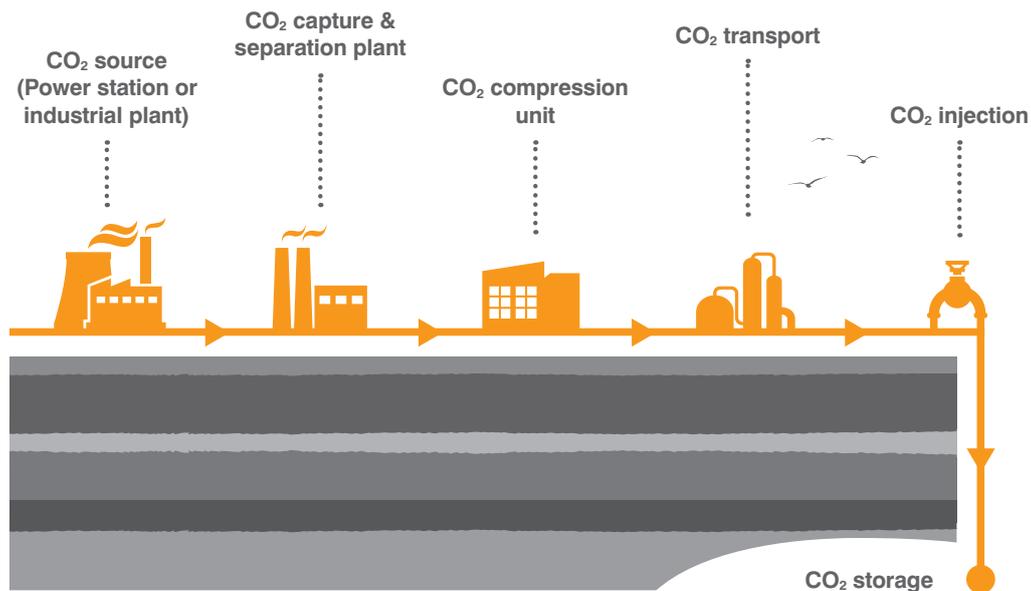
## STEP 2

### Step 2: Integration of HELE with Carbon Capture and Storage (CCS)

CCS is the capture of CO<sub>2</sub> from power stations (or other industrial facilities) and storage in deep underground reservoirs. CCS is a proven, established technology and a reality in many parts of the world:

- The Sleipner project in Norway has been storing approximately 0.9 million tonnes of CO<sub>2</sub> per year in a deep saline formation under the North Sea seabed since 1996<sup>126</sup>
- In the US, about 68 million tonnes of CO<sub>2</sub> is captured and injected into oil fields every year to enhance oil recovery<sup>127</sup>
- The first large-scale CCS project in the power sector, SaskPower's Boundary Dam project in Canada, began operation in October 2014 and is achieving an emissions reduction of 1 million tonnes of CO<sub>2</sub> a year—the equivalent of taking 250,000 cars off the road annually.<sup>128</sup>

CHART 17 How Carbon Capture and Storage works



### Advances in Australia

The Australian coal sector has committed around \$300 million to develop low emissions coal technologies in addition to R&D financed by the industry's research program ACARP. Progress to date includes:

- Successfully capturing CO<sub>2</sub> at a coal-fired power plant near Biloela in Queensland. This is the world's largest demonstration of oxy-fuel technology to date and has run for 10,000 hours, proving up technology that can be subsequently deployed around the world<sup>129</sup>
- Successfully sequestering 65,000 tonnes of CO<sub>2</sub> in a depleted gas field in Victoria's Otway Basin<sup>130</sup>
- Intensifying the search for storage sites for future CCS projects with exploration work underway or planned in Queensland, New South Wales, Victoria and Western Australia<sup>131</sup>
- Improved methane drainage from underground mines<sup>132</sup>
- Launching a substantial research project with the Australian government to develop technology capable of safely treating the very low and highly variable methane levels in ventilation air from underground operations and investigate novel abatement concepts.<sup>133</sup>

# 5 MYTHS ABOUT COAL

## **MYTH 1** Major countries are moving away from coal

The world will use 1 billion tonnes more coal in 2019 than today – more than 9 billion tonnes a year.<sup>134</sup> There is more coal-fired electricity capacity in the investment pipeline than any other type and the International Energy Agency projects that coal will remain the largest single source of electricity generation.

In 2030, coal is expected to fuel 10,253 terawatt hours of electricity (31 per cent of global generation) – nearly twice as much as hydro, four times more than wind and eight times more than solar.<sup>135</sup>

In its 2015 energy update, the IEA says: 'China is, and is projected to remain, the world's largest consumer and producer of coal through to 2030'.

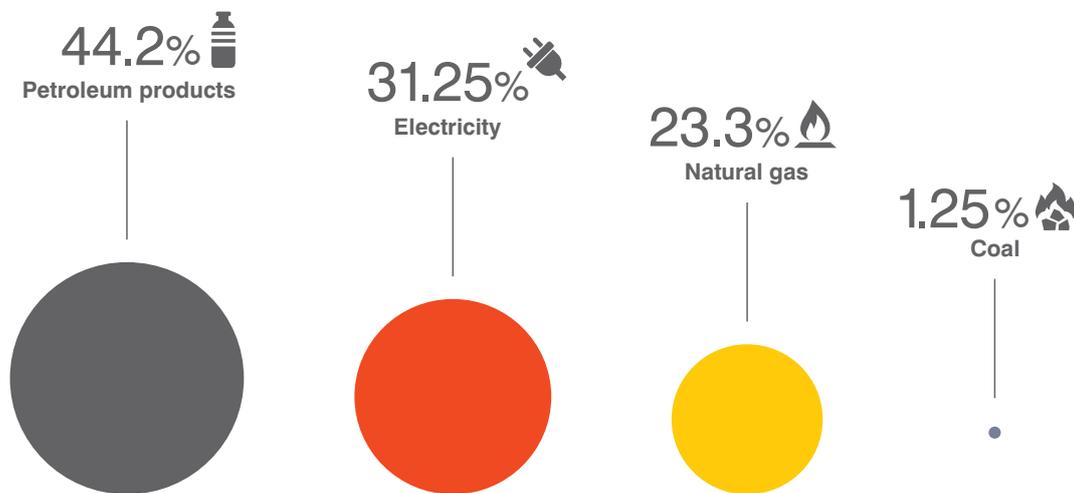
While China's coal demand growth is expected to plateau in the 2020s, it shows 'no notable sign of decline by 2030'.<sup>136</sup>

India's installed coal power capacity has doubled in just six years (2008 to 2014) and around 113 gigawatts of new capacity is under construction or approved – more than twice Australia's existing total capacity for all energy types. India's installed coal power capacity is relatively new and has many years of operational life remaining. India's investment in coal power is outstripping renewables.<sup>137</sup>

By 2030, coal is expected to become the dominant fuel in Southeast Asia.<sup>138</sup>

CHART 18 Pre-tax energy subsidies by fuel type<sup>143</sup>

Source: International Monetary Fund



## MYTH 2 Coal is the beneficiary of lavish fossil fuel subsidies

The Australian coal industry does not rely on subsidies. The Productivity Commission finds that: 'The estimated effective rate of assistance from tariff and budgetary assistance for **mining** is negligible.'<sup>139</sup>

The effective rate of assistance is the ratio of assistance to output; and for mining it has fallen from 0.2 per cent to 0.1 per cent over the past year.<sup>140</sup>

The Productivity Commission's finding is consistent with the message successive Australian governments have reiterated to our G20 partners that Australia does not maintain fossil fuel subsidies.<sup>141</sup>

At a global level, the International Monetary Fund has found that just 1.25 per cent of 'fossil fuel subsidies' are directed to the coal sector.<sup>142</sup>

### MYTH 3 Investors are moving away from coal

The divestment movement seeks to pressure shareholders and financiers to stop investing in coal on the basis that future climate change policies will render coal resources and infrastructure 'stranded assets'. Yet this assertion is not borne out by the facts:

- Global financing for coal mining rose to US\$66 billion in 2014, up from US\$55 billion in 2013 and a 360 per cent increase from 2005.<sup>144</sup>
- All energy sources are required to meet the world's

accelerating demand for energy—the IEA expects global demand for energy to increase 37 per cent by 2040 supporting an estimated 40 per cent increase in the global coal trade by 2040.<sup>145</sup>

- Rapid technological advances mean coal is not incompatible with a low emissions future (see Myth 4).

Even the anti-coal group BankTrack admits that 'despite falls in some years, the overall trend is rapid growth in commercial bank finance for coal.'<sup>146</sup>

### MYTH 4 Coal and a low emissions future are mutually exclusive

Moving the current average global efficiency rate of coal-fired power plants from 33 per cent to 40 per cent by deploying more high efficiency, low emissions technology could cut 2 gigatonnes of CO<sub>2</sub> emissions. This is the equivalent of India's annual CO<sub>2</sub> emissions.<sup>147</sup>

664 gigawatts of high efficiency, low emissions coal-fired power plants are currently planned or under construction around the world.<sup>148</sup>

Carbon capture and storage technologies can reduce CO<sub>2</sub> emissions by around 90 per cent.<sup>149</sup> Globally, there are 22 large-scale carbon and capture storage projects

in operation or under construction, with a total CO<sub>2</sub> capture capacity of around 40 million tonnes a year.<sup>150</sup> These projects include Canada's Boundary Dam project, the world's first commercial coal-fired power plant with CCS. Boundary Dam has applied CCS to an ageing lignite (brown coal) plant to achieve an annual emissions reduction of 1 million tonnes of CO<sub>2</sub>. That's the equivalent of taking 250,000 cars off the road every year.<sup>151</sup>

In Australia, CO<sub>2</sub> has been successfully captured at Queensland's Callide coal-fired power plant and over 65,000 tonnes of CO<sub>2</sub> have been successfully sequestered in a depleted gas field in Victoria's Otway Basin.<sup>152</sup>

### MYTH 5 Renewables can replace coal as a cornerstone energy source

Australia's official energy forecaster has reasoned that: 'There is no single energy option that will allow a country to meet all of its growth and environmental objectives'.<sup>153</sup> While the trend towards greater technological diversity will continue, it is important to recognise the central role of baseload power sources – including coal and uranium – in meeting the growing global demand for energy.

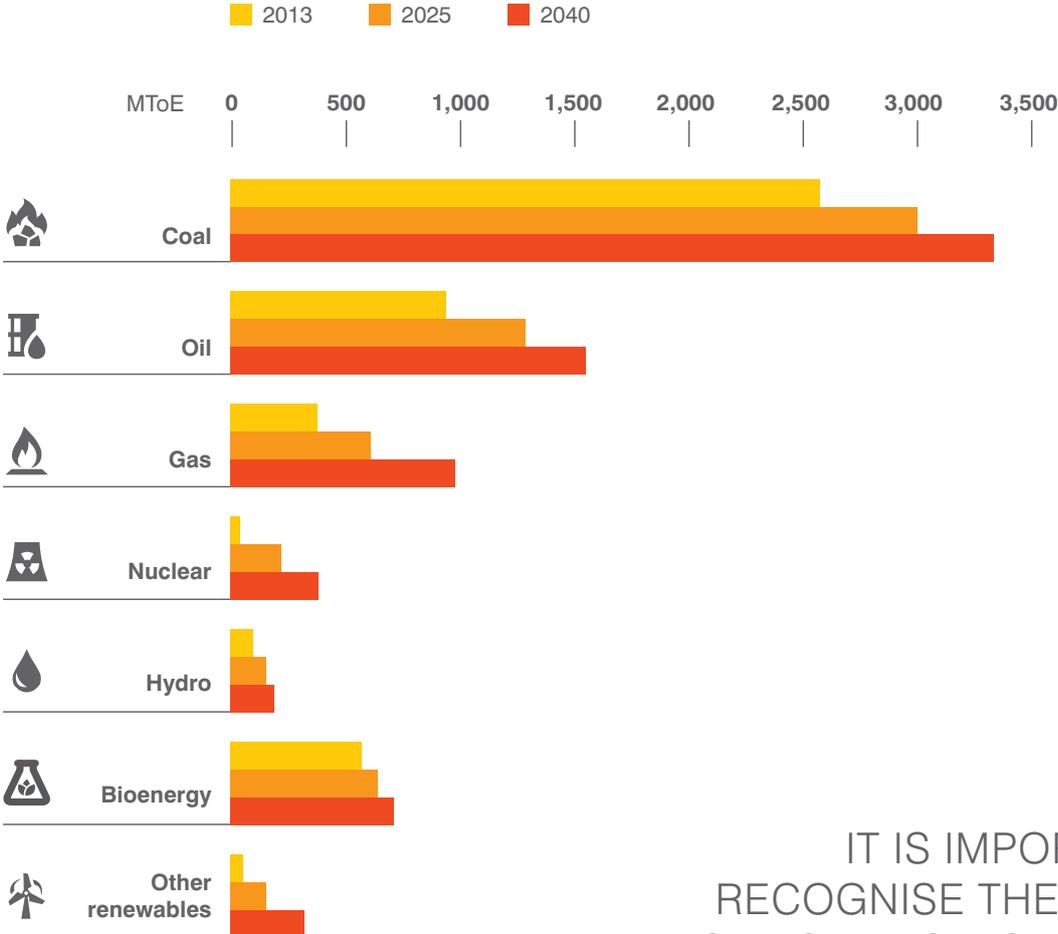
The scale and time needed to replace the 4,030,000 megawatts of fossil fuels power plants operating today with renewables would be prohibitive:

- Replacing fossil fuels with solar would require with 100 times the current total installed capacity, require 95,900 km<sup>2</sup> and take 470 years to install at current rates.
- Replacing fossil fuels with wind power would require 35 times the present installed capacity, at a rate of 630 new 3 megawatt wind turbines per day to achieve replacement by 2030.

Replacing fossil fuels with hydro would require 13 times current capacity at a rate of 310 dams a year.<sup>154</sup>

CHART 19 Developing Asia primary energy demand (2013, 2025 and 2040)<sup>155</sup>

Source: International Energy Agency



IT IS IMPORTANT TO RECOGNISE THE CENTRAL ROLE OF BASELOAD POWER SOURCES – INCLUDING COAL AND URANIUM – IN MEETING THE GROWING GLOBAL DEMAND FOR ENERGY.

## Endnotes

- <sup>1</sup> International Energy Agency, *World Energy Outlook Special Report on Energy and Climate Change: Energy and CO<sub>2</sub> trends in the INDC Scenario: World INCD Scenario data tables*, Paris, last updated 15 June 2015.
- <sup>2</sup> A. F. Britt *et al.*, *Australia's Identified Mineral Resources 2014*, Geoscience Australia, Canberra, p. 4.
- <sup>3</sup> BP, *Statistical Review of World Energy 2015*, 10 June 2015.
- <sup>4</sup> Department of Industry and Science, *Resources and Energy Quarterly – June Quarter 2015: Statistical tables; Resources and Energy Quarterly – June Quarter 2015: Commodity data*, released on 30 June 2015, Canberra; Victorian Department of Economic Development, Jobs, Transport and Resources, *Victoria, Australia: A principal brown coal (lignite) province*, Melbourne, p. 1.
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- requirements: Wind turbine spacing 3 to 10 times rotor diameter—5 assumed; and 3MW turbine rotor diameter 100 to 125m—110m assumed. Spacing required is 550m. 3,459,600 turbines set out in square grid of 1860 x 1860 turbines with 550m spacing totals 1,046,529 sq. km. Source for coal content of wind turbines: USGS, Wind Energy in the United States and Materials required for the land based wind turbine industry from 2010 to 2030.
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# COAL

## Hard Facts

This publication is part of the overall program of the MCA, as endorsed by its Board of Directors, but does not necessarily reflect the views of individual members of the Board.

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