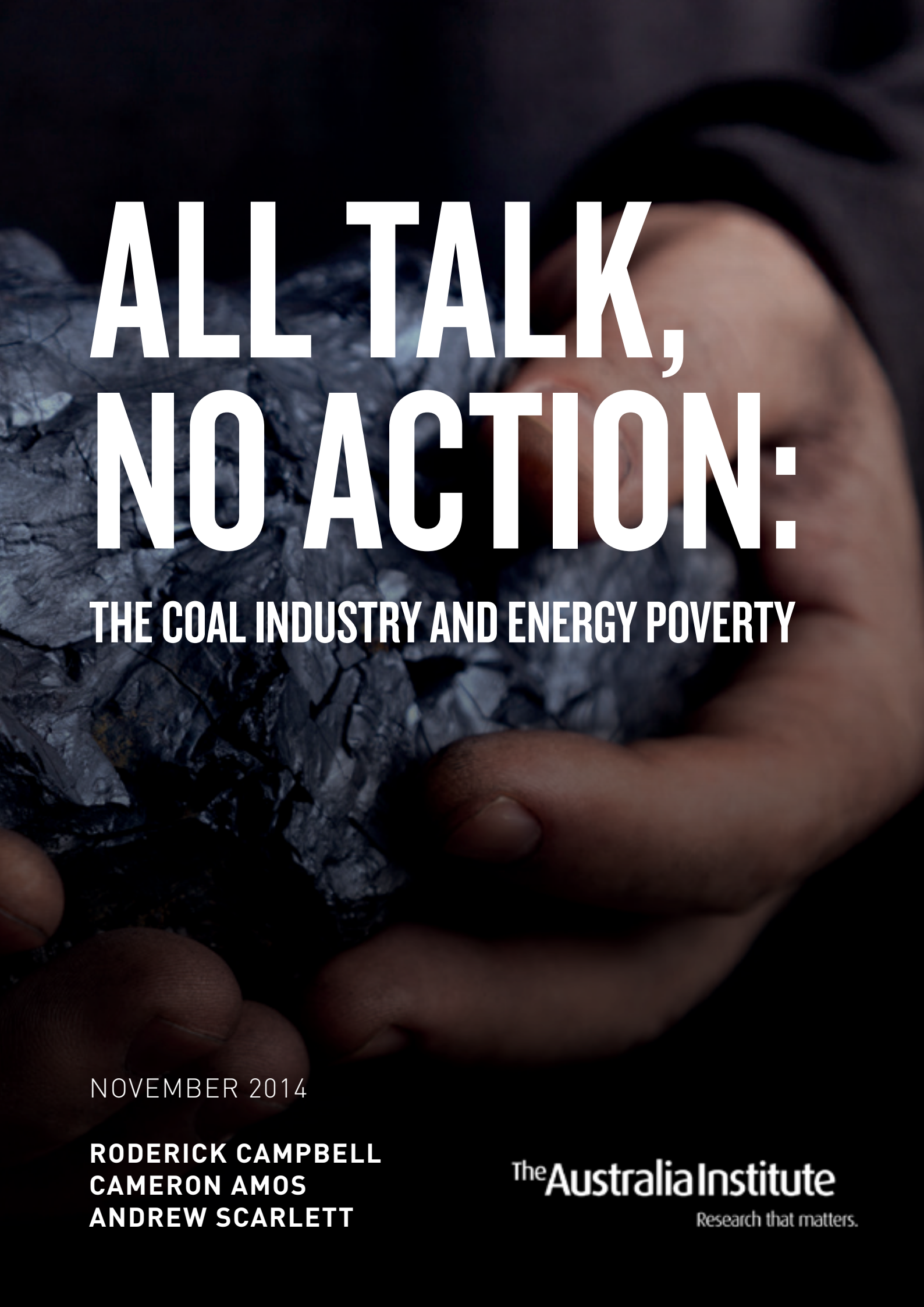


ALL TALK, NO ACTION:

THE COAL INDUSTRY AND ENERGY POVERTY

NOVEMBER 2014

RODERICK CAMPBELL
CAMERON AMOS
ANDREW SCARLETT

The Australia Institute
Research that matters.

The Australia Institute
Research that matters.

All talk, no action:

The coal industry and energy poverty

Policy Brief
November 2014
ISSN 1836-9014

Roderick Campbell

Cameron Amos

Andrew Scarlett

The Australia Institute

Research that matters.

About The Australia Institute

The Australia Institute is an independent public policy think tank based in Canberra. It is funded by donations from philanthropic trusts and individuals and commissioned research. Since its launch in 1994, the Institute has carried out highly influential research on a broad range of economic, social and environmental issues.

Our philosophy

As we begin the 21st century, new dilemmas confront our society and our planet. Unprecedented levels of consumption co-exist with extreme poverty. Through new technology we are more connected than we have ever been, yet civic engagement is declining. Environmental neglect continues despite heightened ecological awareness. A better balance is urgently needed.

The Australia Institute's directors, staff and supporters represent a broad range of views and priorities. What unites us is a belief that through a combination of research and creativity we can promote new solutions and ways of thinking.

Our purpose—'Research that matters'

The Institute aims to foster informed debate about our culture, our economy and our environment and bring greater accountability to the democratic process. Our goal is to gather, interpret and communicate evidence in order to both diagnose the problems we face and propose new solutions to tackle them.

The Institute is wholly independent and not affiliated with any other organisation. As an Approved Research Institute, donations to its Research Fund are tax deductible for the donor. Anyone wishing to donate can do so via the website at https://www.tai.org.au or by calling the Institute on 02 6130 0530. Our secure and user-friendly website allows donors to make either one-off or regular monthly donations and we encourage everyone who can to donate in this way as it assists our research in the most significant manner.

Level 5, City Walk Centre
131 City Walk
Canberra City, ACT 2601
Tel +61 2 6130 0530
Email: mail@tai.org.au
Website: www.tai.org.au

Contents

Summary

The term “energy poverty” refers to people who do not have access to electricity and clean cooking facilities. Globally, 1.3 billion people do not have access to electricity in their houses and 2.6 billion people cook by burning coal, wood and other solid fuels. This has major impacts on people’s health, safety and quality of life.

The coal industry is very vocal in promoting energy poverty and pushing coal as a solution to it. The head of major coal company Peabody Energy describes the problem as:

> *Energy poverty is the world’s number one human and environmental crisis.*

However, what Peabody ***says*** and what it ***does*** about energy poverty are very different. Although the company contributes to many charitable causes, it does not donate money, staff time, expertise or discounted fuel to any project that directly alleviates energy poverty.

Peabody’s only contribution to energy poverty is maintaining a website and social media page which promotes coal as the solution to the problem.

While Peabody talks about energy poverty, other organisations act. The United Nations, World Bank, governments and non-government organisations are addressing energy poverty through programs relating to electrification, lighting and improving access to cooking facilities, often in partnership with the private sector. The largest program is the United Nations and World Bank ‘Sustainable Energy for All’ initiative which has links with governments in 85 countries.

None of the main energy poverty initiatives promotes the use of coal.

Perhaps because of this, the coal industry does not support any of the main energy poverty initiatives.

Other coal companies regularly echo Peabody’s statements on the importance of addressing energy poverty, however unlike Peabody, some of them do support direct efforts to alleviate energy poverty, such as:

- Indian coal company Adani provides solar-powered street lighting to rural areas in India.
- BHP Billiton supports solar projects in Pakistan.
- Rio Tinto connected villages in Peru to hydo and gas-fired electricity grids.
- Anglo American are piloting an off-grid electricity system for South African villages using platinum and methanol fuel cells
- Thai coal company Banpu built a mini grid for villages near a mine in Indonesia, powered by a diesel generator.

Despite extensive searches and contact with companies and mining lobby groups, we could not find a single example where coal companies have supported coal-powered energy poverty alleviation projects.

The reason that even coal companies do not use coal-fired power to assist with energy poverty alleviation is that it is not economically rational to do so. The cost of other energy sources, including renewables, is now competitive with coal-fired power at a utility scale. More importantly, off-grid and mini-grid initiatives avoid the large up-front costs associated with coal-related infrastructure making them a much better investment for households, communities and governments affected by energy poverty.

In light of this economic reality, many of the claims made by Peabody Energy and other coal industry supporters do not withstand scrutiny:

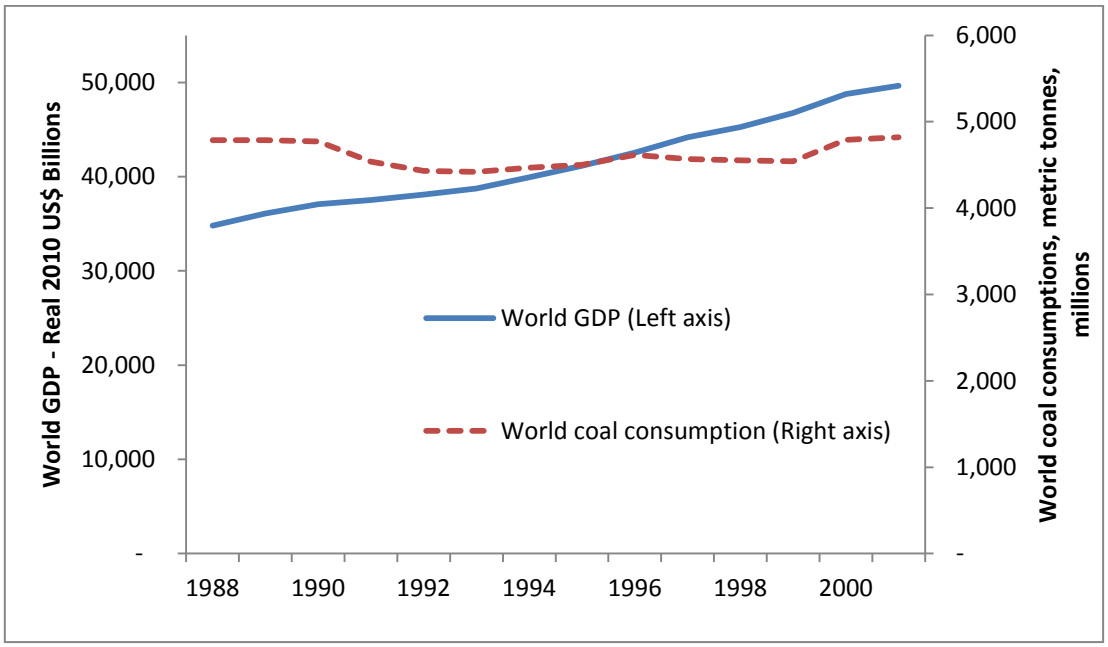
Claim 1: Coal use drives world economic growth

A regular claim made by the coal industry is that coal use causes economic growth. This claim mistakes correlation with causation. It is not coal that causes economic growth, but economic growth can lead to increased coal use.

In fact coal use has grown much slower than economic growth. If world GDP had grown at the same rate as coal consumption since 1980, today's world economic output would be almost USD$12 trillion lower than it is.

Even the correlation between economic growth and coal use is not as strong as the coal industry claims. Official data sources show that from 1988 to 2002 world coal use was flat while economic growth was strong, as shown below:

World GDP and coal consumption



Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset,* United States Energy Information Agency (2014) *International Energy Statistics*

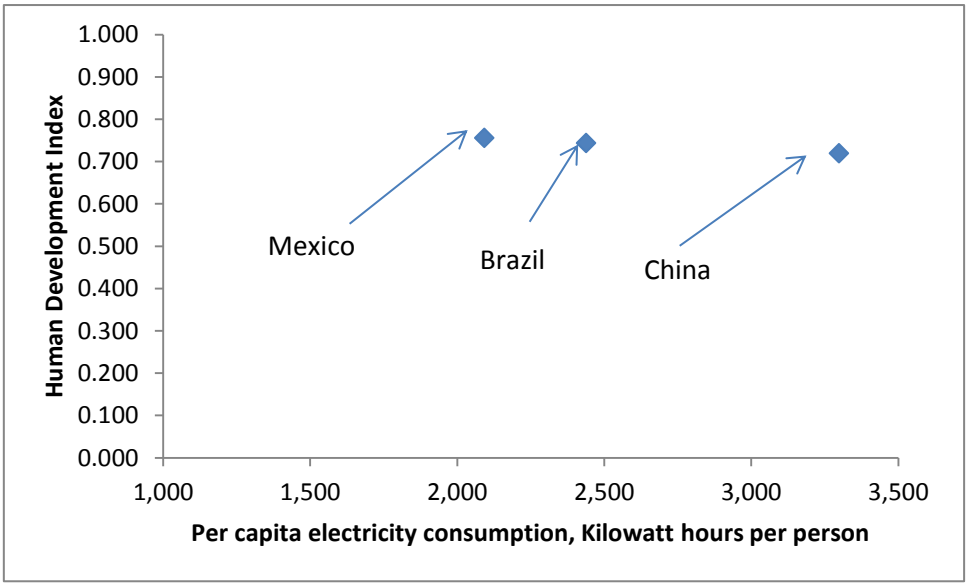
Further analysis of official data shows that developed countries have reduced coal use while economic growth has been unaffected. Developing countries are now the major coal users, but with alternatives becoming cheaper, they are likely to reduce coal use much earlier in their development.

Claim 2: Coal use increases life expectancy and quality of life

Peabody Energy claims that coal use has led to increased life expectancy over the last 1,000 years of human history. Life expectancy and coal use can both be correlated with economic growth, but it is not coal use that causes any increase in life expectancy. On the contrary, coal use is often associated with lower life expectancy due to health impacts of indoor and outdoor air pollution and the global health impacts of climate change.

Increasing electricity use from very low levels contributes to increases in quality of life as measured by the United Nations' Human Development Index (HDI). Once basic electricity access is achieved however, there is little correlation between quality of life and electricity use. For example, Mexico, Brazil and China have similar HDI scores, but have widely differing electricity use per person. In fact, Mexico uses the least electricity per person and has the highest HDI score, while China uses the most electricity with the lowest HDI score, as shown below:

Human Development Index and electricity use, Mexico, Brazil and China



Sources: United Nations Development Program (2014) *Human Development Reports*, World Bank (2013) *Electric power consumption*

Claim 3: Coal is getting cleaner

Major improvements in the emissions standards of coal-fired power stations have been achieved in relation to sulphur, nitrogen and particulate pollution, which affect human health. Coal-fired power remains, however, a major source of carbon dioxide emissions which cause climate change.

To make serious reductions in coal-fired power greenhouse emissions, carbon capture and storage is required. The capacity for carbon capture and storage is low – only thirteen projects are operational worldwide, sequestering only 25 million tonnes of carbon dioxide per year, or less than one tenth of one per cent (0.07 per cent) of the world's total 33,376 million tonnes of emissions each year.

Conclusion

The problems of energy poverty are real and large. Promising solutions are becoming available and many organisations are working to hasten their implementation. Coal companies are not, in general, major contributors to energy poverty alleviation efforts. When they do contribute, it is ironically with support for energy sources other than coal. Claims that coal use is vital for economic growth and quality of life are not supported by economic data and should be dismissed as coal industry public relations rather than a genuine contribution to alleviating energy poverty.

Introduction

What is energy poverty?

The term 'energy poverty' refers to people not having access to modern energy services, specifically:

> *Household access to electricity and clean cooking facilities (e.g. fuels and stoves that do not cause air pollution in houses).*[1]

A lack of electricity and clean cooking facilities poses many problems for human and economic development. Without electric lights, opportunities for work and study are limited to daylight hours, or people must use light sources such as kerosene lamps which give poorer light and cause indoor air pollution. Cooking with poorly ventilated stoves fuelled with coal, wood, crop residue or animal dung causes major health problems for people exposed to the smoke, who are most often women and children. Collecting wood and other fuels can lead to other environmental problems such as deforestation, erosion, flooding and loss of soil fertility.

What is the extent of energy poverty?

Energy poverty is a major problem. While most people in richer countries take electricity access for granted, billions of people are affected worldwide. The International Energy Agency estimates that over 1.3 billion people do not have access to electricity and 2.6 billion people do not have clean cooking facilities.[2] This contributes to four million premature deaths each year, according to the World Health Organisation, and addressing the problem is considered a "key imperative for economic development" by the World Economic Forum.[3]

The areas most heavily affected by energy poverty are sub-Saharan Africa and South Asia. Sub-Saharan Africa has 620 million people without electricity access and 730 million people who lack clean cooking facilities, with Nigeria, Ethiopia and Democratic Republic of the Congo having the largest numbers. In Asia, India alone has 306 million people without electricity access. Another 56 million live in neighbouring Pakistan, with 66 million in Indonesia.[4]

What is being done about energy poverty?

A range of governments, organisations and companies are working to address energy poverty.

In 2010, the United Nations designed 2012 to be the International Year of Sustainable Energy for All and launched the Sustainable Energy for all (SE4ALL) initiative in partnership with the World Bank. SE4ALL has three overarching goals:

1. To ensure universal access to modern energy services
2. To double the rate of improvement in energy efficiency
3. To double the share of renewable energy in the global energy mix.

[1] International Energy Agency (IEA) (n.d.) *IEA website: Energy poverty*
[2] International Energy Agency (IEA) (n.d.) *IEA website: Energy poverty*
[3] World Health Organisation (2014) *Household air pollution and health* and WBCSD, WEC & WEF, (2009) *Energy Poverty Action*
[4] IEA (2014) *Africa Energy Outlook,* IEA (2013) *World Energy Outlook 2013*

SE4ALL has engagement with 85 governments in Africa, the Americas, Asia Pacific, Eastern Europe and former USSR states, and supports programs in many countries.[5]

The Global Alliance for Clean Cookstoves is an initiative of the United Nations Foundation involving national governments, non-government organisations and the private sector. It offers finance for clean cooking facilities to communities in developing countries. The Alliance aims to provide better facilities to 100 million households by 2020.[6]

Power Africa is an initiative of the United States Government, managed through US Aid in partnership with six African governments, twelve US Government agencies and tens of private sector companies. Power Africa aims to:

> *[Expand] mini-grid and offgrid solutions and building out power generation, transmission, and distribution structures, Power Africa will also increase electricity access by adding more than 60 million new household and business connections.*[7]

In addition programs sponsored by governments and multi-lateral donors, there are many energy poverty efforts by international and local non-government organisations. One example is the Solar Electric Light Fund, founded in 1990 in the USA, which offers small-scale solar energy systems for homes in rural communities in Africa and Asia. Since 2008, the organisation has delivered solar systems for more than one million people.[8]

There are a large range of energy poverty programs, supported by a diverse range of organisations, across many different countries. Despite this diversity, one thing is absent in all the major initiatives – none of them promote coal-fired electricity as a solution to energy poverty. Furthermore, none of them lists a major coal producing company as a partner, donor or supporter.

Given the coal industry's lack of involvement in the main energy poverty initiatives, it is surprising that coal companies have launched public relations campaigns to highlight the extent of the problem. Perhaps less surprising is that coal companies use this publicity to promote greater use of their product as an answer to energy poverty.

Energy poverty and the coal industry

> *Energy poverty is the world's number one human and environmental crisis.* [9]
>
> Gregory Boyce, Chief Executive Officer, Peabody Energy.
>
> *Affordable and reliable, coal-driven energy is the best answer to global poverty.* [10]
>
> Stephen Galilee, Chief Executive, NSW Minerals Council.

The international coal industry has been vocal in emphasising the size of the energy poverty problem and in advocating that coal is the solution to this problem. It is surprising then that members of the coal industry are very rarely involved in energy poverty alleviation through their charity or corporate social responsibility programs. More surprising still, when coal

[5] http://www.se4all.org/
[6] http://www.cleancookstoves.org/our-work/transformation-strategies/
[7] http://www.usaid.gov/powerafrica
[8] http://self.org/
[9] Peabody Energy (2013) *2013 Corporate and Social Responsibility Report*
[10] Galilee (2014) *Coal critics wasting energy*

companies do support energy poverty programs, they do not use coal-fired power as a solution.

Analysis of company annual reports and corporate social responsibility reports shows that while some coal companies have considerable charity and community outreach programs, very few address energy poverty. Those projects that do assist with electrification and lighting provision employ solar, diesel and other energy sources. We could not identify a single energy poverty related project directly supported by coal companies which used coal-fired generation to alleviate energy poverty.

In addition to company reports we contacted coal companies and industry representative groups the Minerals Council of Australia, Queensland Resource Council and New South Wales Minerals Council, which represent most of the world's largest coal producers. They were also unable to find any examples of their members donating money, expertise, staff time, discounted fuel or other form of assistance to coal-fired electrification or other energy poverty related projects. If coal companies are using coal-fired power in energy poverty projects, they are not publicising these efforts.

Peabody Energy

Peabody Energy is one of the world's largest coal producers. Unlike most other companies discussed in this report, Peabody is a 'pure-play' coal company – it only produces coal and does not produce or market other minerals and fuels.

Peabody is the loudest voice among coal companies in promoting energy poverty and proposing coal as a solution to it. The company sponsors the *Advanced Energy for Life* website and associated social media.[11] The site claims:

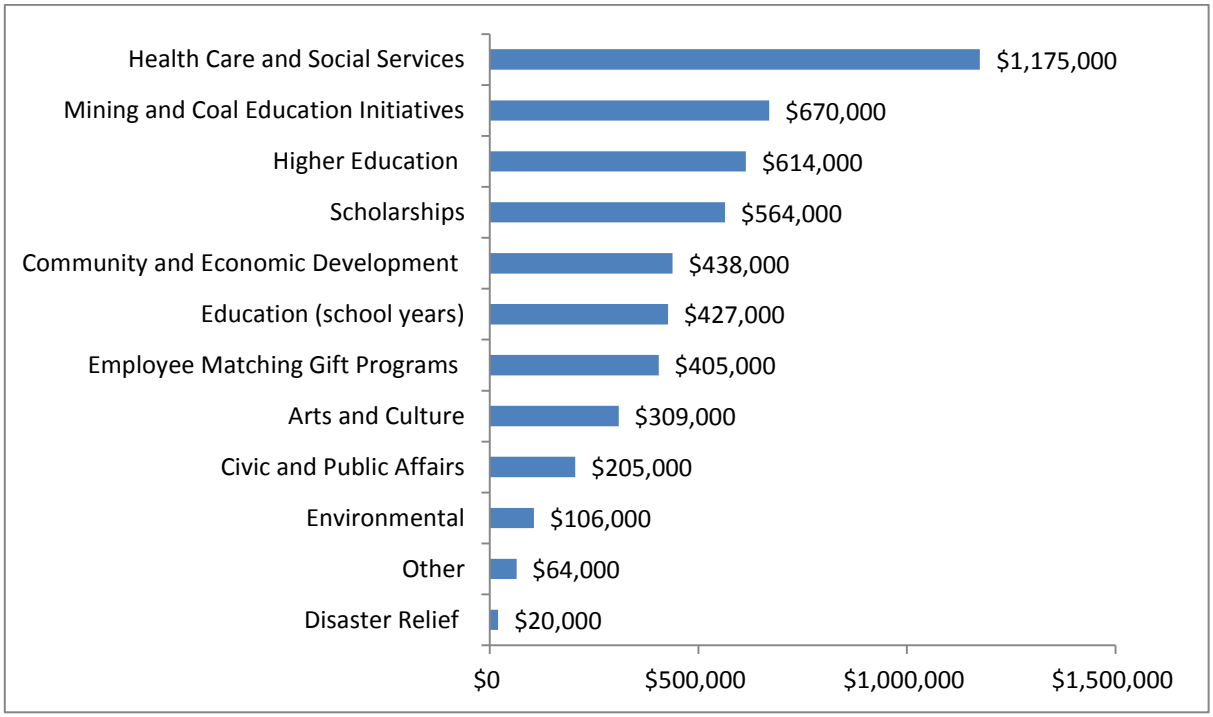
> *The goal of the Advanced Energy for Life campaign is simple: to end energy poverty and increase access to reliable, low-cost electricity around the world. To achieve this goal, we recognize that the world needs all forms of energy – particularly greater use of clean coal. Clean coal has the power to solve energy poverty, keep energy prices low, fuel the world's best economies and use advanced technologies to improve the environment.*

The *Advanced Energy for Life* campaign publishes articles from other sources relating to energy poverty, particularly those that promote coal use. There is almost no mention of the major initiatives discussed above. Based on the website, Peabody's reports and multiple attempts to contact the company and site administrators, it appears that the site does not conduct any original research or analysis or have any direct involvement in energy poverty alleviation projects.

In fact, Peabody Energy does not support energy poverty projects through its corporate social responsibility programs. The company gave nearly USD$5 million to charitable causes and scholarships in 2013, 0.07 per cent of their USD$7 billion in revenue.[12] The major focus of the company's charitable efforts is St Louis, USA, where the company has its world headquarters. Support is also provided to causes in other areas of operations in the USA and Australia. The company reports donations to programs involved in a range of causes, particularly 'health care and social services', 'mining and coal education' and 'higher education' as shown in Figure 1 below:

[11] www.advancedenergyforlife.com
[12] Peabody Energy (2013), Peabody Energy (2014) *Annual Report*

Figure 1: Peabody Energy charitable causes 2013



Source: (Peabody Energy, 2013) p12

Surprisingly, there is no mention of direct involvement in energy poverty projects in any of Peabody's Corporate and Social Responsibility reports, even though other initiatives are covered in detail, for example:

> *Peabody employees planted 600 trees to coincide with Planet Ark National Tree Day. The trees were placed along a one kilometre strip of property bordering the Coppabella [Queensland, Australia] Golf Club, protecting the fairway against erosion and preserving an important recreational facility in the township.*[13]

> *Foidel Canyon School House in Routt County, [Colorado, USA], stood vacant since 1957, but once numbered among hundreds of one-room schools erected to educate the children of pioneer families throughout the U.S. West. With crucial funding and countless hours of volunteer-effort, Peabody has nearly completed a renovation of this historic building.*[14]

While initiatives like improving golf courses and restoring historic buildings may be highly valued by local communities and important for Peabody's social licence to operate in particular areas, it is difficult to understand why the company places emphasis on these activities rather than on any efforts to alleviate what the company's CEO sees as the 'world's number one human and environmental crisis'.

It is possible that the *Advanced Energy for Life* campaign is considered part of Peabody's 'coal education' spending within its claimed charitable activities. While many may question whether industry public relations campaigns are actually charitable, the company says in its corporate social responsibility reports:

[13] (Peabody Energy, 2013) p14
[14] (Peabody Energy, 2013) p15

> *As an industry leader, Peabody seeks to influence public perceptions and legislative outcomes in favor of greater coal mining and use. The company acts independently and in cooperation with associations and grassroots advocates to emphasize coal's far-reaching benefits in the United States and Australia.*[15]
>
> *We are particularly focused on advancing the worldwide use of coal as the only energy resource that can be deployed at scale in a sustainable manner to eradicate energy poverty and elevate the living standard of the human community to that enjoyed by the peoples of the developed world.*[16]

While Peabody's actions on energy poverty seem to go no further than public relations campaigns and political lobbying in their own commercial interests, other coal companies are involved in direct efforts to provide lighting and electricity to communities near their operations. Contradicting Peabody's claims that coal is the most useful fuel for addressing energy poverty, no programs supported by coal companies use coal. As the following section shows, most programs use renewable energy.

Adani

Indian conglomerate Adani owns major coal-fired electricity assets in India and is the proponent for the proposed Carmichael coal mine in the Galilee Basin in Queensland, Australia, potentially one of the largest coal mines in the world. Despite its involvement in coal and India being a country with considerable energy poverty problems, Adani states:

> *India is in the clutches of a severe power crisis. With such a huge population, it has been become a Herculean task to ensure the availability of a basic necessity. India's power grid has not yet reached maturity, with about 80,000 villages without electricity as of 2004. Such a situation calls for desperate measures.*
>
> *India's dense population and high solar insolation make solar energy the most viable option for India.*[17]

As part of their program to improve rural infrastructure in India, Adani have been providing:

> *Solar Street Lights: Harnessing the solar power and setting up solar street lights has been seen as an initiative to promote the use of renewable energy technology to meet the energy requirements of the community.*

Adani also owns utility-sized solar generation assets in India.

Cargill

Cargill are one of the world's largest commodity trading companies, which traded coal up until early 2014.[18] Much of the company's coal trading business was conducted from the Singapore office, which supports an energy poverty project on the nearby Riau Islands, part of Indonesia.[19]

Project Light is run by the Singapore-based non-government organisation, Nusantara Development Initiatives, which aims to "end energy poverty through empowerment of

[15] Peabody Energy (2012) *2012 Corporate and Social Responsibility Report* p13
[16] (Peabody Energy, 2013) p27
[17] http://www.adanirealty.com/blog/solar-energy-in-residences.html
[18] http://www.cargill.com/news/releases/2014/NA31370402.jsp
[19] http://www.cargill.com/connections/project-light/

women." It works in rural Indonesia, training women entrepreneurs and providing them with solar lamps to sell in villages without regular electricity supply.[20]

Cargill supports the project financially and sends staff on field trips to experience energy poverty and NDI's work first hand. One noted:

> *All the hard work paid off when we witnessed how the program was effectively helping households solve persistent electricity supply problems and, at the same time, lower their monthly fuel bills.*[21]

BHP Billiton

BHP Billiton is one of the world's largest mining companies, and has coal mining operations in many countries. The company is involved in a wide range of environmental and social programs and aims to invest one per cent of pre-tax profit in community programs, achieving a total of $242 million in 2013-14.[22]

While few of BHP Billiton's community programs address energy poverty, CEO Andrew Mackenzie echoes the sentiments of Peabody Energy in his comments on climate change and energy poverty:

> *We must address energy poverty and climate change together. Any attempt to solve one without the other is destined to fail... The world will continue to rely on fossil fuels over the long term because their continued supply is vital to the development that will deliver huge reductions in abject poverty.*[23]

Despite Mackenzie's view that fossil fuels will deliver reductions in poverty, the only example of an energy poverty project directly supported by BHP Billiton we could find is focused on renewable energy. The company supports an electrification project in southern Pakistan, where the company has a stake in oil and gas developments. The project is powered by photovoltaic solar cells.[24]

Rio Tinto

Rio Tinto is one of the world's largest mining companies, including large coal assets in Australia and until recently also in Africa. Like BHP Billiton it contributes to a wide range of environmental and social activities, particularly near its operations:

> *In 2013, our businesses contributed to just under 2,200 socioeconomic programmes covering a wide range of activities such as health, education, business development, environmental protection, housing and agricultural development. We spent US$331 million on these community assistance programmes.*[25]

Very few of Rio Tinto's community assistance programs relate to energy poverty, although like most other coal companies it makes reference to a role for coal in addressing the problem.[26] The only electrification project mentioned in Rio Tinto's corporate social responsibility reports is one in the Querocoto District, Chota Province, Peru, where the company operates a copper mine. Rio Tinto has assisted with connecting several villages to

[20] http://ndi.sg/index.php
[21] Nusantara Development Initiatives (2012) Annual report 2012
[22] BHP Billiton (2014) *Sustainability report 2014*
[23] Mackenzie (2014) *Energy, Commodities and the Global Economy*
[24] http://ebr-energy.com/pakistan/news/details/11
[25] Rio Tinto (2013) *Annual report*, p21
[26] http://m2m.riotinto.com/issue/5/article/energy-golden-thread

the main electricity grid.[27] Coal plays a minimal role in electricity generation in Peru, where the grid is mainly powered by hydroelectricity and gas.[28]

Anglo American

Anglo American is a large global mining company headquartered in the United Kingdom, with operations in many countries including coal mines in Australia, South Africa and Colombia. Like the other large mining companies, Anglo American contributes to a range of social and environmental causes. The company claims to have supported 1,447 community development projects in 2013, with contributions worth USD$128 million, 2.8 per cent of operating profit before tax.[29]

Anglo American representatives write publically about energy poverty and the importance of government subsidies for coal development:

> *Government support and enabling regulation for cost-effective clean coal technology is the best approach to improving global access to affordable energy, stimulating economic growth, and job creation.*[30]

However, Anglo American's own energy poverty project in South Africa is not powered by burning coal, but is based on platinum and methanol fuel cells.[31]

Banpu

Banpu is a Thai energy and mining company which owns coal and coal-fired power assets in many countries in Asia and Australia. The company donated USD$21 million to community and environment causes in 2013, three per cent of the company's earnings before interest, tax and other expenses.[32]

The company owns several mines in East Kalimantan, Indonesia, where many villages do not have access to electricity. In 2012-13 Banpu subsidiaries built a generator and mini grid connected to 85 houses in the village of Muara Begai Village, Muara Lawa, West Kutai. Surprisingly, the generator is not powered with coal, but with diesel.[33]

Other coal companies

We investigated the corporate social responsibility reports and web pages of other major coal producers, Glencore Xstrata, Arch Coal, Alpha Natural Resources, GVK, Yancoal and Shenhua, but found no direct involvement with energy poverty projects. No coal company that we can find supports an energy poverty alleviation program which uses coal as a fuel source.

Furthermore, when building their own facilities in areas away from major electricity networks, coal producing companies use solar energy. For example:

---

[27] Rio Tinto (2007) *Progresamos juntos: La Granja boletin informativo*

[28] http://www.iea.org/statistics/statisticssearch/report/?year=2010&country=PERU&product=ElectricityandHeat

[29] Anglo American (2013) *Sustainable development report 2013*

[30] Fisher (2014) *Balancing South Africa's Energy Poverty and Climate Change Commitments*

[31] http://ourviews.angloamerican.co.za/2014/08/05/powering-communities-with-platinum/

[32] Banpu (2013) *Sustainability report 2013*

[33] Indo Tambangraya Megah (2013) *Bubuhan*

- Rio Tinto's Weipa bauxite mine is building a AUD$23.4 million, 1.7 megawatt solar power station to reduce diesel fuel costs.[34]
- Anglo American's thermal coal mines in South Africa are building a range of solar facilities both grid-connected and off-grid.[35]
- BHP Billiton installed an AUD$1.5 million 300 kilowatt solar installation at its Leinster Nickel project.[36]

Economics of energy poverty solutions

The reasons why energy poverty alleviation projects, even those supported by coal-producing companies, are focused on renewable energy and other non-coal options are economic. New coal-fired generation capacity involves large up-front costs to build power stations and distribution networks. These costs can be prohibitive even for governments and multinational companies. By contrast, approaches to energy poverty such as those outlined above can provide significant energy services for people at relatively little cost.

While coal companies claim that electricity from coal is cheap, building a coal-fired power station is expensive. The US Energy Information Agency estimates that a medium sized coal fired power plant costs US$2.1 billion. A similar plant that sequesters its carbon dioxide emissions through carbon capture and storage costs US$3.4 billion. Costs are lowest in China, where a medium sized plant could be built for as little as US$436 million.[37] Further costs are involved in transmitting and distributing the electricity through a grid, as well as maintenance and fuel of the plant.

Coal mining also involves costs. In addition to companies financial expenditure and environmental costs, governments often subsidise coal mining. For example, the government of Queensland, Australia's largest coal producing state, spent over AUD$8 billion assisting coal operations in the state mainly through provision of infrastructure.[38] Not only does this subsidise the production of coal, but reduces the state's capacity to spend money on other social objectives, as Queensland's State Treasury makes clear:

> *Governments face budget constraints and spending on mining related infrastructure means less infrastructure spending in other areas, including social infrastructure such as hospitals and schools.*[39]

By contrast, other solutions to energy poverty are relatively cheap and do not divert spending from social infrastructure. For example, access to lighting through provision of solar lamps can be provided for just tens of dollars per household, as shown by Project Light supported by Cargill, discussed above. The International Energy Agency considers such programs "invaluable":

---

[34] Vorrath (2014) *Tag Pacific steps in to build solar plant at Rio Tinto mine*

[35] (Anglo American, 2013)

[36] http://www.commsolar.com.au/expertise/commercial-rooftop-solar-pv/bhp-billiton-nickel-west-leinster-solar-rooftops-project/

[37] Based on 650 megawatt unit with capital costs per kilowatt of $3,246 (conventional) and $5,227 (with CCS), as outlined in US Energy Information Administration (2013) *Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants.* China figure from IEA, NEA, & OECD (2010) *Projected Costs of Generating Electricity 2010*, USD$672 per kilowatt. Note these estimates are 'overnight' capital costs – they assume the plant is built overnight and no financing and interest costs are incurred.

[38] Peel, Campbell, & Denniss (2014) *Mining the age of entitlement: State government assistance to the minerals and fossil fuel sector*

[39] Queensland Treasury (2013) *Queensland Treasury Response to Commonwealth Grants Commission*, p15

For the poorest communities, smaller solar technologies, such as solar lamps, can provide an invaluable initial step towards electricity access. [40]

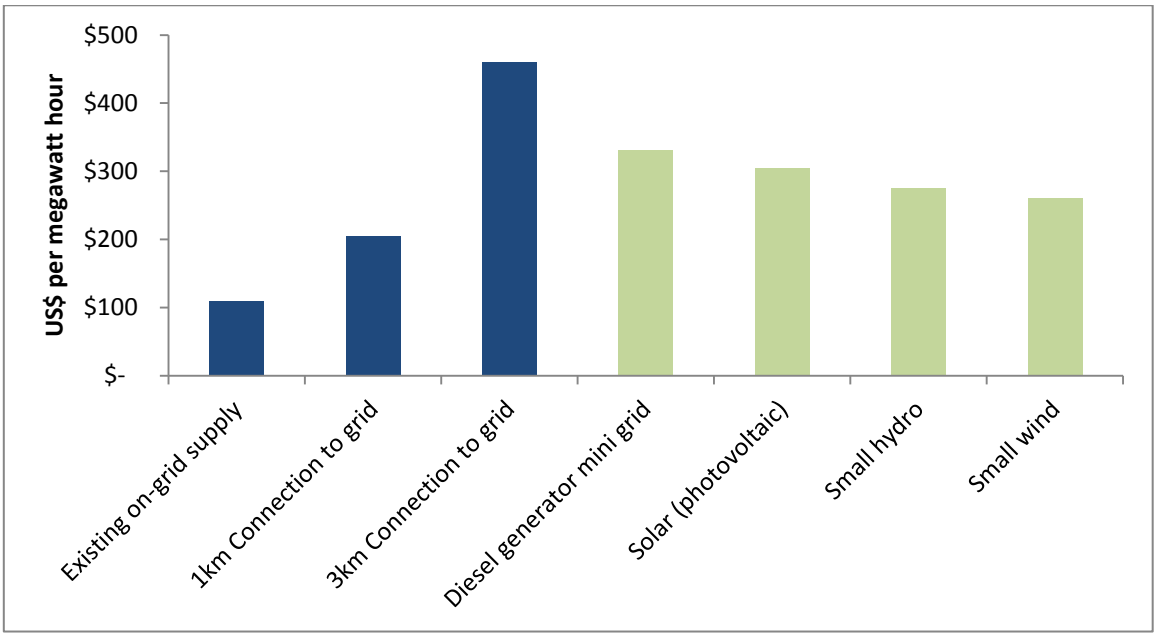
Coal-fired power has no comparable small-scale, low cost electrification option.

Main electricity grids, off-grid and mini-grid systems

Beyond such initial steps in energy access, the next question is whether households and communities should be connected to central electricity grids, or if they should rely on their own mini-grids or off-grid power sources such as diesel generators or renewable energy.

The answer to this question depends on how far they are from existing electricity grids. Where people live close to existing grids, connecting them can be the cheapest option, but costs increase rapidly with distance, according to data from the International Energy Agency (IEA) graphed in Figure 2 below:

Figure 2: Indicative levelised costs of electricity in sub-Saharan Africa, 2012



Source: IEA (2014) *Africa Energy Outlook*, p128

The darker blue bars in Figure 2 show grid connection options that are likely to include some coal-fired power. It is clear that where communities have existing grid connections, or a connection within one kilometre, that grid connections are currently the cheapest way to provide power on a levelised cost basis.[41] Communities living more than three kilometres from the grid can expect to pay levelised costs of almost $500 per megawatt hour for grid connections, substantially more than mini-grid or off-grid options. Similar effects are reported for grid connections in India.[42] These considerations are likely to have been a factor in Rio Tinto's decision to join communities to the national grid near their Peru copper mines, discussed above.

[40] IEA (2014) *Africa Energy Outlook*, p129
[41] Levelised cost considers capital and operating expenses and total generation over time, expressed in a single present value by applying a discount to future costs and generation. The IEA does not specify what discount rate has been used in this data; elsewhere in the document discount rates of 7 to 10 per cent are used.
[42] Vasudha Foundation (2014) *Electricity for all in India: Why coal is not always king*

The lighter green bars in Figure 2 show off-grid options that do not involve coal-fired power. The data shows that diesel generators have a relatively high levelised cost per megawatt hour. However, they have low initial costs as diesel generators are a mature and well understood technology. The vast bulk of the IEA's estimate of diesel generation costs relates to fuel expenses, which can vary depending on delivery expenses. For example, Banpu's electrification project in East Kalimantan, discussed above, may have been the most economic option as diesel delivery costs to villages near the mine site may be low, as the mine is also likely to require regular, large quantities of diesel to fuel its machinery. Diesel generation will require the community to pay ongoing fuel costs, something renewable technologies would avoid or reduce.

Solar, small hydro and small wind levelised electricity costs are all expected to decline in the future. While solar is currently the most expensive of the three, the IEA forecasts this cost will decline to under $200 per megawatt hour by 2040, making solar mini-grids competitive with central grids. Small wind and small hydro are likely to see smaller declines in cost according to the IEA's Africa report.[43]

Existing grids do not always assist with energy poverty

While connections to existing grids are generally a less-expensive option for providing electricity services, providing greater grid capacity and connections does not necessarily address energy poverty. Grid connections, like most services, go to those who can pay for them – urban, middle class households. Households suffering from energy poverty are often unable to afford even these relatively cheap services, as has been the case in India:

> *The pattern of household electrification rates across the country reveals a further injustice.…Some of the areas with the densest concentrations of coal power plants also have the lowest rates of household electrification…Despite the fact that [coal-fired] electricity generation capacity increased by more than 100 per cent between 2002 and 2013 (from 72 GW to 153 GW), the number of rural households reached by electricity increased by only 6.4 per cent during the same period.*[44]

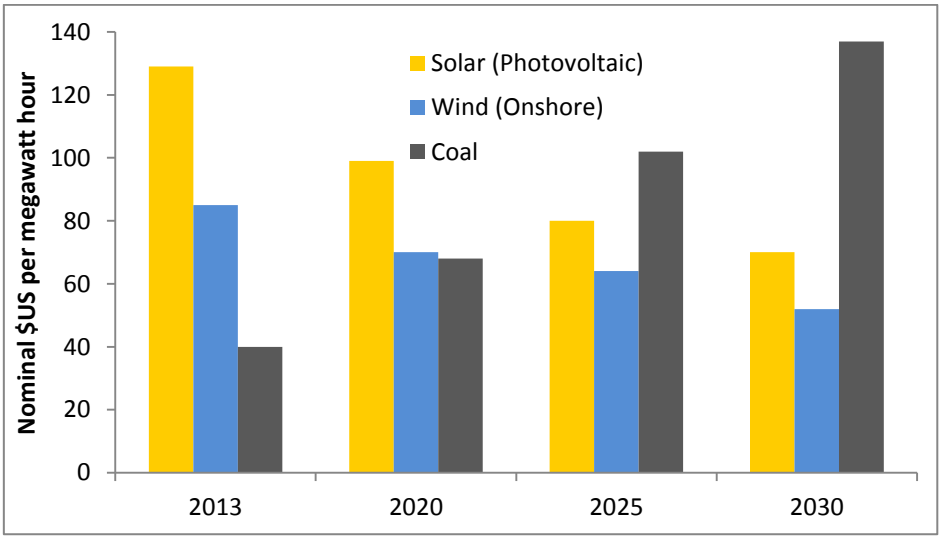
India's experience shows that increasing the amount of coal-fired generation into a grid does not necessarily improve access to energy services for poor people. While coal-fired generation can clearly play a role in providing electricity to the world's growing urban middle classes, coal's ability to address energy poverty is limited unless grid connections are provided to the poorest citizens.

Costs of coal and renewable grid generation

Even in providing large scale electricity generation to central grids, coal's cost advantages are rapidly declining. The costs of renewable technologies such as solar and wind are declining as technology improves and economies of scale develop in manufacturing and installation. Conversely, the costs of generating electricity from coal are increasing due to increasing coal prices, capital costs and regulations on greenhouse gas and other emissions. These trends are forecast to be prevalent in key energy markets and energy poverty areas, such as India and China, as shown in Figures 3 and 4 below:

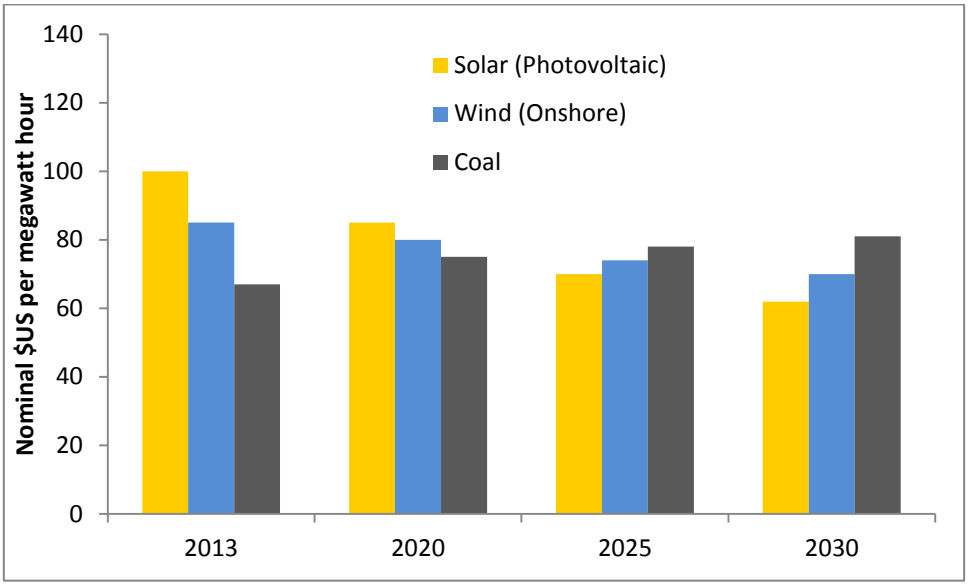
[43] IEA (2014)
[44] (Vasudha Foundation, 2014) p12

Figure 3: Forecasts of levelised cost of utility scale generation in China



Source: Bloomberg Energy Finance (2014) *2030 Market outlook: Asia Pacific*

Figure 4: Forecasts of levelised cost of utility scale generation in India



Source: Bloomberg Energy Finance (2014) *2030 Market outlook: Asia Pacific*

In both China and India, analysts are expecting wind and solar energy to become cheaper as equipment costs decline and efficiency improves. Coal generation in China is expected to become rapidly more expensive as the Chinese government enacts new pollution control measures, and more slowly in India with rising production costs and difficulties accessing India's coal reserves, which are often in heavily populated and sensitive areas. In both India and China, solar and wind are forecast to be cheaper than coal between 2020 and 2025.

There is little potential for coal to directly assist with energy poverty alleviation projects involving household-scale technologies or mini-grid and off-grid systems. Central electricity grids will be expanded to provide electricity to urban middle classes, but often these expansions fail to address energy poverty. Even generating for central grids at a utility scale,

coal is becoming more expensive than large scale renewables in key markets such as India and China.

These observations help explain why even coal companies do not use coal-fired energy when they support energy poverty projects, as discussed earlier. Bearing this in mind, in the next section we turn our attention to the macro level claims made by coal company, Peabody Energy, in their public relations campaigns. Most of these claims are misleading and not supported by empirical data.

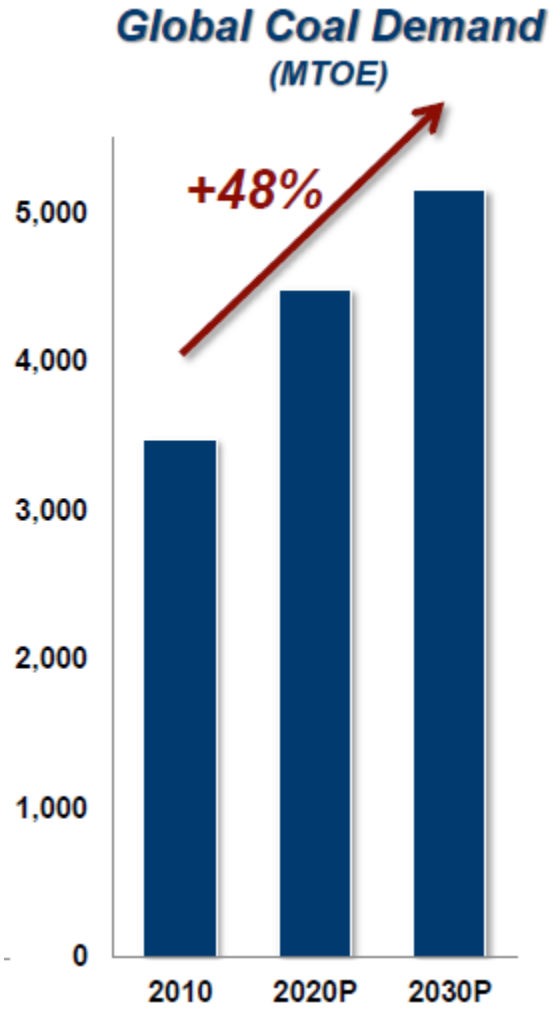
Assessing the claims of Peabody Energy on energy poverty

Peabody Energy makes many claims about coal use, economics and energy poverty through its *Advanced Energy for Life* website and other 'Coal Education' programs. Most of these claims are not based on official data and appear to be aimed at political lobbying rather than a contribution to informed public discussion.

Claim: coal demand is increasing rapidly

Peabody Energy misrepresents the work of the International Energy Agency (IEA) in their public relations material, particularly in relation to forecasts of coal demand. The company quotes the IEA as the source of a graph showing strong growth in demand for coal out to 2030, reproduced in Figure 5 below:

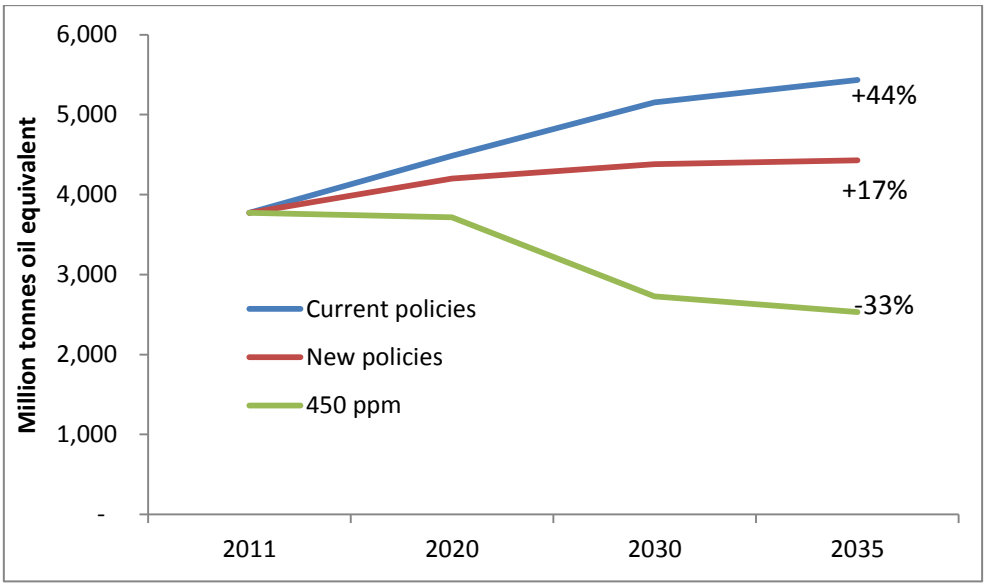
Figure 5: Forecast of world coal demand



Source: Peabody Energy (2014) *Coal: Advanced Energy For Life G20 Energy Access Workshop*

The graph shows an increase of 48 per cent in global coal demand between 2010 and 2030, measured in million tonnes of oil equivalent, a measure used to compare consumption of different energy sources. Peabody's presentation claims the source for this estimate is "International Energy Agency, 2013 World Energy Outlook". However, Peabody's chart reflects only the IEA's upper estimate for coal demand and excludes reference to its central and lower estimates. These are represented in Figure 6 below. Further, the IEA report uses 2011 rather than 2010 as a starting point and provides an estimate out to 2035 rather than 2030 as included in Peabody's graph above.

Figure 6: World coal demand under IEA scenarios



Source: IEA (2013) *World Energy Outlook 2013*, p572

Figure 6 shows that Peabody's claim of a 48 per cent increase in coal demand by 2030 is beyond even the IEA's upper estimate in the 'Current policies' scenario, which shows a 44 per cent increase in 2035. The three scenarios are defined by the IEA as:

- Current policies - takes account only of policies already enacted as of mid-2013.
- New policies - analyses the evolution of energy markets based on the continuation of existing policies and measures as well as cautious implementation of policies that have been announced by governments but are yet to be given effect.
- 450 ppm - The 450 Scenario shows what it takes to set the energy system on track to have a 50 per cent chance of keeping to 2 degrees the long-term increase in average global temperature.[45]

The IEA makes it clear that it considers the 'New policies' scenario to be the central estimate, based on "cautious" implementation of climate change policy rather than any firm global agreement.

Peabody, by contrast, says:

[45] IEA (2013) *World Energy Outlook 2013*, p33

> *Looking forward, Peabody believes the IEA's Current Policies Scenario to be the most realistic.*[46]

The company is entitled to its opinion. However it is wrong to suggest that their published estimates in coal demand are based on the IEA's own best estimates, which are in fact substantially lower than Peabody's preferred figures. It is important to realise that the IEA is far from the lower end of estimates of coal demand, as the following comments from financial analysts and investment banks show:

> *Our base-case outlook for coal-plant CO2 emissions is far less than the 4.6 billion and 5.2 billion metric tons forecast in the IEA's New Policies and Current Policies scenarios. It matches the results of the IEA's aggressive 450 Scenario, which imposes the policy changes necessary to limit the increase in global temperatures to 2 degrees Celsius.*[47]

> *Coal demand in China is about to start falling, and — with India and Indonesia the only remaining structural growth markets for coal — the global thermal coal market will never recover.*[48]

> *The countries most affected by energy poverty also happen to be the most vulnerable to the expected impact of climate change on crop yields, food security and poverty. Rather than enjoying a broad- based increase in coal-fired generation, we believe that future demand growth will be increasingly concentrated in just a handful of countries: India, Korea, Taiwan, and Japan….**This is the thermal coal paradox: the world has a significant deficit in electricity but the investment outlook for this cheap, widely available energy source is nonetheless poor.***[49]

> *Thermal coal is facing twin challenges of cyclically strong supply growth and a structural decline in demand growth.* [50]

These are not predictions by environmentalists or climate change activists, but by major investment banks and financial analysts. While there are a range of views on the future of the coal market, it is difficult to find any major analyst or international institution that shares Peabody's view.

The reason Peabody would want to exaggerate future coal demand is clear from other parts of their presentations and reports - they seek to create the impression that coal demand is inevitably tied to economic growth. As continued economic growth is essential for poverty alleviation in many countries, they therefore claim that continued increase in coal demand is also essential. Neither of these claims is supported by evidence.

Claim: Coal causes economic growth

Peabody Energy regularly makes claims that coal causes economic growth, as shown in the following Peabody quotes:

> *Coal advances economic growth.*[51]

---

[46] Peabody Energy (2014a) *21st Century Coal's Role in the Future of Energy,* p12
[47] MorningStar (2014) *Burned out: China's Rebalancing Heralds the End of Coal's Growth Story,* p9
[48] Bernstein Research (2013) *Asian Coal & Power: Less, Less, Less...The Beginning of the End of Coal*, p5
[49] Goldman Sachs (2014) *The thermal coal paradox,* p1, bold in original
[50] Citi (2014) *Global Thermal Coal: When cyclical supply met structural demand,* p1
[51] Peabody Energy (2013) *2013 Corporate and Social Responsibility Report*, p9

Peabody believes greater use of clean coal drives energy security, economic growth and environmental solutions.[52]

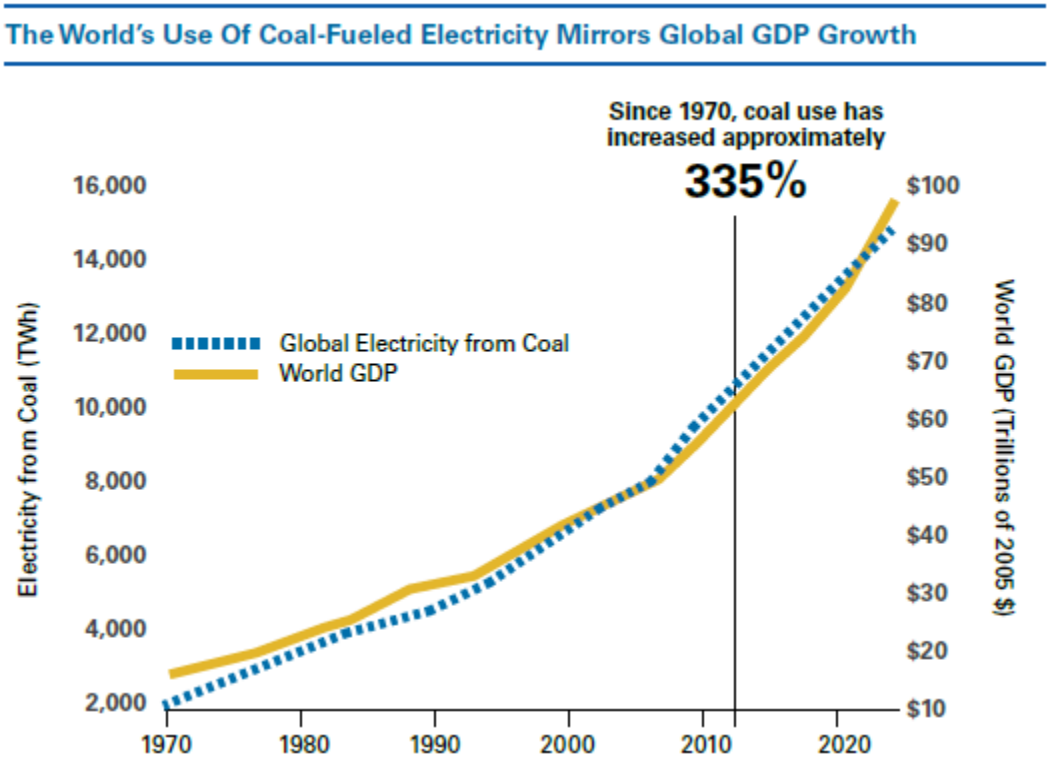
Coal is a significant catalyst for economic growth, powering both the largest and best global economies.[53]

Greater coal use delivers energy security, economic growth and environmental solutions[54]

Coal Fuels Global Economic Miracle[55]

Graphs often accompany such statements, such as Figure 7 below showing correlation between global gross domestic product and coal use:

Figure 7: Peabody Energy economic growth and coal use



Source: Peabody Energy (2013) *2013 Corporate and Social Responsibility Report*, p9[56]

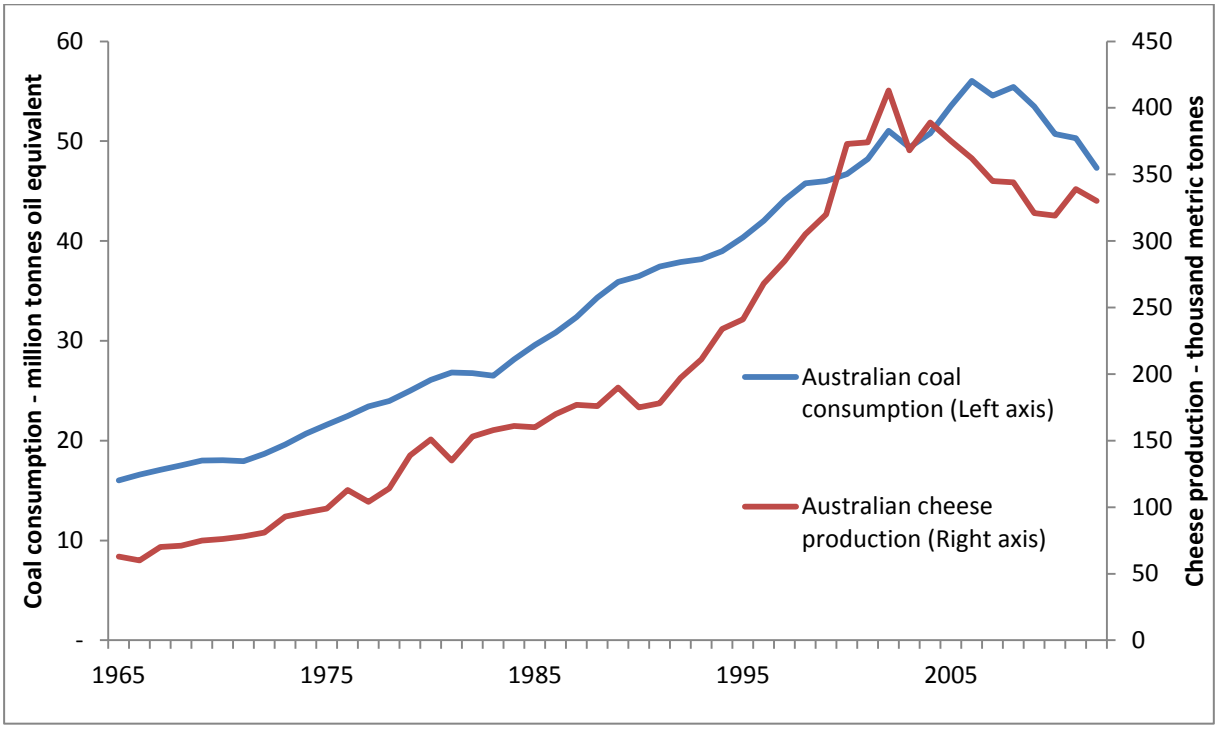
In making claims that coal "drives", "delivers", "fuels" or "catalyses" economic growth, Peabody mistakes causation with correlation. It is not coal use that causes economic growth;

[52] Peabody Energy (2012) *2012 Corporate and Social Responsibility Report*, p2
[53] Peabody Energy (2012) *2012 Corporate and Social Responsibility Report*, p18
[54] Peabody Energy (2011) *2011 Corporate and Social Responsibility Report*, p53
[55] Peabody Energy (2010) 2010 Corporate and Social Responsibility Report, p5
[56] Peabody's sources for this figure are the US Department of Agriculture and the IEA's World Energy Outlook. While the US Department of Agriculture does publish time series data on world gross domestic product (GDP), it is not clear where the "Electricity from coal" figures have come from, as the IEA does not appear to publish such a data series over this period. To investigate the relationship between coal and economic growth in this section we have used the same US Department of Agriculture world GDP figures and statistics on world coal consumption from the US Energy Information Agency, converted into metric tonnes.

it is economic growth that increases coal use, although this is not always the case as discussed below.

Economic growth increases the production and consumption of most goods and services. For example, production of cheese is also correlated with economic growth, and therefore also with coal use. Figure 8 below shows Australia's cheese production and its coal consumption are closely correlated:

Figure 8: Australian cheese production and coal consumption



Sources: Index Mundi (2014) *Australia Dairy, Cheese Production by Year,* BP (2014) *Statistical Review of World Energy*

Figure 8 shows that coal and cheese trends move closely together. From around the turn of the century, cheese production trends seem to precede changes in coal consumption. But rarely do people suggest that cheese production causes changes in coal use because we know that both are affected by economic growth and other market trends.

Completely different variables are often driven by the same economic trends and wider policies. This is well demonstrated by a website that shows close correlation between seemingly unrelated trends, such as:

- Per capita consumption of chicken correlates with total US crude oil imports.
- Number people who drowned while in a swimming-pool correlates with power generated by nuclear power plants in the USA.
- Worldwide non-commercial space launches correlates with sociology doctorates awarded in the USA.[57]

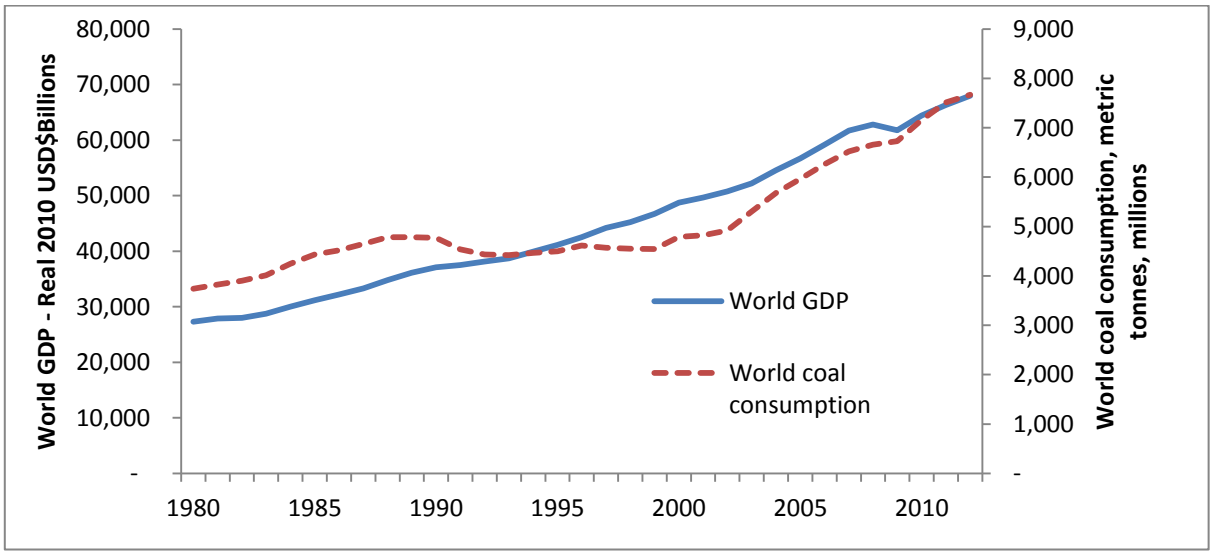
These examples show that it is important to distinguish trends that are correlated, from the factors which are causing the trends. Correlation does not equal causation. Peabody is

[57] Vigen (n.d.) *Spurious Correlations*

wrong to suggest that coal causes economic growth when it is economic growth that can cause coal use. However, even the correlation between coal use and economic growth is not as close as Peabody claims.

Figure 9 below shows that while both coal consumption and economic output have grown over the last 35 years, their trends have not always been in the same direction:

Figure 9: World GDP and coal consumption



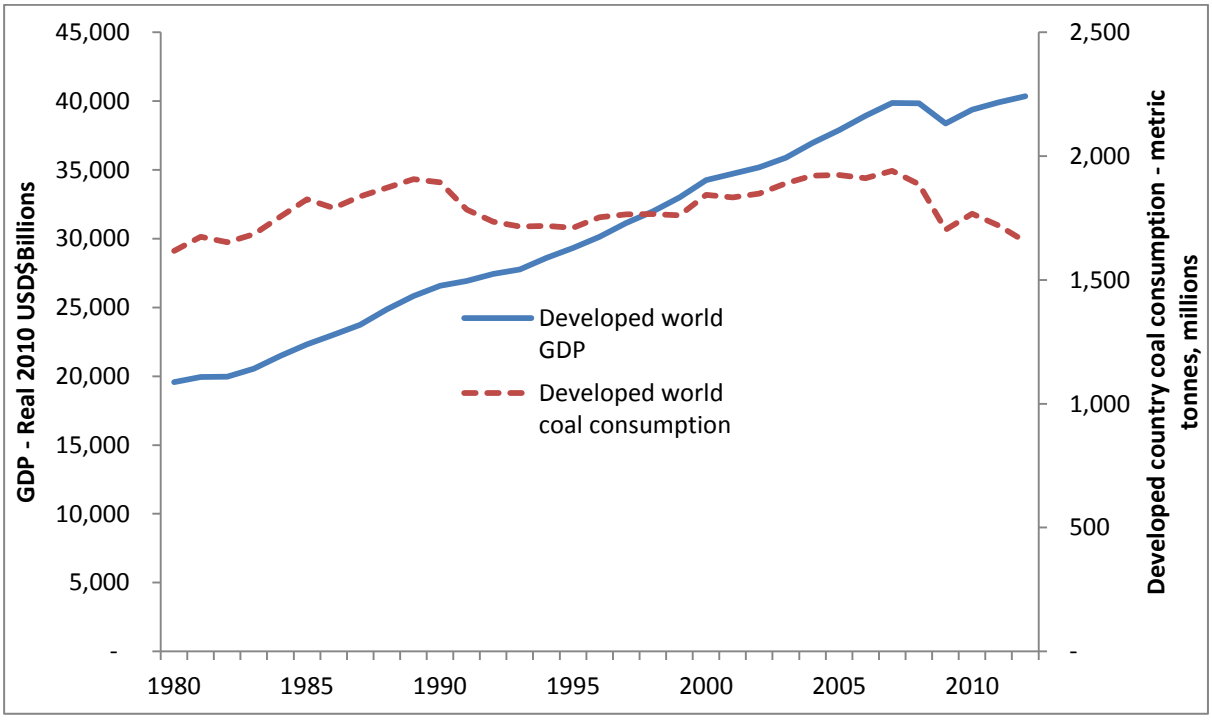
Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset,* United States Energy Information Agency (2014) *International Energy Statistics*

Figure 9 shows that from 1990 world coal consumption decreased while world GDP increased. Coal consumption declined for four straight years from 1990 to 1993, and then remained steady before increasing sharply at the start of the new century. The relationship between world economic growth and coal consumption is clearly not as direct as Peabody Energy claims.

In fact, coal consumption has grown much slower than world GDP. Over the 1980 to 2012 period GDP has increased by 150 per cent while coal consumption has increased by 105 per cent. If GDP had grown at the same rate as coal consumption, today's world economic output would be almost USD$12 trillion less than it is.

The explanation for the de-linking of economic growth and coal over the period from 1990 to 2003 lies in the differences in growth and energy use between developed and developing economies. Around 1990 coal consumption in developed countries peaked, while their economic growth continued on trend. While today the GDP of developed countries is USD$22 trillion per year higher than in 1980, coal use is at the same level, as shown in Figure 10 below:

Figure 10: Developed countries GDP and coal use



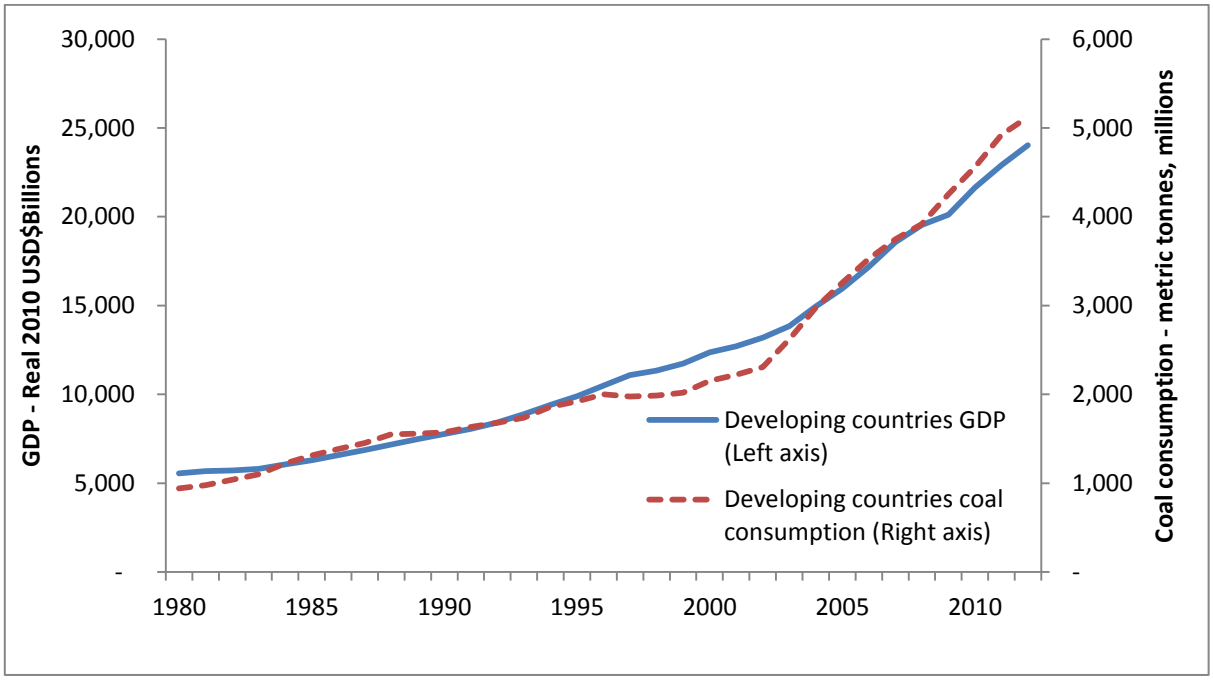
Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset,* United States Energy Information Agency (2014) *International Energy Statistics*[58]

Figure 10 shows that from 1990, developed world coal use declined by 200 million tonnes per year before modest increases to 2004-5 and sharp declines during and following the 2008 global financial crisis. Aside from the financial crisis, GDP growth has been steady. This change has been caused by a shift in developed economies towards services sectors and higher value, less energy intensive production as well as the availability of substitute energy sources for coal.

During the 1990s developed countries' GDP growth accounted for the bulk of the world's GDP growth. Until the mid-1990s developed countries used more coal than developing countries, so the economic growth and the declining coal use of the developed world were the dominant global trends seen between 1990 and 2003 in Figure 9. After this period developing countries became the larger coal users and developing world economic growth became the most important part of world economic growth, as shown in Figure 11 below:

[58] Developed world is defined in these publications as United States, Canada, EU15, Iceland, Norway, Switzerland, Japan, Australia, and New Zealand. Developing world is defined as: Latin America, Cyprus, Malta and Gozo, Asia less Japan, Middle East, Other Oceania, and Africa

Figure 11: Developing countries GDP and coal use



Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset,* United States Energy Information Agency (2014) *International Energy Statistics*[59]

Figure 11 shows that from 2003 developing countries' coal use increased beyond 2 billion tonnes, the amount used by developed countries. Their GDP is approaching USD$25 trillion and will rapidly reach the $40 trillion produced by the developed world. These changes have meant closer correlation between world GDP and coal use since 2003.

This data shows that while coal consumption is correlated with economic growth at early stages of a country's economic development, it is unrelated to economic growth as economies mature. In the future, the relationship between coal use and economic development will change as new technologies play an ever greater role in energy supply, particularly renewable energy and energy storage. It is the uncertainty in how fast these technologies will develop and displace coal which creates the large difference between the IEA's different scenarios for future coal consumption, shown in Figure 6. Peabody's claims that even more coal will be used than the IEA's current policies scenario ignores this reality.

Peabody Energy's claims of coal use causing economic growth are misleading. They gloss over the nature of economic development and confuse correlation with causation. The company goes further than this however, in attempting to draw a link between coal use and life expectancy.

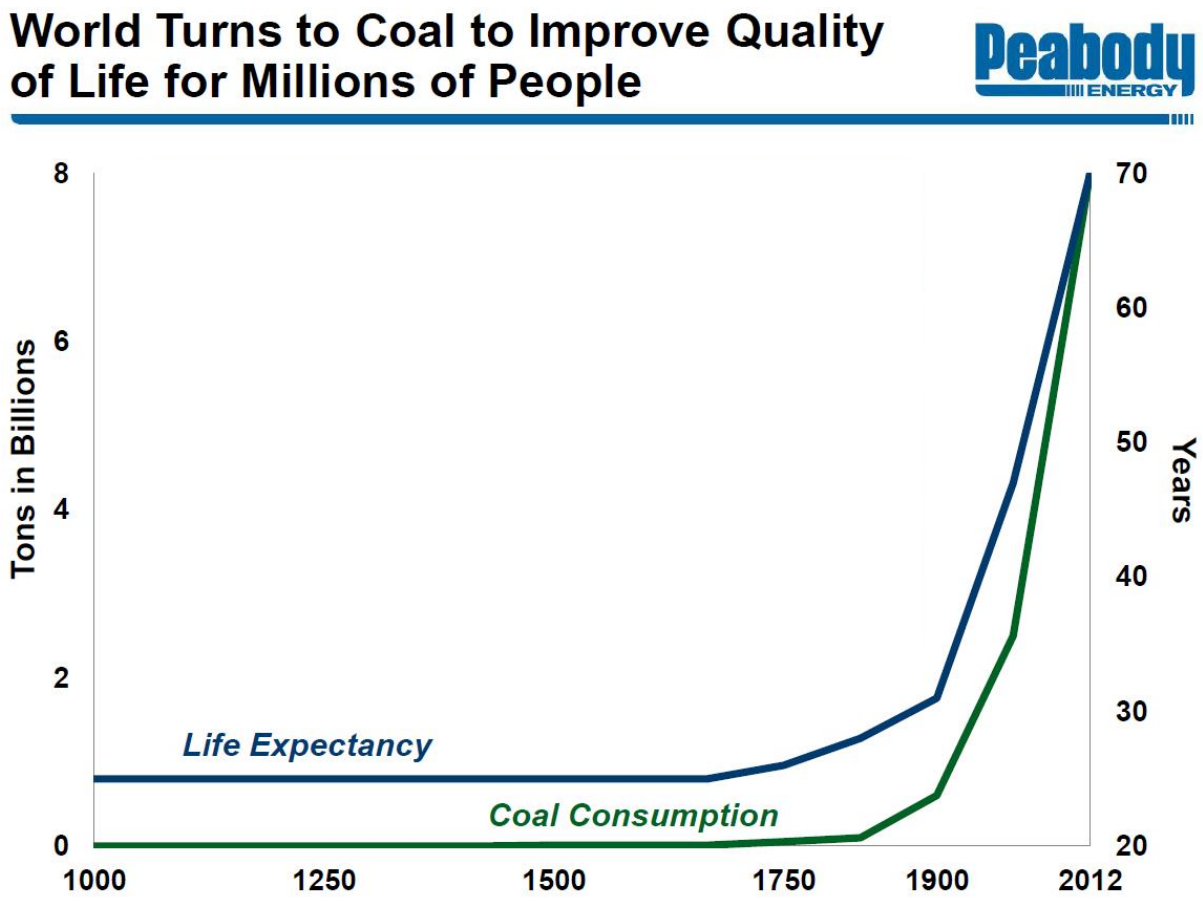
Claim: coal use increases life expectancy

Life expectancy is affected by economic development – richer countries tend to have better access to nutritious food, sanitation and health services and residents on average live longer than people in poorer countries. As discussed above, at earlier stages of countries' economic development, economic growth increases demand for most goods and services, including

[59] Developed world is defined in these publications as United States, Canada, EU15, Iceland, Norway, Switzerland, Japan, Australia, and New Zealand. Developing world is defined as: Latin America, Cyprus, Malta and Gozo, Asia less Japan, Middle East, Other Oceania, and Africa

coal. In their public relations material, Peabody Energy take these two results of economic growth – increased life expectancy and increased coal demand – and claim that the latter causes the former, as shown in Figure 12 below:

Figure 12: Peabody Energy chart on life expectancy and coal use



Source: Peabody Energy (2014) *Coal: Advanced Energy For Life G20 Energy Access Workshop*[60]

There are several problems with this chart. Firstly, as discussed above, life expectancy and coal consumption are both correlated with economic growth, rather than one causing the other. It does not mean coal consumption drives increases in life expectancy.

Secondly, the discussion above on coal consumption and GDP shows that as countries develop they use less coal. As countries can afford to use less coal, they do so, contradicting the suggestion that the world "turns to coal to improve quality of life". In fact, countries "turn away" from coal as soon as they can.

The reasons for this are obvious - burning coal affects people's health at many levels:

- Coal is a major contributor to indoor air pollution. Around 3 billion people burn solid fuels – coal, wood, crop waste, dung, etc – for cooking and heating in their homes. If stoves and heaters are not well designed and ventilated, this causes dangerous pollution inside people's homes, which the World Health Organisation estimates contributes to four million premature deaths each year, through diseases such as stroke, heart disease and pneumonia.[61]

[60] A photo of people reading books under streetlights has been removed for clarity.
[61] World Health Organisation (2014) *Household air pollution and health*

- Globally, outdoor air pollution contributes 3.7 million deaths globally.[62] Chemical and particulate pollution from coal-fired power generation and other coal combustion contribute to this problem, prompting the World Health Organisation to recommend that governments:

  > *Promote the use of clean, renewable energy sources, such as solar and wind-powered energy, and encourage the movement away from dirtier fuels, such as coal.*[63]

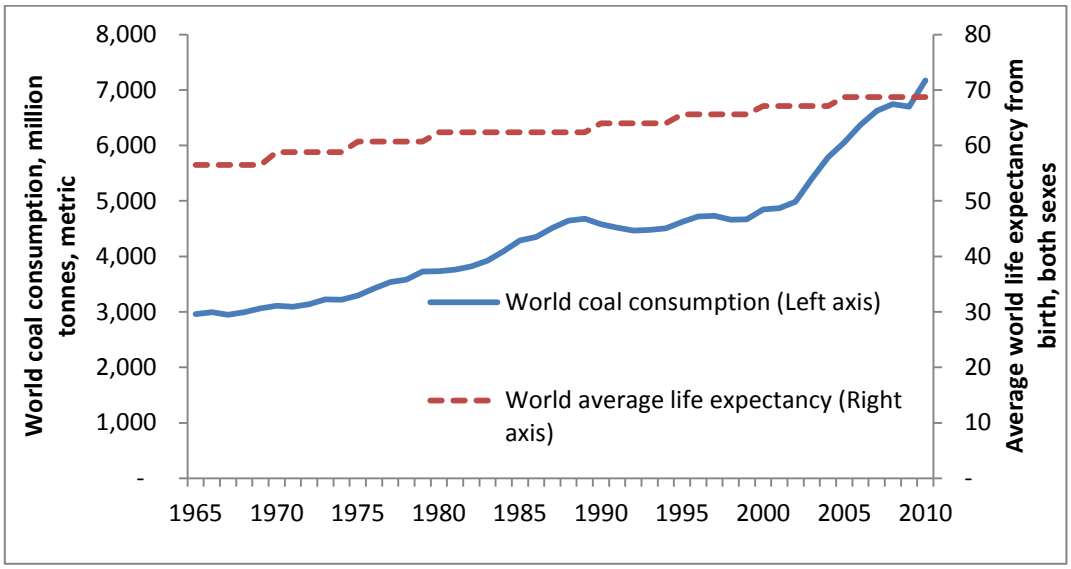
- Burning coal contributes to climate change, which has major implications for human health through impacts on air quality, drinking water, food security and access to secure shelter. The World Health Organisation estimates that between 2030 and 2050 climate change will cause an additional 250,000 deaths from malnutrition, diarrhoea and heat stress.[64]

Another surprising aspect of Peabody's life expectancy and coal use graph is the time frame, going back over 1,000 years. We know of no reliable data set for either variable over such a long time. The claimed sources are "UN, Yale Environment 360 blog", however internet searches based on search terms like "Yale environment 360 blog life expectancy coal" do not show obvious source documents. In fact, the only relevant post on the Yale blog is titled "Peak Coal: Why the Industry's Dominance May Soon Be Over", including reference to:

> *Research findings that dirty air [partly due to coal combustion] is cutting more than five years off the life expectancy of the half-billion citizens of northern China.*[65]

Regardless of the source, Peabody's analysis does not accord with life expectancy data from the United Nations. World average life expectancy for both sexes has shown gradual improvement regardless of increases or decreases in coal consumption, as shown in Figure 13 below:

Figure 13: World average life expectancy from birth and coal consumption



Sources: United Nations, Department of Economic and Social Affairs (2012) *World Population Propects: the 2012 revision*, BP (2014) *Statistical Review of World Energy*

[62] World Health Organisation (2012) *Global Health Observatory Data Repository*
[63] World Health Organisation (2010) *Exposure to air pollution: a major public health concern*
[64] World Health Organisation (2014a) *Climate change and health*
[65] Pearce (2014) *Peak Coal: Why the Industry's Dominance May Soon Be Over*

Figure 13 shows that even during the 1990 to 2003 period when coal consumption was stagnant, life expectancy continued to rise. As noted above, economic growth continued through this period, which is likely to be a more significant cause of increases in life expectancy than coal use.

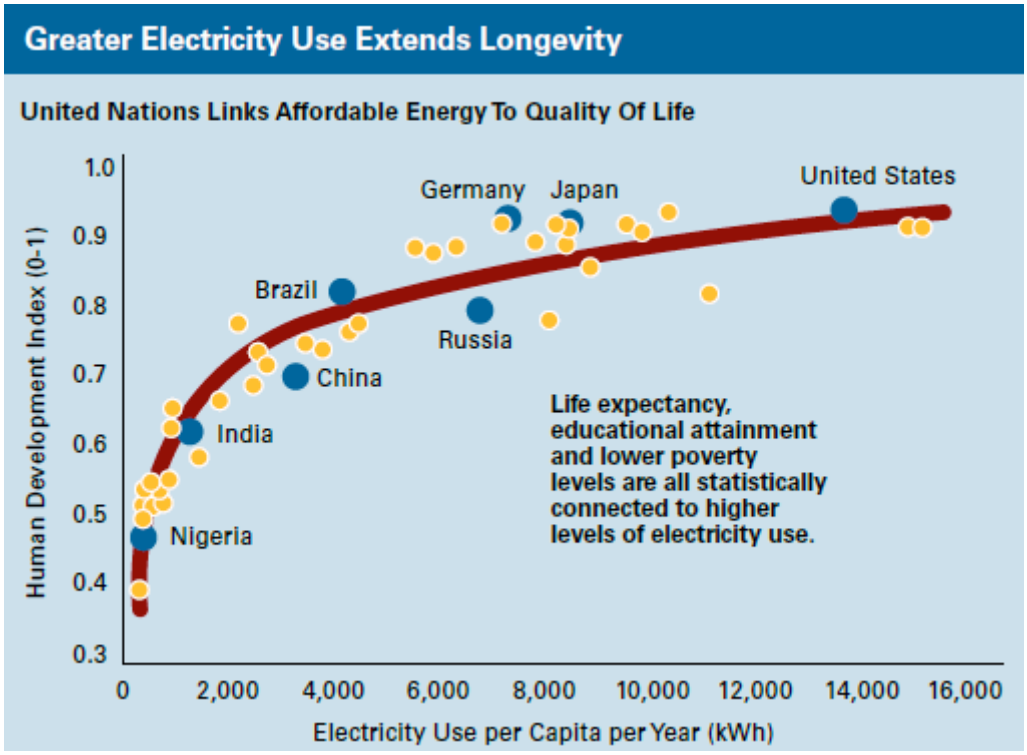
Claim: coal use improves quality of life

A related Peabody claim is that coal use improves the quality of life, as measured by the 'Human Development Index' an indicator derived from a combination of:

- Life expectancy at birth
- Average years of schooling
- Expected years of schooling
- Gross national income per capita

The Human Development Index (HDI) is published by the United Nations Development program for most countries. Peabody regularly reproduces variations on a chart showing HDI scores and electricity consumption, as shown in Figure 14 below:

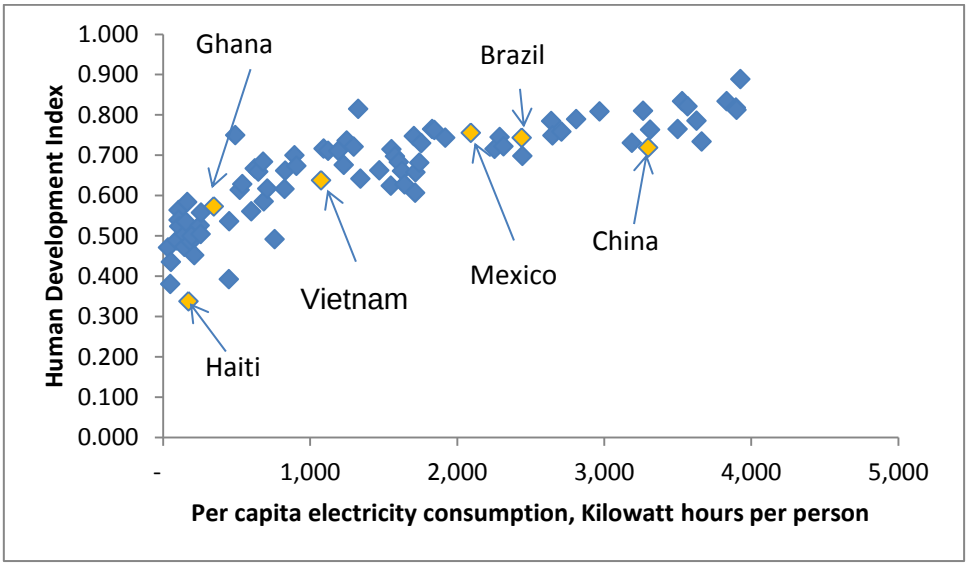
Figure 14: Peabody Energy chart - Human Development Index and electricity consumption



Source: Peabody Energy (2014a) *21st Century Coal's Role in the Future of Energy*

Figure 14 does correspond broadly with United Nations HDI data and World Bank data on electricity consumption. In particular, it is important to note in Figure 14 that initial increases in electricity consumption correlate with large increases in the HDI. A closer look at countries that use under 4,000 kilowatt hours per capita shows this correlation clearly, as shown in Figure 15 below:

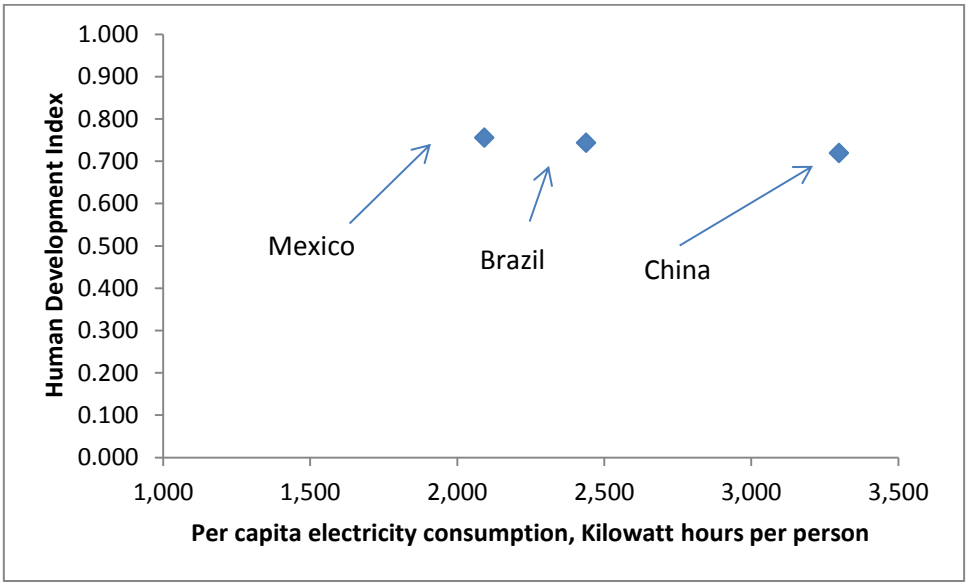
Figure 15: Human Development Index and electricity use up to 4,000 kWh/capita/year



Sources: United Nations Development Program (2014) *Human Development Reports*, World Bank (2013) *Electric power consumption*

In Figure 15 we see that there is a rapid improvement in the HDI scores between countries with the lowest electricity use like Haiti and Ghana, to countries like Vietnam, with electricity use of around 1,000 kilowatt hours per person. Beyond electricity use of around 2,000 kWh/capita, this relationship is less discernible, as shown in Figure 16 below which shows only Mexico, Brazil and China:

Figure 16: Human Development Index and electricity use, Mexico, Brazil and China



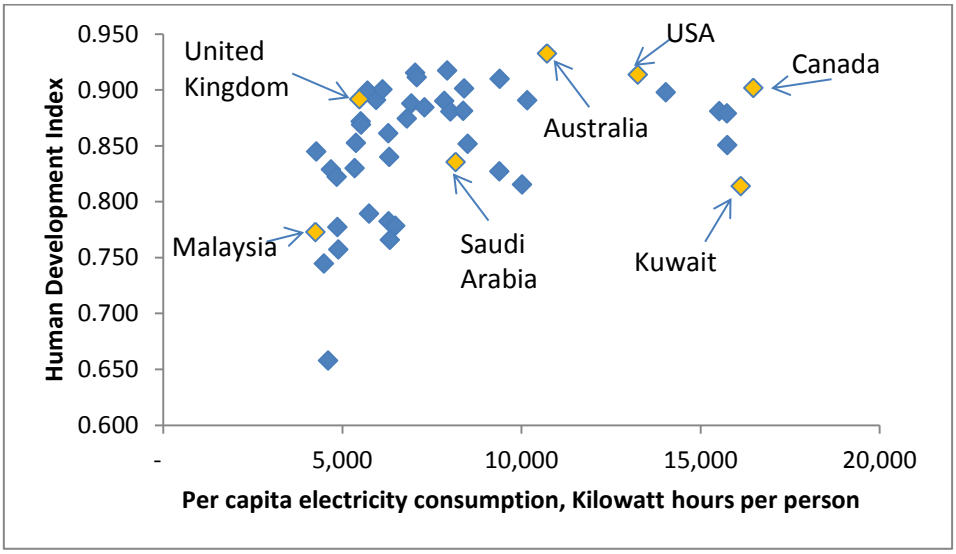
Sources: United Nations Development Program (2014) *Human Development Reports*, World Bank (2013) *Electric power consumption*

Figure 16 shows that even though Mexico, Brazil and China use widely differing amounts of electricity, their score on the HDI is very similar – in fact China's is the lowest of the three, 0.719, even though electricity use is highest. Brazil also has a lower HDI score, 0.744, than

Mexico, even though electricity use is greater. Mexico has the highest score, 0.756, and uses the least electricity per capita.

The greater electricity consumption is, the less clear the relationship with the HDI. As shown in Figure 17 below, beyond 4,000 kWh per person per year, it is difficult to see a strong positive correlation:

Figure 17: Human Development Index and electricity use over 4,000 kWh/capita/year



Sources: United Nations Development Program (2014) *Human Development Reports*, World Bank (2013) *Electric power consumption*

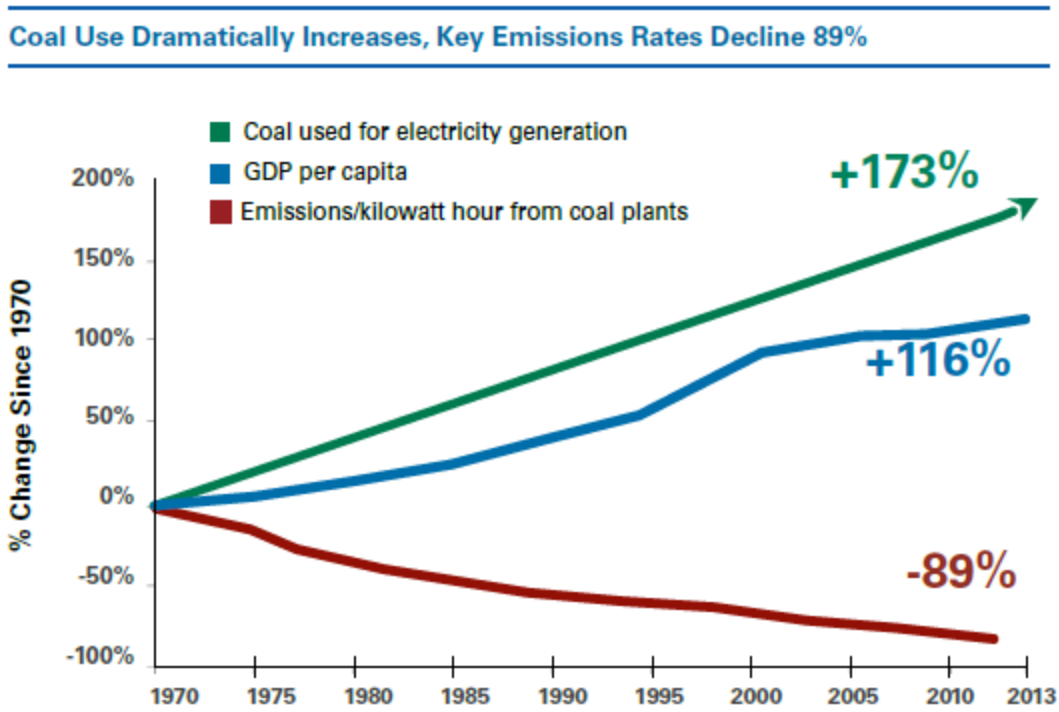
Figure 17 shows that while the UK and Malaysia use similar amounts of electricity per person, the UK scores much higher on the HDI than Malaysia. Canada and Kuwait also use similar amounts of electricity per capita but Canada scores much higher on the HDI. Both Australia and the USA use less electricity per capita than Canada and Kuwait, but are better developed according to HDI scores.

The key point to note from this analysis is that it is the initial increase in energy consumption that is most closely correlated with increases in HDI score. Beyond electricity consumption levels of 1,500 kWh per person per year, increases in HDI score are not as closely correlated with increases in per capita electricity use, suggesting that other factors are much more important in improving quality of life. As discussed above, projects that address the initial levels of electricity consumption up to around 1,000 kWh per capita do not use coal as an energy source. It does not make economic sense to build expensive new grid and generation infrastructure when off-grid and renewable technologies are cheaply available.

Claim: coal is getting cleaner

All commentators on energy poverty reduction agree that whatever role coal is to play, it must be through “clean coal”. What is meant by “clean” coal, however, varies widely. Peabody Energy public relations material gives the impression that with recent improvements in technology, coal’s ‘key emissions’ have been reduced almost entirely, as shown in Figure 18, reproduced below:

Figure 18: Peabody Energy chart on 'key emissions', coal use and GDP per capita



Source: Peabody Energy (2013) Corporate and Social Responsibility Report, p25

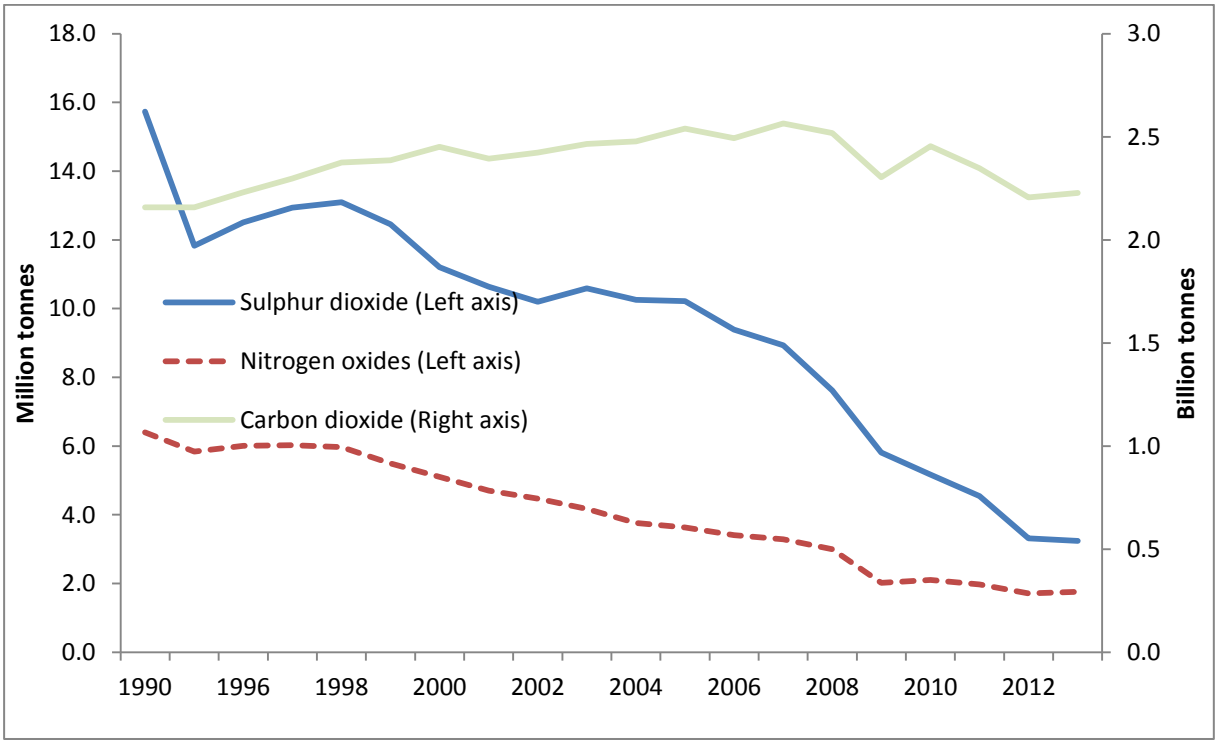
Figure 18 purports to show that since 1970 coal use for electricity in the USA has increased by 173 per cent and that GDP per capita has increased by 116 per cent, while at the same time emissions from coal-fired power plants have decreased by 89 per cent on a per kilowatt basis. Variations on this chart appear in many Peabody publications with minor changes in figures.[66,67]

Peabody's claims on emissions reductions relate only to coal-fired power plant emissions of sulphur dioxide and nitrogen oxides, as measured by the US Environmental Protection Agency. Carbon dioxide emissions which are responsible for global warming, however, have not seen the same reductions, as shown in Figure 19 below:

[66] See for example (Peabody Energy, 2012a, 2014c).

[67] While the focus of this chart is emissions, GDP and coal use statistics seem to contradict other data sources. For example, according to the BP *Statistical Review of World Energy*, the USA used 309 million tonnes of coal in 1970 and 456 million tonnes in 2013, an increase of only 47 per cent. BP lists coal consumption in "million tonnes of oil equivalent" but the different unit should not affect this change in overall use as a percentage.
World Bank (2013) *GDP per capita* data shows that US GDP per capita has increased by over nine times since 1970, from US$5,246 per person in 1970 to $53,142 per person in 2013. Peabody's claim that US GDP per capita has only increased by 116 per cent heavily understates changes measured by the World Bank.

Figure 19: US Power plant emissions



Source: US Environmental Protection Agency (2014) *Power Plant Emission Trends.* Note no data is listed for 1991-1994

Figure 19 shows that emissions of sulphur and nitrogen oxides have been reduced substantially since 1990, due to the introduction of air pollution standards in the USA.[68] It is likely that these standards are stricter than those applying in most countries and that this significant reduction in the USA is not typical of global experience.

The US emissions standards do not apply to carbon dioxide emissions, the main gas affecting climate change. Figure 19 shows that carbon dioxide emissions in the USA have barely changed since the early 1990s. Part of the reason why emissions standards do not apply to carbon dioxide is that it is far more difficult and expensive to reduce carbon emissions from coal-fired power plants than other emissions. The main hope for reducing carbon emissions from coal-fired power is carbon capture and storage (CCS).

Global progress on CCS projects has been slow. There are currently only 13 operating CCS projects in the world, which can reduce carbon emissions by around 25 million tonnes per year. Most of these CCS projects are not attached to electricity generation, but to other industrial processes, making their link with energy poverty even more remote.[69]

To put this in perspective, the world emitted 33,376 million tonnes of CO2 in 2011, with the USA emitting 5,420 million tonnes and Australia emitting 400 million with a much smaller population.[70] As shown in Figure 19 above, power sector emissions alone in the USA

[68] US Energy Information Administration (2012) *Annual Energy Outlook 2012* Specifically these reductions were due to the Cross-State Air Pollution Rule (CSAPR), the Mercury and Air Toxics Standards (MATS) and the Clean Air Interstate Rule (CAIR), see p101

[69] Global CCS Institute (2013) *The global status of CCS,* Global CCS Institute (2014) *The global Status of CCS February 2014*

[70] European Commission (2012) *Emission Database for Global Atmospheric Research (EDGAR)*

produce 2,200 million tonnes of CO2 per year. Based on these figures, CCS accounts for less than one tenth of one per cent (0.07 per cent) of world emissions at present.

The outlook for CCS is for low growth. Without a high carbon price and heavy public subsidies, CCS is not economically viable. In 2013 many projects were cancelled, downscaled and put on hold. The number of projects in early stages of development has declined from 65 in 2010 to 45 in 2013.[71] Even CCS professionals have little faith that their industry will provide any contribution to climate change efforts:

> *Another concern is a consistent lack of confidence by some members of the CCS community in CCS playing an increasingly important role in mitigating future global emissions. … This reflects the commercial reality that there is currently no real indication that any particular large–scale clean energy technology solution, or even one within the stable of CCS capture options, will emerge as the most attractive from a least cost abatement perspective, given that most are still being demonstrated.*[72]

Technical solutions exist to reduce the impacts of coal on health. Indoor air pollution can be reduced though better ventilation and design of stoves and outdoor air pollution has been improved in the United States through implementation of air pollution standards. Global implementation of these initiatives will remain a challenge for years to come.

However, coal's contribution to climate change remains a problem with no solution other than to reduce its use. Implementation of CCS is at minimal levels and likely to slow further. The IEA forecasts that constructing more efficient coal power plants will improve the average efficiency of coal-fired generation by four per cent to 2035,[73] a tiny contribution compared with what is needed. In terms of carbon emissions, it is clear that coal will not be "clean" anytime soon.

Conclusion

Energy poverty is a pressing issue for billions of people. Despite the efforts of a range of organisations and improving technology, energy poverty will remain a problem for years to come.

While coal will be a significant component of world electricity generation for some years, coal-fired power has little to contribute to energy poverty alleviation. The up-front costs of coal-fired generation are prohibitive for most developing country governments and where grid connections are not immediately available cheaper off-grid and mini-grid solutions are already available.

This reality is demonstrated by the fact that not even coal companies use coal in the energy poverty projects they support. We could not find a single example of a coal company supporting an energy poverty alleviation project that uses coal-fired power, despite extensive searching and contact with companies and industry associations.

This shows that coal industry public relations materials relating to energy poverty are just that – public relations spin. The claims that coal is vital to economic growth, quality of life and environmental improvement are not supported by data or analysis, but are designed to influence public opinion and government policy.

[71] (Global CCS Institute, 2013) p25
[72] (Global CCS Institute, 2013) p86
[73] (IEA, 2013) p182

Even though coal industry claims to assist with energy poverty do not stand up to basic scrutiny, they are enthusiastically embraced by governments and companies with a vested interest in the coal industry. An obvious example occurred during the writing of this paper, when the Prime Minister of Australia, Tony Abbott, declared that:

> *Coal is good for humanity, coal is good for prosperity, coal is an essential part of our economic future, here in Australia, and right around the world.*[74]

Addressing the challenges of energy poverty will become even more difficult if public relations campaigns are able to influence government policies away from genuine solutions and towards spending that benefits the coal industry. The real solutions to energy poverty do not focus on coal.

References:

Anglo American. (2013). *Sustainable development report 2013*. Retrieved from http://www.angloamerican.com/~/media/Files/A/Anglo-American-Plc/reports/annual-report-2013/AA-SDR-2803.pdf

Banpu. (2013). *Sustainability report 2013*. Retrieved from http://www.banpu.com/pdf/Banpu_SD_Report_2013_EN.pdf

Bernstein Research. (2013). *Asian Coal & Power: Less, Less, Less...The Beginning of the End of Coal*.

BHP Billiton. (2014). *Sustainability report 2014*. Retrieved from http://www.bhpbilliton.com/home/society/reports/Documents/2014/BHPBillitonSustainabilityReport2014_interactive.pdf

Bloomberg Energy Finance. (2014). *2030 Market outlook: Asia Pacific*.

BP (2014) Statistical Review of World Energy, available at: http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html

Citi. (2014). *Global Thermal Coal: When cyclical supply met structural demand*. Citi Research -Multi Asset. Retrieved from https://ir.citi.com/MHQVVh0UIyfvtOGK1XIzCyxIAl2a2dMWNcmAqQaWyGCMEhCHhwKfWA==

European Commission (2012) Emission Database for Global Atmospheric Research (EDGAR), available at: http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2011

Fisher, N. (2014) Balancing South Africa's Energy Poverty and Climate Change Commitments, Cornerstone Magazine, published 28 July 2014, available at:

[74] Massola, Ker & Cox (2014) *Coal is 'good for humanity', says Tony Abbott at mine opening*

http://cornerstonemag.net/balancing-south-africas-energy-poverty-and-climate-change-commitments/

Galilee, S. (2014) Coal critics wasting energy, The Australian, 17 October, available at: http://www.theaustralian.com.au/opinion/coal-critics-wasting-energy/story-e6frg6zo-1227093043561

Global CCS Institute. (2013). *The global status of CCS*. Global Carbon Capture and Storage Institute, Melbourne, Australia. Retrieved from http://decarboni.se/sites/default/files/publications/115198/Global-Status-CCS-2013.pdf

Global CCS Institute. (2014). *The global Status of CCS February 2014*. Retrieved from http://decarboni.se/sites/default/files/publications/121016/global-status-ccs-february-2014_0.pdf

Goldman Sachs. (2014). *The thermal coal paradox*. Heat Sensor - Commodities Research, May 2014.

IEA. (2013). *World Energy Outlook 2013*. International Energy Agency, Paris, France.

IEA. (2014). *Africa Energy Outlook*. International Energy Agency, Paris, France. Retrieved from http://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf

IEA, NEA, & OECD. (2010). *Projected Costs of Generating Electricity 2010*. Joint publication of International Energy Agency, Nuclear Energy Agency and Organisation for Economic Cooperation and Development: OECD Publishing. doi:10.1787/9789264084315-en

International Energy Agency (IEA) (n.d.) IEA website: Energy poverty, available at: http://www.iea.org/topics/energypoverty/

Index Mundi (2014) Australia Dairy, Cheese Production by Year, available at: http://www.indexmundi.com/agriculture/?country=au&commodity=cheese&graph=production

Indo Tambangraya Megah. (2013). Bubuhan (pp. 1–16). Communication Media of PT Indo Tambangraya Megah Tbk Fostered Community. Retrieved from http://www.itmg.co.id/_uploadedfile/files/itm-file-1395905319-bubuhan-31-eng-revisi.pdf

Mackenzie, A. (2014) Energy, Commodities and the Global Economy, speech given to CERAWeek conference, Houston, 4 March 2014, available at: http://www.bhpbilliton.com/home/investors/reports/Documents/2014/140304_CERASpeech.pdf

Massola, J., Ker, P. & Cox, L. (2014) Coal is 'good for humanity', says Tony Abbott at mine opening, Sydney Morning Herald, 13 October 2014, available at: http://www.smh.com.au/federal-politics/political-news/coal-is-good-for-humanity-says-tony-abbott-at-mine-opening-20141013-115bgs.html

MorningStar. (2014). *Burned out: China's Rebalancing Heralds the End of Coal's Growth Story*. MorningStar Basic Materials Observer.

Nusantara Development Initiatives. (2012). *Annual report 2012*. Retrieved from http://ndi.sg/annual/NDI_AnnualReport2012.pdf

Peabody Energy. (2010). *2010 Corporate and Social Responsibility Report*. Retrieved from http://www.peabodyenergy.com/mm/files/News/Publications/CSSR Report/2010CSR.pdf

Peabody Energy. (2011). *2011 Corporate and Social Responsibility Report*. Retrieved from http://www.peabodyenergy.com/mm/files/2011_CSRR_6-29-FIN.pdf

Peabody Energy. (2012a). *2012 Corporate and Social Responsibility Report*. Retrieved from http://www.peabodyenergy.com/mm/files/2012-CSR.pdf

Peabody Energy. (2012b). *2012 Corporate and Social Responsibility Report*. www.peabodyenergy.com.

Peabody Energy. (2013). *2013 Corporate and Social Responsibility Report* (pp. 1–68). Retrieved from http://www.peabodyenergy.com/mm/files/2014_CSRR.pdf

Peabody Energy. (2014a). *2013 Annual Report*. Retrieved from http://www.peabodyenergy.com/mm/files/investors/annual-reports/pe-ar2013.pdf

Peabody Energy. (2014b). *21st Century Coal's Role in the Future of Energy*. Retrieved from http://www.peabodyenergy.com/mm/files/21st-Century-Coal's-Role-in-the-Future-of-Energy.pdf

Peabody Energy. (2014c). *Coal: Advanced Energy For Life G20 Energy Access Workshop*. Presentation by Charles Meintjes, President, Australia, Peabody Energy. Retrieved from http://static.guim.co.uk/ni/1413264860948/Peabody-presentation.pdf

Pearce, F. (2014) Peak Coal: Why the Industry's Dominance May Soon Be Over, post on Yale Environment 360 blog, available at: http://e360.yale.edu/feature/peak_coal_why_the_industrys_dominance_may_soon_be_over/2777/

Peel, M., Campbell, R., & Denniss, R. (2014). *Mining the Age of Entitlement: State government assistance to the minerals and fossil fuel sector*. The Australia Institute, Technical Brief No. 31. Retrieved from www.tai.org.au

Queensland Treasury. (2013). *Queensland Treasury Response to Commonwealth Grants Commission: Response to Terms of Reference for Commonwealth Grants Commission 2015 Methodology Review*. Retrieved from https://www.cgc.gov.au/index.php?option=com_attachments&task=download&id=1728

Rio Tinto. (2007). *Progresamos juntos: La Granja boletin informativo*. Information bulletin for the La Granja copper project, in Spanish only. Retrieved from http://www.riotintolagranja.com/documents/Boletin_externo1.pdf

Rio Tinto. (2013). *Annual report*. Retrieved from http://www.riotinto.com/annualreport2013/downloads/index.html

United Nations, Department of Economic and Social Affairs (2012) World Population Propects: the 2012 revision, Population Division, Population Estimates and Projections

section, Life expectancy at Birth, both sexes. Available at: http://esa.un.org/wpp/Excel-Data/mortality.htm

United Nations Development Program (2014) Human Development Reports, Data, available at: http://hdr.undp.org/en/data

United States Department of Agriculture Economics Research Service (2014) International Macroeconomic Dataset, Real Historical Gross Domestic Product (GDP) and Growth Rates of GDP, available at: http://www.ers.usda.gov/data-products/international-macroeconomic-data-set.aspx#.VEbxZ_mUdyV

US Energy Information Administration. (2012). *Annual Energy Outlook 2012*. Retrieved from http://www.eia.gov/forecasts/aeo/pdf/0383(2012).pdf

US Energy Information Administration. (2013). *Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants*. Retrieved from http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf

US Energy Information Agency (2014) International Energy Statistics, total coal consumption, available at: http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=1&pid=1&aid=2&cid=regions&syid=1980&eyid=2012&unit=TST

US Environmental Protection Agency (2014) Power Plant Emission Trends, available at: http://www.epa.gov/airmarkets/progress/datatrends/index.html

Vasudha Foundation. (2014). *Electricity for all in India: Why coal is not always king*. Retrieved from http://www.vasudha-foundation.org/wp-content/uploads/Electricity-for-all-in-India-Why-Coal-is-not-always-king1.pdf

Vorrath, S. (2014) Tag Pacific steps in to build solar plant at Rio Tinto mine, RenewEconomy, 2 September 2014, available at: http://reneweconomy.com.au/2014/tag-pacific-steps-in-to-build-solar-plant-at-rio-tinto-mine-35392

Vigen (n.d.) *Spurious Correlations,* available at: http://tylervigen.com/

WBCSD, WED & WEF, (2009) Energy Poverty Action, joint project of the World Business Council for Sustainable Development, World Energy Council and the World Economic Forum, available at: http://www.weforum.org/pdf/ip/energy/EPA.pdf

World Bank (2013) Electric power consumption, available at: http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC

World Bank (2013) GDP per capita (current US$), available at: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD

World Health Organisation. (2010). *Exposure to air pollution: a major public health concern*. Retrieved from http://www.who.int/ipcs/features/air_pollution.pdf

World Health Organisation (2012) Global Health Observatory Data Repository, Data By theme, Public health and environment, Ambient air pollution, Burden of disease, available at: http://apps.who.int/gho/data/node.main.156?lang=en

World Health Organisation. (2014a). *Climate change and health* (pp. 1–4). Fact sheet number 266, reviewed August 2014. Retrieved from http://www.who.int/mediacentre/factsheets/fs266/en/#

World Health Organisation. (2014b). *Household air pollution and health* (pp. 1–5). Fact sheet number 292, updated March 2014. Retrieved from http://www.who.int/mediacentre/factsheets/fs292/en/