LAND COURT OF QUEENSLAND

Individual Expert Witness Report

Financial and Market Analysis

Tim Buckley, Institute of Energy Economics and Financial Analysis (IEEFA)

REGISTRY: Brisbane

NUMBERS: MRA428-14, EPA429-14
MRA430-14, EPA431-14
MRA432-14, EPA433-14

Applicant:	**ADANI MINING PTY LTD**
	AND
First Respondent:	**LAND SERVICES OF COAST AND COUNTRY INC.**
	AND
Second Respondent:	**CONSERVATION ACTION TRUST**
	AND
Statutory Party:	**CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION**

Executive Summary

This report provides a detailed analysis of four issues relating to the proposed Carmichael coal and rail thermal coal project in the Galilee Basin.

I consider that the Carmichael coal project is financially unviable and unbankable. The coal deposit is low energy, high ash thermal coal that will be valued by the export market at approximately a 30% discount to the Newcastle benchmark price. [1] The proposal is for a new coal mine to be built in the Galilee, a region that lacks all of the commercial infrastructure needed to access, mine, wash and transport the coal to its international end market. The Adani Group already has high financial leverage with US$14bn of net debt, and has not demonstrated it has the financial capacity to fund the additional A$10-14bn investment required. The financial model supplied by Adani Mining has so many omissions and errors that no respectable financial institution would place any reliance on it.

A key point of disagreement in the Joint Experts Report was the contention by Jon Stanford that coal demand is still growing, with Jon citing a reliance on the International Energy Agency (IEA) forecasts. The IEA forecast is, however, based on outdated data and assumptions that have already been superseded.[2] Recent evidence indicates that there is a structural decline of seaborne thermal coal market. This view is consistent with: numerous global financial institutions; the 60% collapse in the coal price in recent years; and China possibly passing peak demand in 2013.[3]

The Carmichael coal mine is one of the largest new coal mines globally and individually would increase global thermal seaborne supply by 4-6%,[4] and in enabling another 8 Galilee mines, this development could expand supply by 30% or 282 million tonnes per annum (Mtpa),[5] with significant downward pressure on the equilibrium coal price as a result. Additionality is in no doubt.

Finally, I firmly disagree with Jon Stanford's assertion in the Joint Expert Report that coal alleviates poverty. In this report I cite the Energy Minister Piyush Goyal only this past week as confirming the illogic of such a statement with respect to India. Institute for Energy Economics and Financial Analysis's (IEEFA) own analysis shows that imported coal into India is the least cost effective solution available to the Indian Government for alleviating energy poverty.[6]

[1] See Section 1.1.1 below.
[2] See Section 2 below.
[3] See Section 2.1 below.
[4] See Section 3.1 below.
[5] See Section 3.2 below.
[6] See Section 4. below.

1. Commercial Viability

1.1 Viability of the project

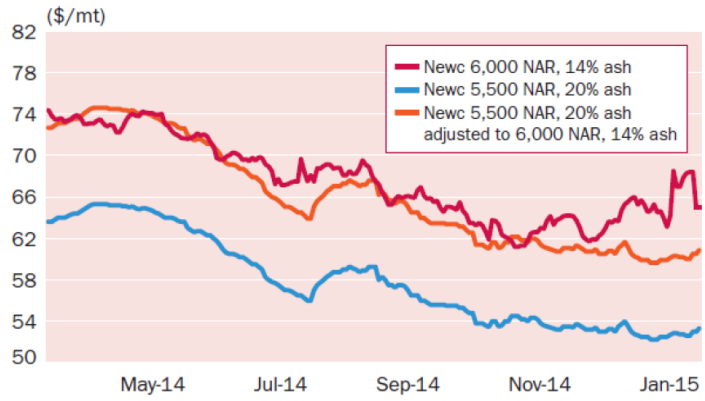
1.1.1 Carmichael Coal is Low Quality … Expect a 30% Price Discount to Benchmark

The coal from the Carmichael mine is low quality when compared to the Newcastle benchmark thermal coal (Figure 1). This means the proposal will receive considerably less revenue per tonne, in the order of 30%. As per page 11 of the Joint Exports Report, Jon Stanford had no view of this.

The Newcastle export benchmark index has a net energy content of 6,000kcal Net as Received (NAR), and 12-14% ash content. As a result the coal from the Carmichael mine is expected to be valued at a significant discount, I estimate this at 30%.[7] The coal from the Carmichael mine's energy content of ~5,200kcal Gross as Received (4,950kcal NAR) is 17% lower than the benchmark. The 26% average ash content (as disclosed in the Supplementary Environmental Impact Statement (SEIS)[8]) is double the 6,000kcal index.

The Financial Model supplied by Adani Mining Pty Ltd (Adani Mining) via Dr Jerome Fahrer's Economic Assessment on 30 January 2015 Attachment B has numerous oversights and excessively optimistic assumptions. A key question is that there does not appear to be any adjustment to adjust for the likely price discount. Reducing the assumed revenues by 30% makes the project commercially unviable – refer to Section 1.4.

Figure 1: Australian Thermal Coal Price – 5,500kcal vs 6,000kcal benchmark



Source: Platts, February 2015

[7] To illustrate, using the Argus price sheet from 31/10/2014, the Newcastle 6,000kcal price was US$63.94/t, while the Newcastle 5,500kcal was US$53.15/t. The US$10.79 difference is 17%. Taking the coal energy content down from 5,500 to 4,950kcal is another 10% reduction. Lifting the ash content from 20% to 26% takes us to ~30%.

[8] Adani Mining P/L SEIS Report for Updated Mine Project Description 18 October 2013, page 15.

Reducing the energy content and/or doubling the ash content has seen coal consistently priced at a major discount to the Newcastle benchmark price. The coal from the Carmichael mine in my view would be priced at a 10-15% discount to the Newcastle 5,500kcal NAR, 20% ash index which consistently trades at US$12/t discount to the 6,000kcal index– refer to Figure 1.

1.1.2 Remote and lacks any existing infrastructure

The Carmichael coal mine proposal is not considered commercially viable given the extreme distance from the end users and the absolute lack of any of the required commercial scale infrastructure. Absent from the Galilee is commercial scale access to electricity, water, sewage, rail, ports, sealed roads and an airport. This makes the project very expensive, in that the capital costs of the mine need to include the capital cost of building all the associated infrastructure. The very remote location will also materially increase the building costs.

Adani Mining's $400m new 150MW Moray Power Station proposal highlights the absence of any electricity grid connectivity or water/sewerage treatment facilities in the Galilee.[9]

Adani Mining requires 12 gigalitres of water per annum required by Carmichael.[10]

The black soils and absence of sealed roads in the region of the mine site would make access impossible after rains without significant road upgrades.[11]

The need for 388km of greenfield, single purpose railway line is another $2.5bn[12] plus capital cost.

There is no unallocated port capacity at Abbot Point through to July 2019,[13] with most of the contracted capacity extending through to 2025-2028, so the greenfield A$3-5bn 'Terminal 0' (T0) coal export facility needs to be built.[14] This also requires the dredging and dumping of

[9] http://www.moraypower.com.au/Project
[10] Adani Mining P/L SEIS Volume 2 Mine Studies 13 November 2013, page 11 and http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=referral_detail&proposal_id=7410
[11] Ausenco, 'Alpha Coal Project', Ausenco website, accessed 31 May 2013. Available at: http://Ausenco.com/case-studies/alpha-coal-project
[12] Dr Jerome Fahrer's Economic Assessment on 30 January 2015 page 9, footnote 7.
[13] Adani Abbot Point Terminal Pty Ltd Investor Briefing April 2013
[14] The BFS proposes a significant change to now involve a two stage development of Adani Abbot Point Terminal Zero ("T0"), 40Mtpa in Stage I and then at a future point 30Mtpa in Stage II. Assuming a construction cost of A$75m/Mtpa of coal port capacity, Stage I would cost A$3.0bn, and assuming some scale advantages lower the Stage II cost to A$70m/Mtpa, then Stage II would cost another A$2.1bn. The A$3.3bn capital cost of WICET for 27Mtpa of capacity by comparison cost A$122m/Mtpa of capacity over 2012-2015, and the BMA Hay Point Stage III 11Mtpa expansion cost US$1.5bn or US$136m/Mtpa of incremental capacity over 2013-15.

spoil in or adjacent to the Great Barrier Reef World Heritage Area, with unconfirmed press reports suggesting the Queensland Government cost estimates range from $200m to $400m,[15] without any confirmed statement as to who will fund this expense.

Given the scale of the Carmichael mine, I assume there will be significant use of fly-in, fly-out workers[16] and this includes building a new commercial airport.[17]

Compared to a new coal mine proposal in an established coal mining area like the Bowen basin or Hunter Valley, the greenfield infrastructure capital construction costs for the first coal mine in the remote Galilee area are prohibitive, particularly at a time when existing mines are struggling to produce at a gross cashflow breakeven[18] and coal companies are seeing the share prices plummet.[19]

[15] The Weekend Australian, Graham Lloyd, "The A sea change in reef policy", 13 September 2014.
[16] Adani Mining P/L SEIS Report for Updated Mine Project Description 18 October 2013, Section 9.2, page 92.
[17] Adani Mining P/L SEIS Report for Updated Mine Project Description 18 October 2013, Section 9.3, page 95.
[18] http://holdfastcommunications.com.au/uncategorized/coal-giant-peabody-reports-net-loss-following-fall-in-us-aus-revenues/
[19] Refer to Section 1.3 below.

1.2 Ability to finance the project

The Adani Group is a sizable collection of companies,[20] but the existence of a significant level of debt across all arms of the group[21] means there is very little borrowing capacity available. The Adani Group does not have binding agreements for debt borrowing capacity for much of the A$10-15bn project, and no substantive new equity finance has been sourced to date.

As per page 16 of the Joint Experts Report, Jon Stanford said he was not qualified to comment on the Adani Group's financial standing.

1.2.1 Non-binding Deals Announced

In a flurry of announcements, Adani Mining has announced that POSCO E&C would build and help fund the proposed railway line,[22] that the State Bank of India (SBI) would take a lead in funding the overall project, that the Newman government would take an equity stake in the rail project, that POSCO E&C would build and help fund the Abbot Point Coal Port,[23] and that Downer EDI would take on the $2bn mine development contract.

However, while the wording of these announcements suggests binding transactions and deadlines are in place, the reality is that most, if not all, of these announcements are for non-legally binding proposals:

1. In November 2014, the press reported that POSCO had distanced itself from the project. Both POSCO E&C and potential funding partner, South Korea's Export-Import Bank, said any agreements were at early stages and "It is hard to predict when a contract will be signed."[24]
2. In December 2014, SBI clarified their additional loan proposal had not been through due diligence and was in fact only for a proposed loan increase of US$200m.[25]
3. In December 2014, Downer EDI reported "Adani Mining advising of its intention to enter into contracts for the provision of mining services." "Both Letters of Award are subject to the parties executing binding contracts which would be followed by pre-production and

[20] Refer Appendix A for Group Structure.
[21] IEEFA "Remote Prospects: A financial Analysis of Adanis coal gamble in the Galilee Basin" page 11, http://ieefa.org/adani_coal_report/
[22] http://www.adanimining.com/Common/Uploads/MediaTemplate/_Dowlload_Rail%20Partner%20Announcement.pdf
[23] http://theindependent.sg/blog/2014/12/24/posco-ec-is-appointed-as-the-preferred-epc-contractor-for-1-billion-aud-terminal-port-project-in-australia/
[24] http://in.reuters.com/article/2014/11/12/adani-australia-coal-idINKCN0IW2I620141112
[25] http://www.business-standard.com/article/companies/sbi-chief-says-adani-carmichael-project-viable-114112001114_1.html

planning in early 2015 with mine infrastructure construction commencing in the fourth quarter of 2015."[26]

1.2.2 Adani Enterprises Already has Significant Financial Leverage

The listed Adani Group has a combined external equity capitalisation exceeding US$14bn,[27] including the listed subsidiaries of Adani Ports and SEZ Ltd and Adani Power Ltd. However, against this equity, the listed group has net indebtedness of over US$12bn,[28] plus another US$2bn held in private Adani family companies against the Abbot Point Coal Port T1,[29] taking external financial leverage to US$14bn.

Whilst the combined listed Adani Enterprises reported Earnings before Interest and Tax (EBIT) of US$1.06bn in the nine months to December 2014,[30] Adani Enterprises reported net interest expense of US$0.83bn (with additional non-disclosed interest expense capitalised on incomplete projects[31]). This is a net interest cover of 1.27x, leaving little margin for error. This also leaves little capacity for further borrowings on the existing corporate structure.

Adani Mining already is more than 100% debt funded to-date, with borrowings exceeding A$1.0bn.[32] Abbot Point T1 is likewise 80-90% or more debt funded.[33]

[26] Downer EDI Press Release dated 19 December 2014 "Downer receives letters of award for Carmichael coal mine contract".
[27] Calculated as at 6 February 2015 using closing share prices on the Bombay Stock Exchange for Adani Enterprises Ltd of Rs627, Adani Ports and SEZ Ltd of Rs300 and Adani Power Ltd of Rs47 per share, eliminating the Adani Enterprises Ltd holding of 75% in Adani Ports and the 69% ownership of Adani Power to prevent double counting.
[28] Calculated from the published accounts of Adani Enterprises Ltd for the half to 30 September 2014.
[29] Adani Abbot Point Terminal Pty Ltd 2012/13 annual report, note 14 as lodged with ASIC 22/7/2013 states debt of A$1.13bn, and the Adani Ports 2012/13 annual report states there was an additional US$800m debt against Adani Abbot Point Port Terminal Pty Ltd from State Bank of India, hence the total debt is estimated at US$2bn (refer note 33 below).
[30] http://www.bseindia.com/corporates/anndet_new.aspx?newsid=87c2ee7b-73fd-48b8-90a3-09129762b962
[31] Adani Enterprises Ltd Annual Report 2012/13, page 128, note q.
[32] Adani Mining Pty Ltd 2013/14 Annual Report, as lodged with ASIC on 20 May 2014, page 5.
[33] Adani Abbot Point Terminal Pty Ltd 2013/14 Annual Report, as lodged with ASIC on 18 June 2014, page 8, adjusted for the US$800m SBI loan facility disclosed in the Adani Ports and SEZ 2012/13 Annual Report page 146 and then Mundra Port P/L 2013/14 annual report page 14 that I assume is still outstanding, as per press reports quoting SBI in Nov'2014.

1.2.3 Financing has Not Been Established

For a combined mine, rail and port project of peak 60Mtpa capacity as outlined in the Supplementary Environmental Impact Statement (SEIS) of November 2013, I estimate capital costs at A$15bn.[34]

The Adani Group has announced non-binding loan indications of US$200m from the State Bank of India,[35] and an unspecified equity investment intent from POSCO E&C. As such, the Adani Group has established funding for a minor portion of the total project.

Nine major global banks who are key to most global coal mining investments, have moved away from providing finance for the Galilee project proposals, particularly as it relates to building a new coal export facility adjacent to the Great Barrier Reef (GBR). Concerns also relate to the dredging in the Great Barrier Reef World Heritage Area and dredge spoil dumping in the RAMSAR compliant Caley Valley, a key wetland adjacent to the GBR. The 9 banks include: Deutsche Bank; HSBC; Royal Bank of Scotland; Barclays; Morgan Stanley; Citigroup; Goldman Sachs; JP Morgan Chase and most recently Societe Generale.

The ability of the Adani Group to attract new international capital of in-excess of A$10bn is also likely to require clarification of a major legal claim made against the Adani Group.[36] This is particularly so given the opaque nature of the multiple overseas tax havens involved in the proposed Carmichael coal, rail and port proposals.[37] The ultimate owner of a number of Adani Group related entities appears to be Atulya Resources Limited with Vinod Shantilal Adani (alias Vinod Shantial Shah) named as the sole director, rather than the listed parent entity, Adani Enterprises Ltd controlled by the Chairman, Mr Gautam S. Adani.[38]

---

[34] Refer section 1.4 below – footnote 52.

[35] Adani press release (link below) quotes US$1bn, but from this I deduct the existing facility of US$800m already extended – refer note 33 above
http://www.adanimining.com/Common/Uploads/MediaTemplate/_Dowlload_Media%20Release%20-%20Adani%20SBI%20MOU.pdf

[36] http://www.smh.com.au/business/uncertainty-over-massive-queensland-mine-after-election-shock-and-concerns-over-indian-company-20150206-137mbi.html#ixzz3R0BsHFNH ;
http://articles.economictimes.indiatimes.com/2014-01-02/news/45799234_1_adani-group-dri-revenue-intelligence ; http://indianexpress.com/article/business/companies/sit-cbi-to-look-into-adani-group-case/#sthash.WHGYGX7t.dpuf

[37] Adani Global Pte Ltd annual report 2013/14 details on page 45 that a "concessionary rate of 5% of income tax by virtue of Section 43 P of the Singapore Income Tax Act (Cap.134)" is payable relative to the Singaporean Corporate tax rate of 17%. As such, the way Adani Global Pte Ltd is structured in Singapore makes this effectively a tax haven requiring the company to pay very little corporate tax. Adani's Australian subsidiaries are variously owned by offshore Adani family affiliated corporations and trusts based in the Cayman Islands, Mauritius and Dubai Free Trade Zone.

[38] For example, the Business Profile of CARMICHAEL RAIL AND PORT SINGAPORE HOLDINGS PTE LTD (201425301K) as reported to the Singapore Accounting And Corporate Regulatory Authority on 20/12/2014 states that Vinod Shantilal Adani is the only director, and that the ultimate owner is Atulya Resources Limited of the Cayman Islands.

The seemingly contradictory reports on who actually owns Abbot Point Coal Terminal T1 and the company undertaking the T0 development are also an issue in my mind. Adani Ports and SEZ Ltd Annual Reports for 2012/13[39] and 2013/14, plus a subsequent Bombay Stock Exchange announcement[40] on 19 December 2014, details this asset was divested effective on 31 March 2013, but accounts lodged with ASIC state ownership is retained by Adani Ports and SEZ Ltd[41] – refer to Appendix A.

[39] Adani Ports and SEZ Ltd 2012/13 Annual Report, list of subsidiaries page 128 note 30.
[40] http://www.bseindia.com/corporates/ann.aspx?expandable=0
[41] Adani Abbot Point Terminal Pty Ltd 2013/14 Annual Report, as lodged with ASIC on 18 June 2014, page 11, and notice of material events outstanding therein, plus ADANI AUSTRALIA COAL TERMINAL PTY LTD notice lodged with ASIC on 21 December 2014 stating the ultimate parent in Adani Enterprises Ltd.

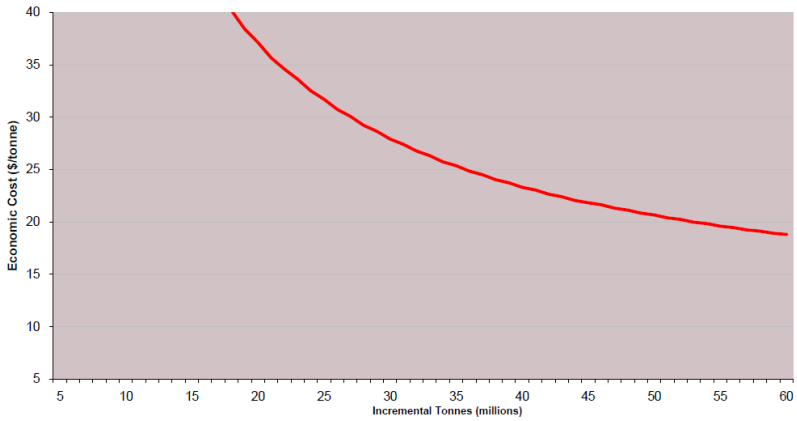
1.2.5 Adani Mining's BFS Reports a 50-60% Reduction in Scale

Dr Jerome Fahrer's Economic Assessment on 30 January 2015 references the Affidavit of Rajesh Kumar Gupta from 21 November 2014 and an undisclosed Bankable Feasibility Study (BFS) done by or on behalf of Adani Mining to detail the financial viability of the proposed project.

The Environmental Impact Statement (EIS) detailed a scale and duration of the project of an average of 60Mtpa of saleable coal over 90 years. The SEIS downgraded this to an average of 40Mtpa over 60 years, a reduction in scale of a third, and a reduction in duration of a third. The BFS report evaluates a project scale averaging 34Mtpa of saleable coal over a life of 30 years. This is a 15% reduction in scale and another halving in the assumed life of the project.

The financial viability of building a greenfield rail line for 388km has been reported by Aurizon as requiring significant scale of 50-60Mtpa to amortise the fixed capital costs (Figure 2). I reference the Aurizon model as showing that cutting the stage I scale by 15% and life by 50% will materially, adversely affect the project viability and bankability.

Figure 2: Scale is a Critical Prerequisite to Galilee Greenfield Rail Viability



Source: Queensland Rail Network P/L, 2009 Coal Rail Infrastructure Master Plan, page 37

The BFS downsizes the mine project considerably. While Adani Mining has referenced this rail and port will have a common user facility to share the cost, other mine proposals (like Resolve Coal's Hyde Park proposal[42]) have either not lodged an EIS or have lodged an EIS but the proposed joint venture partner of the required rail and port infrastructure has said the project will be deferred for several years (Alpha, Alpha West and Kevin's Corner) due to

[42] http://www.hydeparkcoal.com.au/ (accessed 6 February 2015)

questions over commercial viability due to the collapse in the coal price.[43] Having already delayed a decision to proceed several times over 2013/2014, Aurizon chief executive Lance Hockridge was quoted as saying in October 2014 that "The reality is the go-ahead for the Galilee will be some years down the track".[44] In my analysis GVK does not have the financial resources to proceed without Aurizon or a similarly well financed partner.

The Financial Model supplied by Adani Mining via Dr Jerome Fahrer's Economic Assessment on 30 January 2015 suggests that the proposed $2.5bn rail line will be commercially viable on 34Mtpa in direct contrast to Figure 2, above that estimates rail volumes of 55-60Mtpa are required (from the existing rail incumbent), and erroneously assumes the annual running cost of such a railway will be free.

[43] Abbot Point Port and Wetland Project Volume 5 "Appendix 1 Unique Submissions" submission from Aurizon Ltd on page 600.
[44] http://www.smh.com.au/business/mining-and-resources/thermal-coal-prices-stall-aurizon-expansion-into-galilee-basin-20141027-11ckka.html#ixzz3HOAeMaPg

1.3 Collapse of equity values of coal companies globally

The collapse of listed coal mining company share prices over the last four years reflects the combination of increased climate policy action globally, significant existing excessive seaborne coal supply and a sustained weakening of the coal demand outlook.

I note the average 80-90% decline in average global coal listed company share prices in the last four years. Coal India Ltd is one of the few exceptions to this trend, protected by its entirely domestic orientation and exceptional balance sheet strength (US$10bn net cash).

For example, Peabody Energy, the largest private owned listed coal producer by volume has seen more than US$15bn of its US$17bn shareholder wealth destroyed over the last four years. Peabody's stock price is down 90% in this period (Figure 3), whilst the US Equity market index is up 40%. Alpha Natural Resources and Arch Coal are both down more than 98%, and Patriot Coal entered Chapter 11 Administration in 2012.

Figure 3: Shareholder Wealth Destruction in US Listed Coal Companies

Source: Yahoo Finance

Figure 4 details the major listed Australian coal miners like Whitehaven, Yancoal Australia and Cockatoo Coal with share prices generally down more than 50-80%, while previously listed Bandanna Energy was placed into Administration in September 2014. The trend is similar for Chinese and Indonesian listed coal miners.

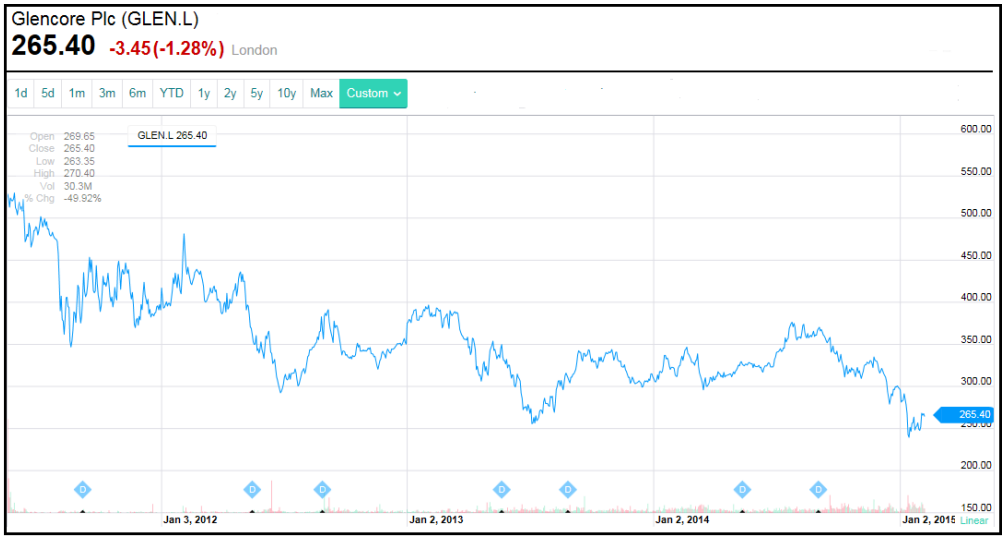
Figure 4: Shareholder Wealth Destruction in Australian Listed Coal Companies

Source: Yahoo Finance

Investing in coal companies is increasingly accepted by the global financial markets as a wealth hazard.[45] This deterioration in my view almost precludes Adani Enterprise's ability to raise new equity capital for the project. Jon Stanford in the Joint Experts Report (page 8) dismisses this share price collapse as the normal cyclicality of mining companies.

Figure 5 details the 49% decline in Glencore Plc since listing in 2011. Glencore shelved its $7bn 30Mtpa Wandoan coal mine project in Queensland in 2013 due to falling coal prices.

Figure 5: Shareholder Wealth Destruction at Glencore Plc



[45] Refer to Section 2.3

1.4 Anomalies in the Financial Model for Carmichael Coal

The Financial Model for the Carmichael Mine and Rail Project supplied by Adani Mining via Dr Jerome Fahrer's Economic Assessment on 30 January 2015 Attachment B has numerous oversights and omissions, and what I would consider excessively optimistic assumptions. A complete financial model rectifying these issues would confirm the project is commercially unviable on anything other than an assumption of more than a 40-60% sustained improvement in the real thermal coal price from current levels.

With the disclosure of this financial model only on 30 January 2015, my preliminary analysis of the modelling issues raises the following quesitons:

1. Adani Mining's model assumes a US$73.33/t real average thermal coal price over the 30 year life of the project.[46] This is a 26% premium to the current Newcastle thermal benchmark price of US$58/t.[47] Adani Mining is making a commercial assessment that thermal export coal prices are currently in a cyclical trough. I disagree, viewing the current price reflective of the structural decline of thermal coal.
2. No adjustment is made to the revenue assumption to allow for the likely 30% discount that the coal from the Carmichael mine proposal is likely to trade at due to low energy and high ash (refer to section 1.1.1 above).
3. I calculate that the Adani Mining model assumes an average real cash cost of production of US$47/t over the 30 year life (excluding rail, port charges, depreciation, interest and tax). This is 22% higher than the US$38.70/t average real cash cost of production free on board (fob) stated in the letter provided by McCullough Robertson on 14/1/2015. This is materially higher than the US$42/t average real price being quoted by in the press attributed to State Bank of India.[48]
4. The Adani Mining model assumes total corporate tax payments of A$9.96bn (real) over the 30 year life. Using the US$47/t real cash cost modelled, the gross cash profit from the mine as modelled is A$31.52bn (real), suggesting an average corporate tax rate of 32%. While notionally similar to the current 30% Australian corporate tax rate, this calculation

[46] I calculate this from the model provided to Dr Jerome Fahrer 30/1/2015 using the 2.5% pa inflation assumption and the US$ nominal coal price in B1, then do a weighted average using the product coal also detailed in B1. I note this US$73.33/t real differs from the US$78.60/t real stated in the letter provided by McCullough Robertson on 14/1/2015.
[47] Quoted spot price as of 29/1/2015, Argus Coal Daily International.
[48] http://www.business-standard.com/article/companies/sbi-chief-says-adani-carmichael-project-viable-114112001114_1.html

appears to make no allowance for tax deductible depreciation. If correct, this would result in a massive overstatement of the corporate tax likely to be paid.

5. This 32% calculation also makes no allowance for the tax deduction of interest expense on any portion of the A$10bn of mine and rail capital investment,[49] again resulting in a massive overstatement of the corporate tax likely to be paid. Given Adani Mining has net borrowings of over A$1bn and negative shareholders funds for its Australian mining invest to-date, and the Abbot Point T1 is at least 80-90% debt financed, it is likely that the Adani Group will continue this pattern and majority debt fund its overall new Australian investment. To illustrate the magnitude of this omission, saying 60% debt finance on A$10bn is A$6bn, funded at my estimate of 7% pa (given intercompany loans into Australia are charged an extra 100-200bp margin by their Adani parent), this is A$420m net interest expense annually.[50]
6. The financial model assumes that because the A$2.5bn rail line cost is owned in-house, there would be zero running costs. I question the absence of any costs associated with rail staff, wear and tear on the equipment, nor fuel costs associated with the rail line. The "rail costs" appear to also omit any allowance for the purchase of locomotives or coal wagons, a capital cost omission of some A$500-625m.[51] With external equity investors being proposed to include Queensland taxpayers and POSCO E&C, I doubt this makes commercial sense.
7. The financial model similarly omits any port loading costs, which in Queensland range currently from A$5/t up to A$15/t for the newly constructed WICET port.[52] Given the private Adani family separately owns the coal port proposed for T0, and the mine project is owned by Adani Enterprises Ltd, the publicly listed Indian firm, this free use of a A$3-5bn coal port for the next 30 years seems unlikely.

[49] I estimate the capital construction cost of the entire 40Mtpa 60 year life project at A$15bn (excluding funding costs), of which Adani has debt funded an estimated A$1.1bn to-date. The Adani model presented in Attachment B details A$2.5bn for the rail line and A$5.7bn for the mine construction, or A$8.2bn combined. In addition, we estimate A$3bn for Stage I of Abbot Point T0 and $2.1bn for Stage II, plus A$0.4bn for the 120MW Moray Power Station, A$0.6bn for the train sets, A$0.7bn for the project proposal purchase, taking the total cost to A$15bn, with Stage I costing A$10bn in addition to the A$1.1bn invested to-date.
[50] This is consistent with Adani Group's current tax minimization strategies including the financing structure of the Australian entities and the creation of a number of legal entities in offshore tax havens – refer Appendix A.
[51] I reference the UBS Equity Research Report by Daniel Morgan et al titled "Coal's rail solution for the Galilee" from 25 March 2013, page 15 Table 7 which calculates to move 30Mtpa of coal for 400km would require 8 train sets at A$70m/set and adds $100m of associated infrastructure to get A$625m. Adani's mine model assumes 33.9Mtpa average product coal, but Adani is proposing standard gauge rail which facilitates fewer, longer trains.
[52] IEEFA briefing note: WICET

8. The proposed rehabilitation charge of A$117m (real) equates to a cost of A$0.10/t of coal (real) over the life of the mine, given run-of-mine production of 1.1bn tonnes of coal. The Australian Government currently has 50,000 unrehabilitated and abandoned mine sites around Australia (15,000 in Queensland alone).[53] In light of the history of the Australian mining sector to leave many mine sites requiring remediation, I question that a provision of 0.13% of total project revenues is adequate to cover the entire clean up cost of moving more than 12bn tonnes of overburden[54] to access the additional 1bn tonne of ROM coal (note, the SEIS references 13bn Bank cubic metres (BCM) of overburden to generate 60Mtpa of coal[55]). I also note that the Queensland financial assurance process is failing according to the last Auditor Office's report.[56]
9. The mine model presented assumes an average 30 year life with run of mine coal of 36.7Mtpa and product coal of 33.9Mtpa – an exceptional headline yield of 92%. This model provides no breakdown of the split between open cut to underground. Assuming the 26% underground to ROM coal ratio of the SEIS holds[57] and a 100% recovery yield on the underground coal, this suggests an assumed open cut mine yield of 90%.[58] This is a very optimistic assumption in light of the multiple coal seams and need for washing given the very high ash content. Australian open cut mine yields are typically 70-80%.[59] Without full disclosure, this analysis is by necessity only approximate. However, the headline yield of 92% saleable coal does not reconcile to the headline yield of 79% disclosed in the SEIS.[60]

[53] Life-of-Mine Conference 2012, paper by C.Unger, A.M. Lechner, V. Glenn, M. Edraki, D.R. Mulligan titled "Mapping and Prioritising Rehabilitation of Abandoned Mines in Australia"
[54] I assume a strip ratio of 6BCM/t which equates to 15t of overburden per tonne of run-of-mine-coal.
[55] Adani Mining P/L SEIS Volume 2 Mine Studies 13 November 2013, page 11.
[56] https://www.thesaturdaypaper.com.au/news/politics/2014/05/24/minings-multi-billion-dollar-black-hole/1400853601 ;
https://www.qao.qld.gov.au/files/file/Reports%20and%20publications/Reports%20to%20Parliament%202013-14/RtP15Environmentalregulationoftheresourcesandwasteindustries.pdf
[57] Adani Mining P/L SEIS Report for Updated Mine Project Description 18 October 2013, Table 3, page 22.
[58] ROM coal is 1.10bn tonnes over the life of the mine as modelled, underground coal is 26% of ROM coal in the SEIS, so 26% of 1.10Bn is 285Mt. Total product coal is 1.02bn tonnes, so less the U/G of 285Mt this gives open cut product coal of 733Mt. ROM coal is 1.10bn less 285Mt is 817Mt ROM opencut coal. The ratio of 733Mt/817Mt gives a yield of 90%.
[59] To illustrate, using the Rio Tinto 2012 Production Profile for nine of Australia's larger coal coal mines, the average yield is 75.9%.
[60] Adani Mining P/L SEIS Report for Updated Mine Project Description 18 October 2013, Table 3, page 22, 50.4Mtpa ROM coal average of mine line vs product coal of 39.8Mtpa.

2. The IEA forecast for a peak in coal by 2030 is outdated

The world's energy and commodity markets saw massive structural change over 2014, with oil, liquid natural gas (LNG), iron ore and coal prices having halved in a very short timeframe. Structural change and market transitions will be profound as a result. While global financial houses are able to reassess their forecasts in rapid succession, with live global trading of currencies, commodities and equities dependent on these assessments. For more detail, please reference the analysis done by the Carbon Tracker / Energy Transition Advisors report from September 2014.[61]

By contrast, the IEA is more conservative and gradual in its methodology. This has left the IEA coal forecasts for continued demand growth through to 2030 as looking increasingly out of date, particularly with 2014 being the first year this century that China's coal consumption has declined,[62] a material reversal of the exceptionally strong 8-10% annual demand growth evident over 2000-2011.

2.1 Global financial houses increasingly see coal as in structural decline

In my discussions with global equity investors and the global banks about the state of the global coal markets, in addition to our own in-house IEEFA models, we reference global financial houses inluding Bernstein, Citigroup, Goldman Sachs, Deutsche Bank, Morgan Stanley and Macquarie Group.

In the Joint Experts Report (page 2), Jon Stanford states that he relies on the IEA and BREE. While I acknowledge that the IEA is one of the more respected global voices, it is only one of a number and it is prone to extrapolate current trends and favour fossil fuels. BREE is not a credible forecaster of global relevance. The Australian Treasury does not rely on BREE forecasts for its budget estimates.

In this section I reference several reports to highlight the magnitude of revisions that global financial houses have made over the last two years downgrading their thermal coal forecasts on the back of the increased risks of structural decline in demand and oversupply.

Macquarie Group published in May 2013 a commodities report in which they state:

> "*Hopes for Galilee Basin development look increasingly remote. With huge upfront capex to build the >500km rail lines and coal quality which compares poorly to*

[61] http://www.carbontracker.org/wp-content/uploads/2014/09/Coal-Financial-Trends-ETA.pdf
[62] http://news.xinhuanet.com/fortune/2015-01/23/c_1114112421.htm

> *peers, at current ~85-90/t FOB pricing and a flat market outlook project paybacks look extremely poor. Unless conventional economics are ignored due to deep pocket financial backing, further delays to Galilee development look certain*."[63]

In June 2013, Michael Parker of Bernstein Research published a seminal report "*The Beginning of the End of Coal*". [64] In the chapter titled "*Dark and Full of Terrors: Valuing Miners in Terminal Decline*", he valued the largest coal mining firms in the world at zero.

Deutsche Bank's Michael Hsueh published a major report - "*Thermal Coal: Coal At A Crossroads*" in May 2013 concluding "*thermal coal markets face a combined threat of steadily growing supply in the largest producing regions and a levelling off or decline in demand in consuming regions.*"[65] Since that time, Deutsche Bank has downgraded their thermal coal forecasts a number of times.

Goldman Sachs published in July 2013 a report titled "*The window for thermal coal investment is closing*".[66] Since then Goldman has published a series on notes downgrading their thermal coal forecasts, including the latest on 23 January 2015 titled "*Thermal coal reaches retirement age*"[67] which downgraded their long term real thermal coal price by another 18% to US$65/t in 2015 dollar terms.

Morgan Stanley's Sara Chan in August, 2014 published "*Asia Insight: Burning Less, Burning Smarter*" and downgraded again their coal price forecasts, stating:

> "*Given structural changes in Chinese coal demand, we see prolonged coal price weakness preventing stocks from outperforming. We cut our demand forecasts and expect coal prices to fall 10% YoY in 2014 and 4% in 2015."*[68]

Citi's Dr Tony Yuen published in September 2013 "*The Unimaginable: Peak Coal in China*".[69] Again in June 2014 Dr Tony Yuen published "*Energy Markets in Transformation: Profound Changes Impacting the Coal Market*" stating that "*Coal: Demand should peak, led*

[63] Macquarie Commodities Research, Colin Hamilton et al, "Commodities Comment: Ample Aus coal infrastructure capacity", 1 May 2013.
[64] Bernstein Research, Michael Parker, "Asian Coal & Power: Less, Less, Less... The Beginning of the End of Coal", June 2013.
[65] Deutsche Bank Research, Michael Hsueh, "Thermal Coal: Coal At A Crossroads", 9 May 2013.
[66] Goldman Sachs Commodities Research, Christian Lelong, "The window for thermal coal investment is closing", 23 July 2013.
[67] Goldman Sachs Commodities Research, Christian Lelong, "Heat Sensor: Thermal coal reaches retirement age", 23 January 2015.
[68] Morgan Stanley, Sara Chan, "Asia Insight: Burning Less, Burning Smarter", 5 August, 2014.
[69] Citi Commodity Research, Dr Tony Yuen, "The Unimaginable: Peak Coal in China", 4 September 2013.

by China's slowdown".[70] In January 2015 Citi again downgraded their thermal coal forecasts for the Newcastle thermal coal 6,000kcal index in 2016 by 20% to US$64/t, as per Figure 6:

Figure 6: Citigroup Bulk Commodity Forecasts – Thermal Coal US$55/t in 2015

	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	2015	2016
Iron Ore - New	66	56	53	58	60	62	62	65	58	62
Iron Ore - Old	72	65	60	62	65	65	65	65	65	65
Thermal Coal (NEWC) - New	56	53	53	56	60	63	65	67	55	64
Thermal Coal (NEWC) - Old	70	68	65	65	70	75	75	80	67	75
Coking Coal (Spot) - New	108	110	114	120	123	126	128	130	113	127
Coking Coal (Spot) - Old	112	117	125	135	140	140	140	140	122	140

Source: Citi Commodities Research, Jan'2015

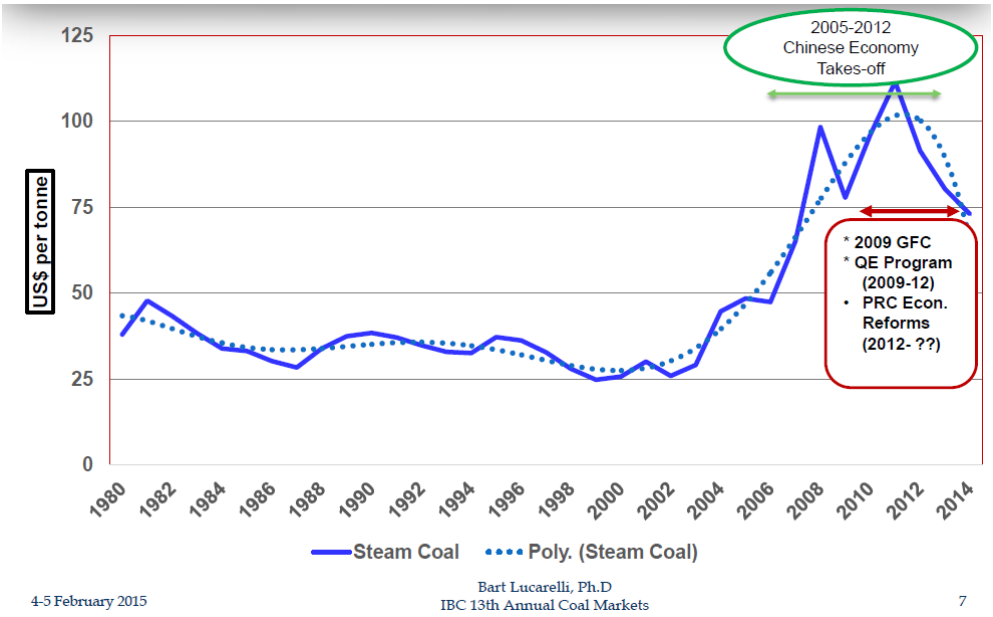
Even the most optimistic of coal forecasters have dramatically curtailed their erroneous forecasts for endless growth in coal demand. Wood Mackenzie in February 2015 reports:

> *"Over the past two decades, commodity demand growth had maintained relatively proportionate annual increases to GDP growth. In 2014, however, the pace of power, gas, coal and diesel demand increase fell more drastically than the slight GDP moderation. ..... Coal remains king in China but growth has been severely reduced due to industrial weakness ..... Through the short term, coal-fired generation will likely be muted by lower power demand, environmental policies and a rise in non-coal generation, including hydro. Longer-term, coal demand pace and patterns will be impacted by structural changes."*[71]

In February 2015 Dr Bart Lucarelli presented the following chart at the IBC Annual Coal Conference, detailing that Newcastle benchmark coal had long traded at US$25-40/t, and the 2005-2012 was an aberration in global demand as China's economy took off, as per Figure 7:

[70] Citi Commodity Research, Dr Tony Yuen, "Energy Markets in Transformation: Profound Changes Impacting the Coal Market", June 2014, page 10.
[71] http://coal.steelguru.com/china/18998/woodmac_expects_slower_growth_in_china_coal_demand

Figure 7: Long Term Thermal Coal Prices – 2005-2012 was an aberration



2.2 IEEFA sees China peaking by 2016 and hence coal in structural decline

China's November 2014 statistics show an acceleration of the trend that has emerged over 2012-2014, and the nexus between real gross domestic product (GDP) growth, electricity growth and coal demand has been broken (Figure 8).

China's coal demand grew 10% annually over the decade to 2011, then the rate of growth halved to 4-5% in 2012 and again 2013.[72] In 2014, China's coal demand has actually declined by 2-3% year-on-year.[73] This suggests IEEFA's view that China's coal demand will permanently peak by 2016 may prove conservative and that 2013 was in fact the peak, as detailed in Professor Ross Garnaut's analysis reported in June 2014.[74] [75] Demand is forecast to gradually decline thereafter.

[72] IEA Medium Term Coal Market Report 2014 page 15.
[73] http://www.afr.com/p/national/china_cuts_thermal_coal_use_by_pc_6jCrkLLG561XUzaBQXlmBL ; http://energydesk.greenpeace.org/2015/01/26/official-chinas-coal-consumption-fell-2014/
[74] China's Role in Global Climate Change Mitigation in China & World Economy, Special Issue: Climate Change and Green Growth: New Thinking, Volume 22, Issue 5, pages 2–18, September–October 2014
[75] http://www.afr.com/f/free/national/china_cuts_coal_intake_weighs_carbon_xdtvx4X3TvRCAwuYtOcLeJ

Figure 8: China Electricity and Thermal Data (Year to November 2014)

Production (TWh)	YTD Nov'13 (TWh)	share	YTD Nov'14 (TWh)	share	YoY
Thermal (gas and coal combined)	3,818	79.7%	3,807	76.5%	-0.3%
Hydro	725	15.1%	887	17.8%	22.4%
Other	245	5.1%	281	5.6%	14.6%
Electricity	**4,788**		**4,975**		**3.9%**
China coal production (Mt)			3,513		-2.1%

Source: http://www.stats.gov.cn/english/PressRelease/201412/t20141216_653855.html

Reaching the inflection point for coal demand in China is the single most important trend for coal globally, given China accounted for half of the world's total coal consumption in 2013. This move away from thermal coal reflects the combination of:

1. A 4.8% reduction in energy use intensity of Chinese GDP in 2014 alone;[76]
2. A slowing rate of economic growth in China;
3. A national focus on reducing air and water pollution;[77]
4. A structural composition shift away from energy intensive sectors; and
5. A long term national policy to improve energy security, diversifying electricity away from coal power by increasing reliance on hydro, nuclear, renewables[78] and gas.

[76] http://www.reuters.com/article/2015/01/20/china-energy-idUSL4N0UZ1QJ20150120
[77] http://www.bloomberg.com/news/2014-04-24/china-enacts-biggest-pollution-curbs-in-25-years.html
[78] http://in.reuters.com/article/2015/01/16/china-power-consumption-idINL3N0UV1IG20150116

2.3 IEA's New Policies Scenario is Too Optimistic on Coal

With US domestic coal demand peaking in 2007 and having declined 18% since then, with European coal demand having peaked back in 1990 and Japan forecast to have peaked in 2014, plus China peaking by 2016 at the latest, the leading global coal demand markets (except for India) are viewed as all being in structural decline by 2016.

The IEA presents three scenarios in their analysis: Business as Usual; New Policies Scenario; and the 450 Scenario. The IEA reminds users these are scenarios, not forecasts, and that their most likely scenario is as per that set out in the New Policies.

The IEA 2014 report forecasts global coal demand grows on average +2.1% per year over the outlook period from 2013-2019.[79] IEEFA views this scenario as too optimistic, given it is based on the 2013 actual data, but does not reconcile with the data that emerged over 2014. Given the dramatic decline from trend in China's coal consumption, particularly relative to the IEA's own forecast for China of 2.5% pa positive growth (again, where China is 50% of world coal consumption). A major turning point was reached in 2014, yet the IEA dismisses this without full analysis. To be fair, the rate of decline accelerated as the 2014 year progressed, and the IEA is therefore missing key data that will be incorporated later in 2015.

However, global financial markets are dynamic, and are therefore able to adjust to dramatic changes with also immediate effect. This saw global prices for oil, iron ore, LNG and coal, all collapse into the last few months of the year. I would therefore reference analysis done by the global financial houses as more comprehensively incorporating this new paradigm shift. To illustrate, the oil price halved over 2014, and this dramatic realignment did not occur in isolation – all energy markets are impacted.

2.3.1 Solar technology roadmap / wind projects too cautious

In the IEA's 2014 Edition of the "*Technology Roadmap: Solar Photovoltaic Energy*", the IEA acknowledged renewable energy trends were accelerating far faster than they had anticipated. IEEFA suggests the IEA's conservatism leads to an unwillingness to extrapolate existing technology and costs trends, meaning the IEA continues to be too cautious on a global energy market in rapid transition. The IEA has for the last decade, continually

[79] IEA Medium Term Coal Market Report 2014 page 63.

underestimated the role of both renewable energy and energy efficiency and hence overstated the world's reliance on coal and nuclear demand. Quoting from the Forward:

> *"PV has been deployed faster than anticipated and by 2020 will probably reach twice the level previously expected. Rapid deployment and falling costs have each been driving the other. This progress, together with other important changes in the energy landscape, notably concerning the status and progress of nuclear power and CCS, have led the IEA to reassess the role of solar PV in mitigating climate change. This updated roadmap envisions PV's share of global electricity rising up to 16% by 2050, compared with 11% in the 2010 roadmap."*[80]

2.3.2 Energy efficiency in South East Asia

Likewise, the IEA's projections on reduced coal demand resulting from the adaption of the world's best practice in energy efficiency are excessively conservative. The IEA Report "A South East Asia Energy Outlook" highlights that there are enormous opportunities, but that the IEA cannot see the implement of specific government policies, so they are discounted:

> *"While Southeast Asia has made some gains in energy efficiency, almost three-quarters of its full economic potential is set to remain untapped in 2035. Removing barriers to energy efficiency deployment would deliver major energy savings."*[81]

By contrast, the "*2014 Statoil Energy Perspectives*" forecasts a "*global improvement in energy efficiency of some 35% from today's level*."[82] This translates into 1.5-2.0% pa, almost double the IEA base assumption. This materially overstates electricity demand growth, and hence overstates the coal demand growth – a key point that saw China undershoot the IEA's October 2014 coal demand projection for China in 2014 by more than 4%.

[80] IEA's "Technology Roadmap: Solar Photovoltaic Energy", 2014 Edition.
[81] IEA special report "A South East Asia Energy Outlook", September 2013, page 12.
[82] http://www.statoil.com/no/NewsAndMedia/News/2014/Downloads/Energy%20Perspectives%202014.pdf

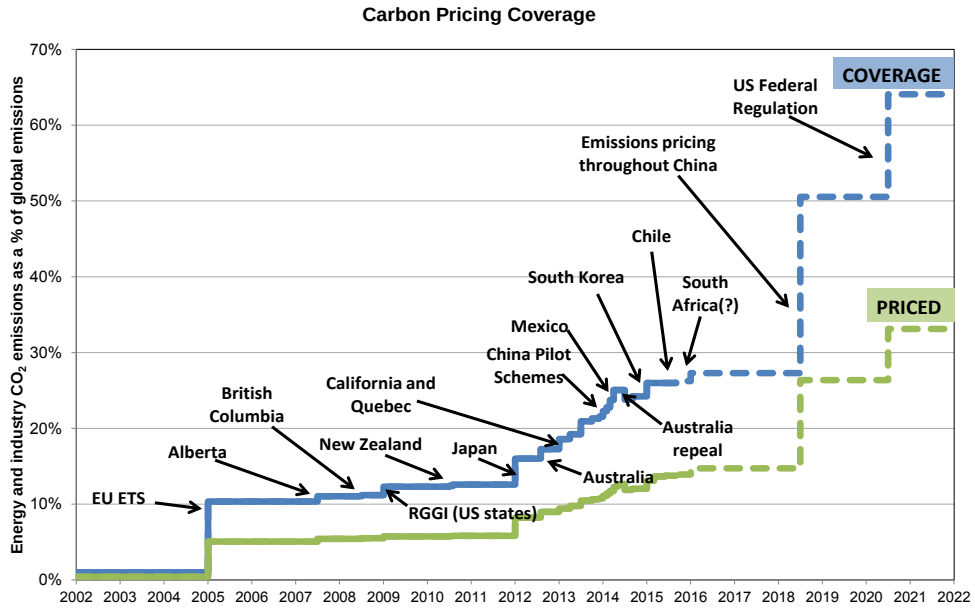
2.3.3 Reliance on CCS and no material global policy progress

The IEA in the quote above also acknowledging that it has overestimated the progress of new largely unproven carbon, capture and storage (CCS), a technology that remains commercially unviable. The IEA also admits that if CCS is not proven to be commercially viable, global governments will inevitably need to take more radical action on climate change, and that this will, by definition, result in a significant decline in coal use, as per the IEA 450 Scenario that sees global coal demand decline 30% by 2035.

The US Department of Energy cancelled its pivotal US$1bn of financial support for the FutureGen CCS plant at Illinois in February 2015 due to the timetable not being adhered to.[83]

The US China Climate Agreement announced in November 2014 reflects the two largest countries in the world's joint acknowledgement of the need for a dramatic acceleration of action on climate change to reduce carbon emissions. Figure 9 details one forecast of the rate of progress on pricing and emissions plans coverage over the 1990-2020 period.

Figure 9: Global regulatory progress on carbon



Source: www.onclimatechangepolicy.org

[83] http://www.eenews.net/stories/1060012843

24

2.4 India will not be the saviour of the global seaborne coal market

India's Energy Minister Piyush Goyal made an unprecedented announcement on 12th November 2014.[84]

> *"I'm very confident of achieving these targets and am very confident that India's current account deficit will not be burdened with the amount of money we lose for imports of coal. Possibly in the next two or three years we should be able to stop imports of thermal coal."*

Where as the financial markets are now increasingly forecasting a peak in coal demand for China, this comes at a time when India is now looking at a massive electricity system transition that could see India's need for imported thermal coal decline materially by 2020.

Plans for the transformation of the entire Indian electricity system include the 100GW of renewable energy installs by 2019. This involves a plan to treble wind installs to 6-8GW and lifting solar installs tenfold to 10GW annually, plus a US$50bn national grid upgrade. In addition, Minister Goyal announced plans to double India's domestic coal production to 1Bn tpa by 2019, requiring a massive investment in rail infrastructure, coal handling and preparation plants plus major new mine development. The consequence for the global seaborne thermal coal market is dire, given India has long been held out as the new source of import demand, particularly coupled with China returning to being a possible net exporter, as forecast by Bernstein and Goldman Sachs.

As per page 4 of the Joint Experts Report, Jon Stanford suggests that Energy Minister Goyal's comments are merely aspirational and not firm policy. However, Energy Minister Goyal gave a long interview in February 2015, clearly stating his aversion to India continuing to import thermal coal and imported coal's total lack of cost-competitiveness:

> *"We cannot create a situation where coal is in short supply and power tariff shoots through the roof. … At no point of time do I feel that imported coal will work except at two or three plants that are in the coastal areas. While we had this major power requirement and shortage of coal, I did a study and found that there were very few plants dependent on imported coal or were situated on the coast."*[85]

[84] http://in.reuters.com/article/2014/11/12/india-coal-imports-idINL3N0T234F20141112
[85] http://www.frontline.in/economy/there-is-no-intention-to-denationalise-coal-india/article6847880.ece?homepage=true

3. Additionality

In the Joint Experts Report on page 9, Jon Stanford cites that the Carmichael mine will have no impact on global coal demand, that if not from the Carmichael mine, it will just come from somewhere else. This is a key area of disagreement in that it ignores the global scale of the Adani Group proposal, currently the single largest new coal proposal in the world. Fundamental economic theory teaches us that increasing supply will, everything else being equal, lower the price and hence increase demand.

3.1 Individually the Carmichael mine at peak production adds 60Mtpa of coal, a 6% expansion of global seaborne thermal coal trade

The IEA quotes global seaborne thermal coal market at 923M tonnes in 2013,[86] with trade flat to down overall in 2014. So the addition of the single Carmichael coal mine proposal would individually add peak coal production of another 60Mtpa, a 6% expansion of global supply from a single project.[87] Evaluating Stage I in isolation would put this at 34Mtpa or 3.7%, but I note the reduced economies of scale will further stress the assumption of commercial viability, an assumption I contest already without this latest loss of scale proposed. This Galilee project is one of the largest thermal coal project proposals currently under development globally, in large part due to the sustained oversupplied nature of the market that is resulting in the continued weakness in the thermal coal price to around US$58/t in January 2015.

[86] IEA "Coal Medium Term Market Outlook 2014", page 118.
[87] 60Mtpa on global seaborne trade in 2013 of 923M tonnes is 6.5%. The BFS states Adani Mining has a proposed Stage I of Carmichael at 34Mtpa, lowering this to 3.7%, but I have evaluated the project in its entirety consistent with the SEIS.

3.2 By opening the Galilee, Carmichael will facilitate the development of up to 282Mtpa of new thermal coal, a 30% global expansion

The successful development of the Carmichael coal project would act as a project enabler for up to eight other greenfield thermal coal projects across the Galilee with a total capacity of 282Mtpa – refer to Figure 10. This reflects the first mover 'disadvantage' of having to build greenfield infrastructure to open up the region. The mines that follow will be better able to leverage the Adani Group's infrastructure once built as part of Adani's commitment to facilitate common user access rights. Adding 282Mtpa of new supply equates to 30.6%.[88]

Figure 10: The Galilee Coal Basin - Proposed Projects

Owner	Project	Type	Status	Targeted net coal output Mtpa	Capex (A$bn)
Adani Group (India)	Carmichael Coal	Open cut & U/G	SEIS complete	60	15.0
GVK Coal (India)	Alpha	Open cut	EIS complete	30	10.0
	Alpha West	Underground	PFS	30	
	Kevin's Corner	Open cut & U/G	EIS complete	20	4.2
Waratah Coal P/L (Clive Palmer)	China First	Open cut & U/G	EIS active	40	8.8
Resolve Coal	Hyde Park	Open Cut	Pre-EIS	10	n.a.
AMCI Group & Bandanna Energy Ltd JV	South Galilee Coal	Open cut & U/G	EIS active	17	4.2
Macmines Austasia Pty Ltd (1)	China Stone	Open cut & U/G	EIS being prepared	45	n.a.
Vale SA (Brazil)	Degulla	Open cut & U/G	Pre-EIS, for sale	30	8.0
Galilee Basin - Total				**282**	**50.2**

(1) Owned by the private Chinese family business, the Meijin Energy Group.

3.3 Increased supply will lower the equilibrium price of coal and increase demand, given price elasticity of demand

Particularly in the context of the structural decline in global demand for seaborne thermal coal, opening up the Carmichael mine will add 34-60Mtpa of new capacity, a 4-6% global expansion. Further, this is likely to enable additional Galilee projects to come onstream, boosting global supply by up to 282Mtpa or a 30% expansion. This could see the equilibrium thermal coal price decline materially, driving up seaborne coal demand due to lower prices whilst at the same time further eroding existing Australian thermal export oriented miners' profitability.

My analysis of the Wood Mackenzie global seaborne coal cost curve database[89] and analysis of the financial accounts of global coal majors like Peabody Energy shows that the average Australian thermal coal mine is operating at not much above gross cashflow breakeven, such that further price erosions will likely see mine closures as a result. Both of these factors will also reduce the likely net employment gains from the Carmichael mine for Australia overall.

[88] 282Mtpa divided by global 2013 seaborne trade of 923Mt is 30.6%.
[89] http://www.carbontracker.org/report/carbon-supply-cost-curves-evaluating-financial-risk-to-coal-capital-expenditures/

4. The Contention That Coal Alleviates Poverty

An area of disagreement in the Joint Experts Report is evident on page 9 where Jon Stanford repeats the claim that coal can lift people out of poverty. This spurious contention is in fact an unsubtle marketing spin presented by Peabody Energy in its 'Advanced Energy for Life" campaign.[90]

4.1 'All Talk No Action'

The Australia Institute Report of November 2014 - '*All talk, no action: the coal industry and energy poverty*' systematically dismantles any suggestion that "coal is good for humanity" or helpful in alleviating poverty – refer to Appendix B.[91]

The problems of energy poverty are real and large. Promising solutions are becoming available and many organisations are working to hasten their implementation. The coal industry is very vocal in promoting energy poverty and pushing coal as a solution to it. But 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.

Providing expensive new coal-fired power generation capacity will do nothing for the very poor people of India or Africa that are not connected to the electricity grid, and who could not generally afford to pay for the electricity even if they were able to access it. Distributed solar and micro grids are the tangible solutions being pursued by the new Indian Government.

4.2 Indian Electricity Prices

In practical terms, IEEFA's '*Indian Electricity Price'* report of May 2014[92] highlights that the electricity sourced from imported thermal coal is likely to generate wholesale electricity at a price of Rs5-6/kWh, double the historic price of domestic coal-fired power prices in India, and well above the Rs4-5/kWh of wind and the Rs3-5/kWh for hydro. Utility scale solar electricity prices have fallen some 60-70% over the last three years, such that the latest solar capacity tender had a peak price cap of Rs5.50/kWh. Combined with the inflationary impact of electricity sourced from imported coal, the IEEFA analysis highlights that if fact imported thermal coal into India is the most expensive fuel source.

As discussed in section 2.4 above, Indian Energy Minister Goyal has clearly articulated the adverse economics of imported coal fired power plants for the country, hence his focus on "*Possibly in the next two or three years we should be able to stop imports of thermal coal*."[93]

[90] http://www.peabodyenergy.com/Investor-News-Release-Details.aspx?nr=816 ; https://www.advancedenergyforlife.com/
[91] http://www.tai.org.au/content/all-talk-no-action-coal-industry-and-energy-poverty
[92] http://ieefa.org/briefing-note-india-power-prices/
[93] http://in.reuters.com/article/2014/11/12/india-coal-imports-idINL3N0T234F20141112

Closing Statement

I confirm the following:

(a) the factual matters stated in the report are, as far as I know, true;

(b) I have made all enquiries considered appropriate;

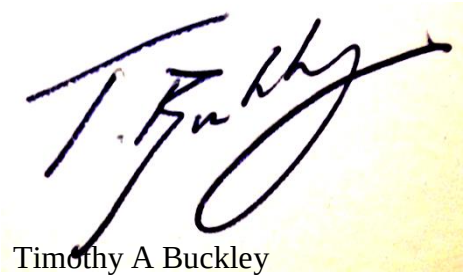
(c) the opinions stated in the report are genuinely held by myself;

(d) the report contains reference to all matters I consider significant;

(e) I understand the duty of an expert to the court and have complied with that duty;

(f) I have read and understood the Land Court Rules 2000 on expert evidence; and

(g) I have not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.

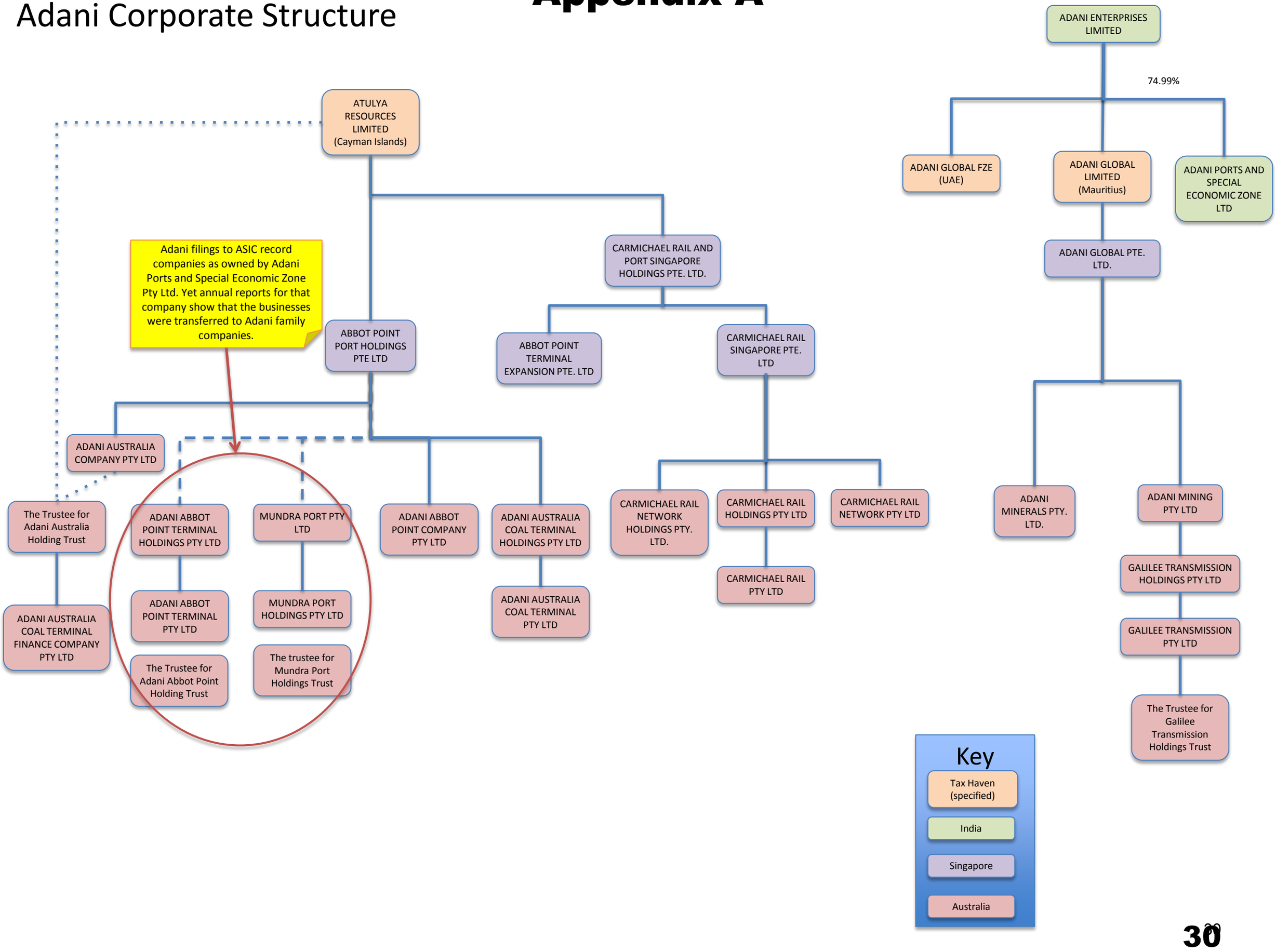


Timothy A Buckley

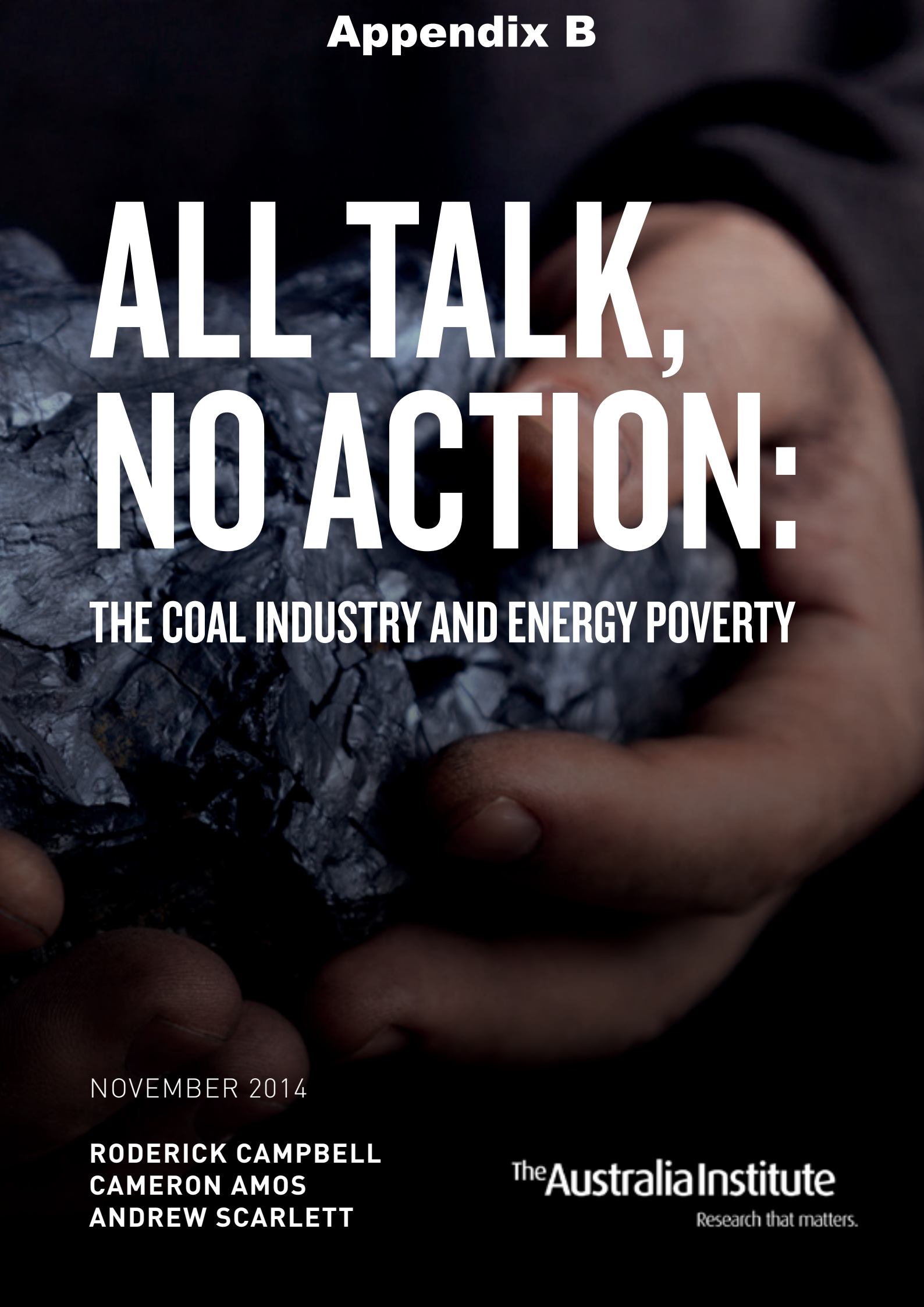
9 February 2015

Appendix A

Adani Corporate Structure



Appendix B



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

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:

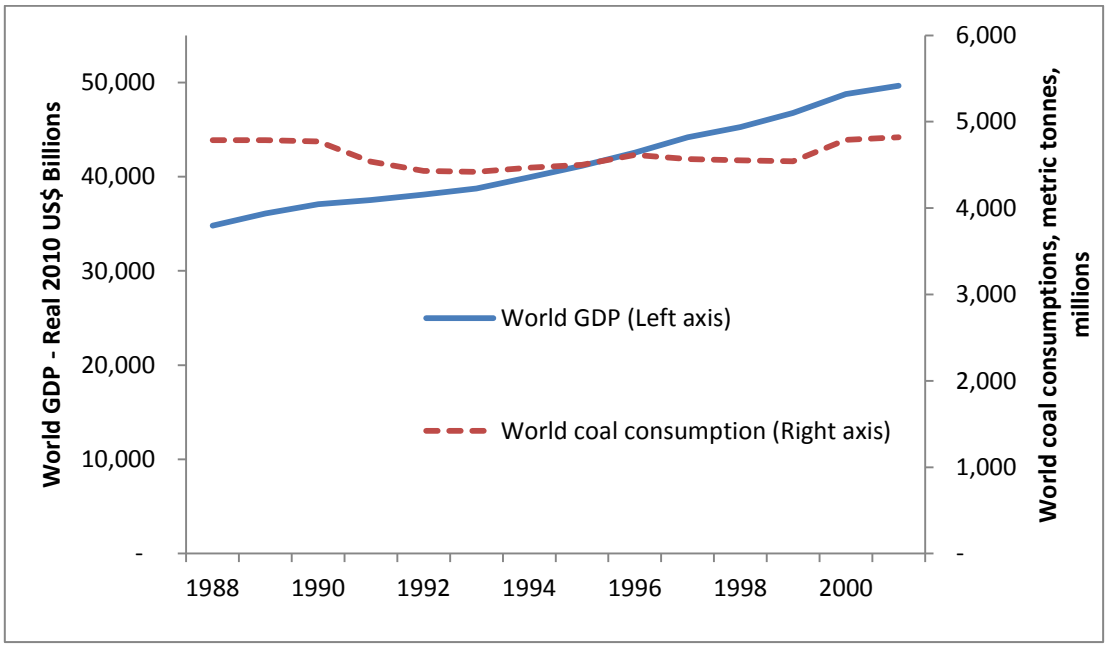
Claim 1: Coal use drives world economic growth

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*

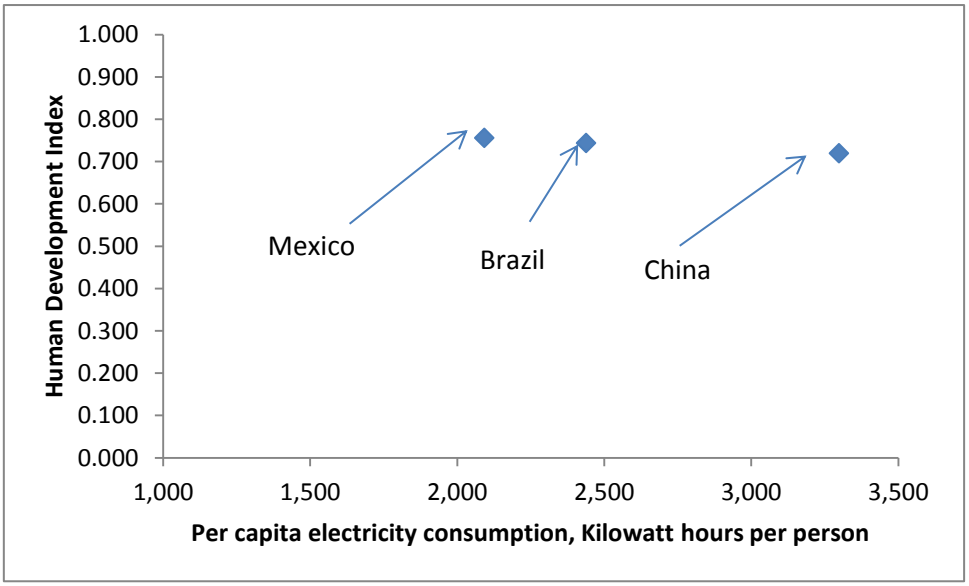
Further analysis of official data shows that developed countries have reduced coal use while economic growth has been unaffected. Developing countries are now the major coal users, but with alternatives becoming cheaper, they are likely to reduce coal use much earlier in their development.

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:

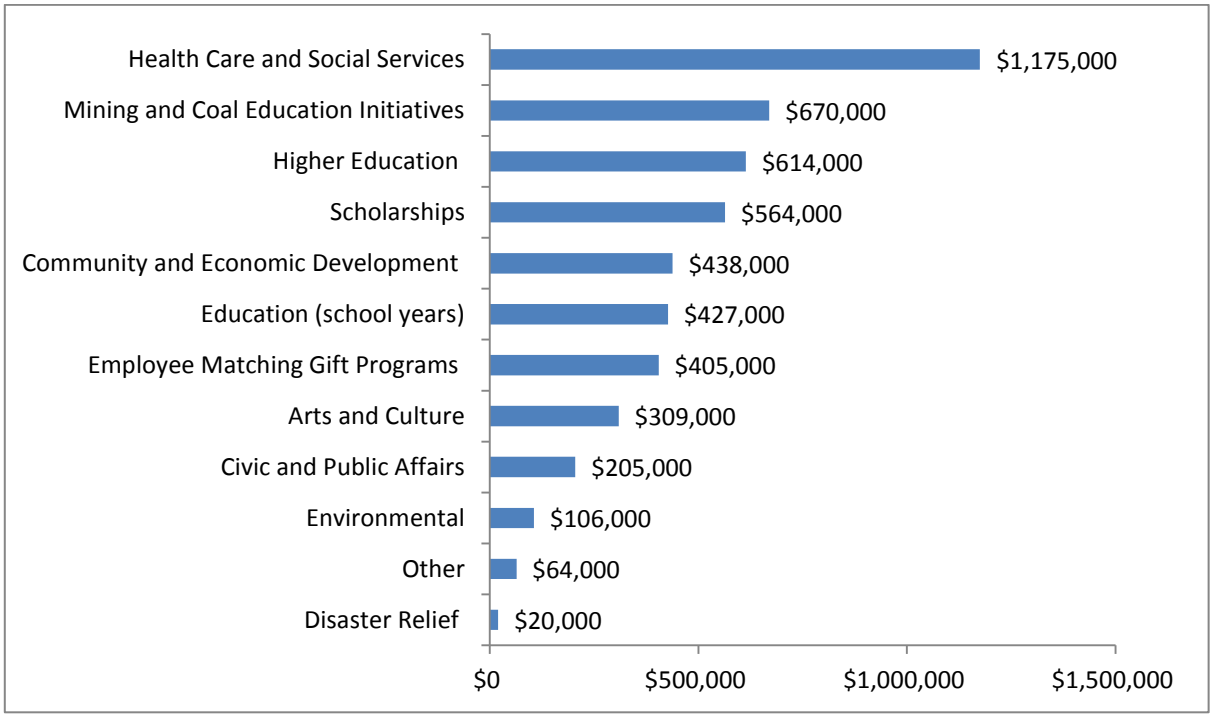
> *The goal of the Advanced Energy for Life campaign is simple: to end energy poverty and increase access to reliable, low-cost electricity around the world. To achieve this goal, we recognize that the world needs all forms of energy – particularly greater use of clean coal. Clean coal has the power 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]

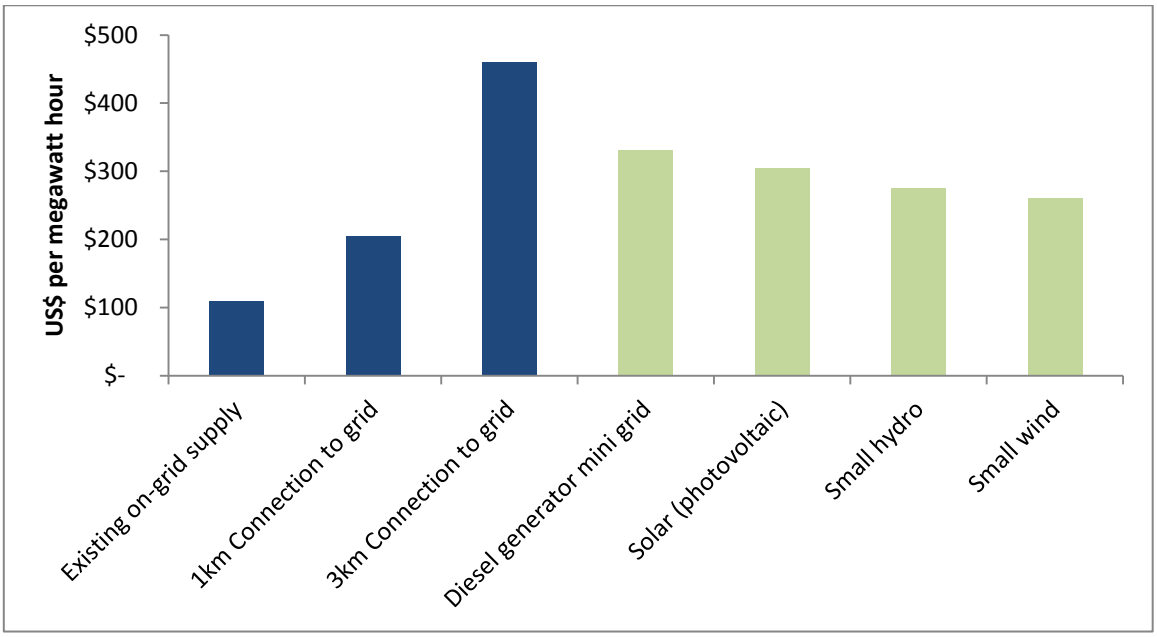
Coal-fired power has no comparable small-scale, low cost electrification option.

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]

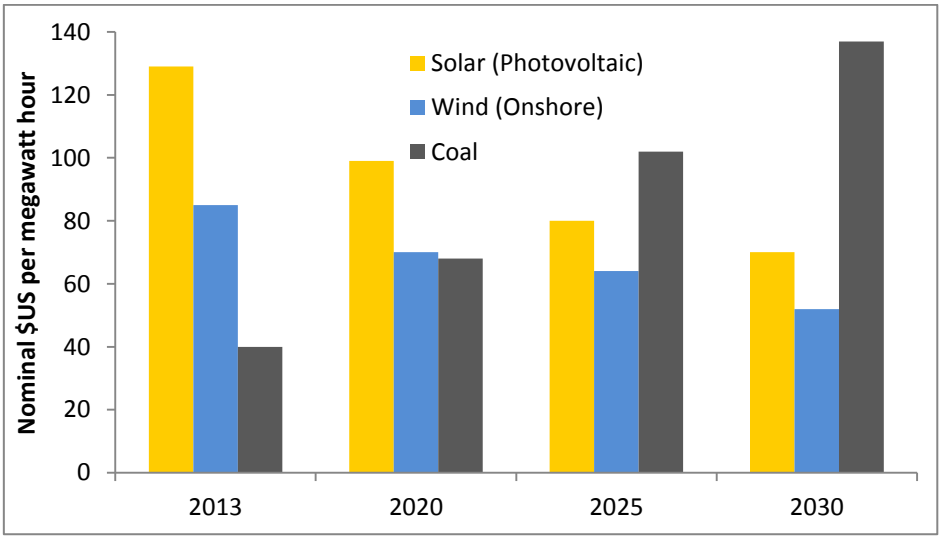
India's experience shows that increasing the amount of coal-fired generation into a grid does not necessarily improve access to energy services for poor people. While coal-fired generation can clearly play a role in providing electricity to the world's growing urban middle classes, coal's ability to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

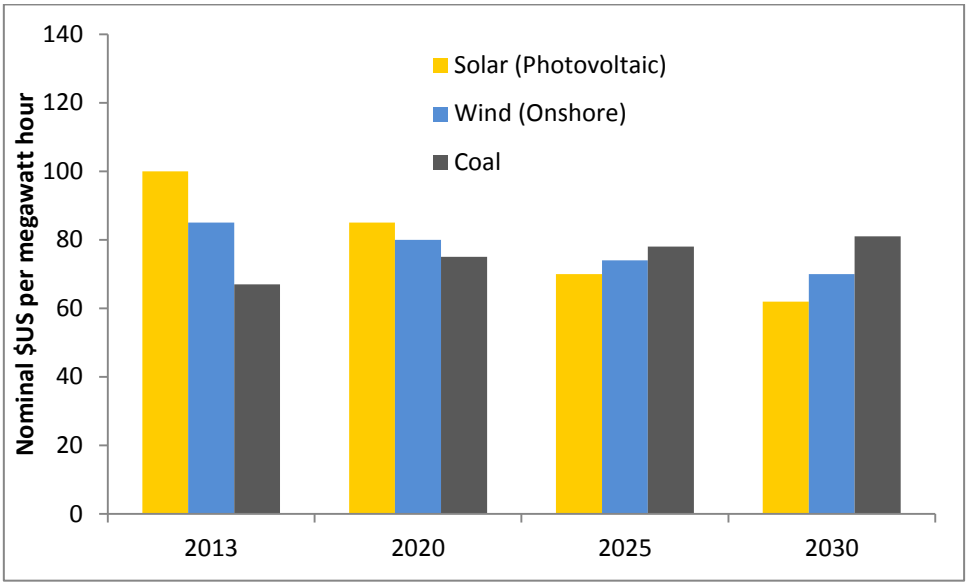
[43] IEA (2014)
[44] (Vasudha Foundation, 2014) p12

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.

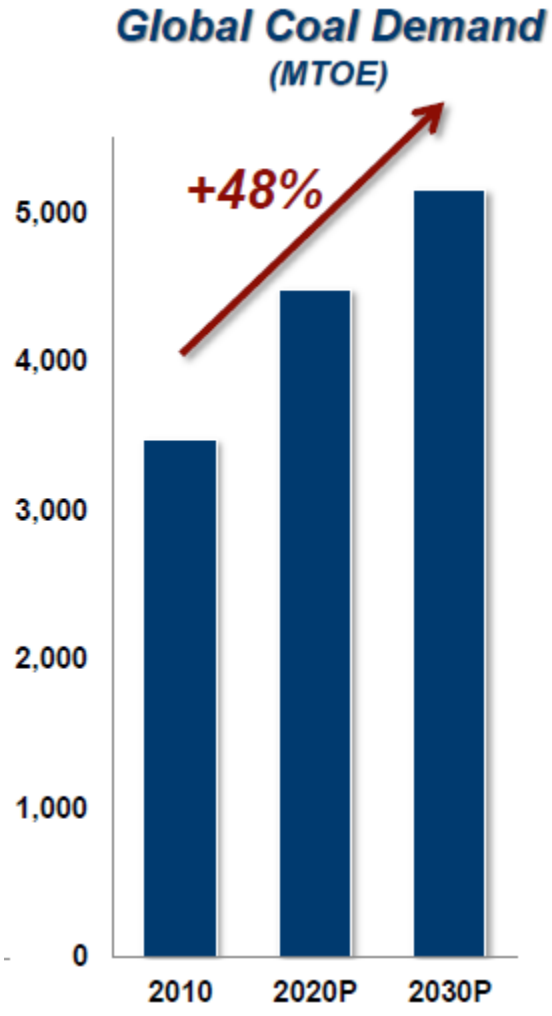
Assessing the claims of Peabody Energy on energy poverty

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:

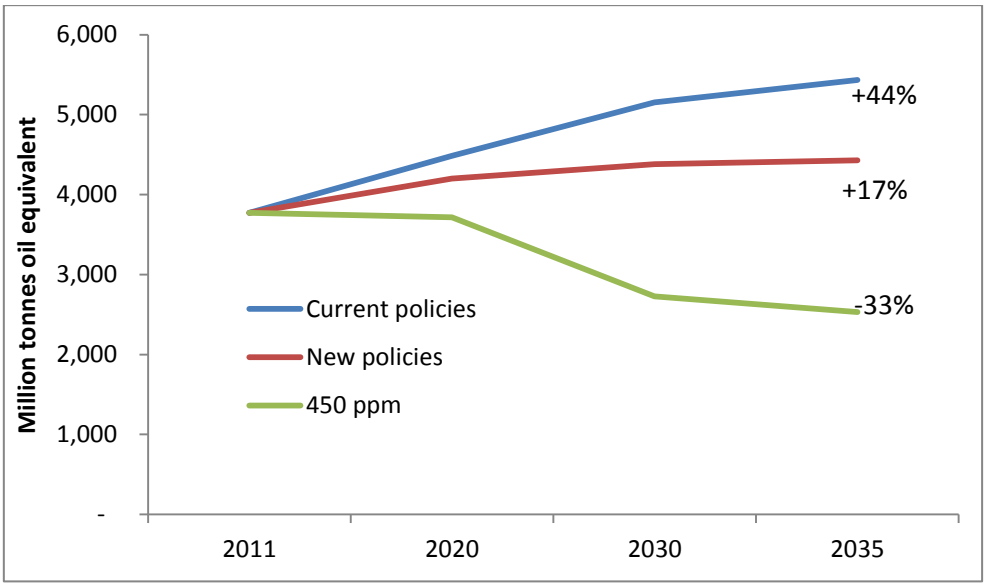
Figure 5: Forecast of world coal demand



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]

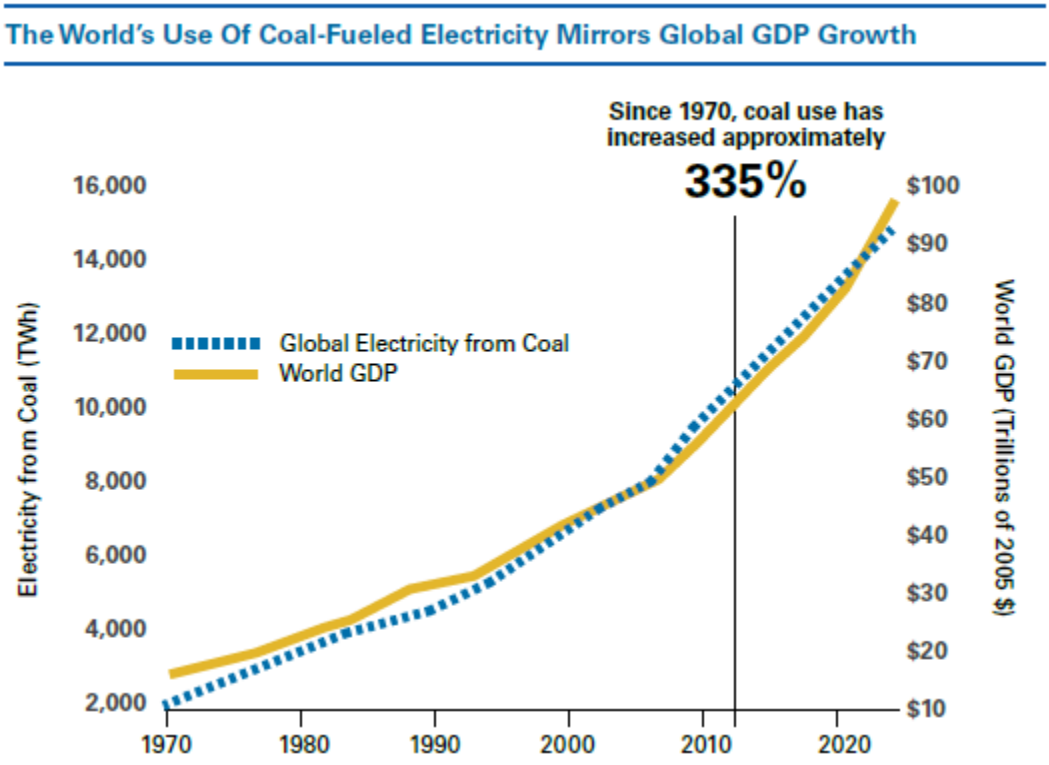
Coal is a significant catalyst for economic growth, powering both the largest and best global economies.[53]

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]

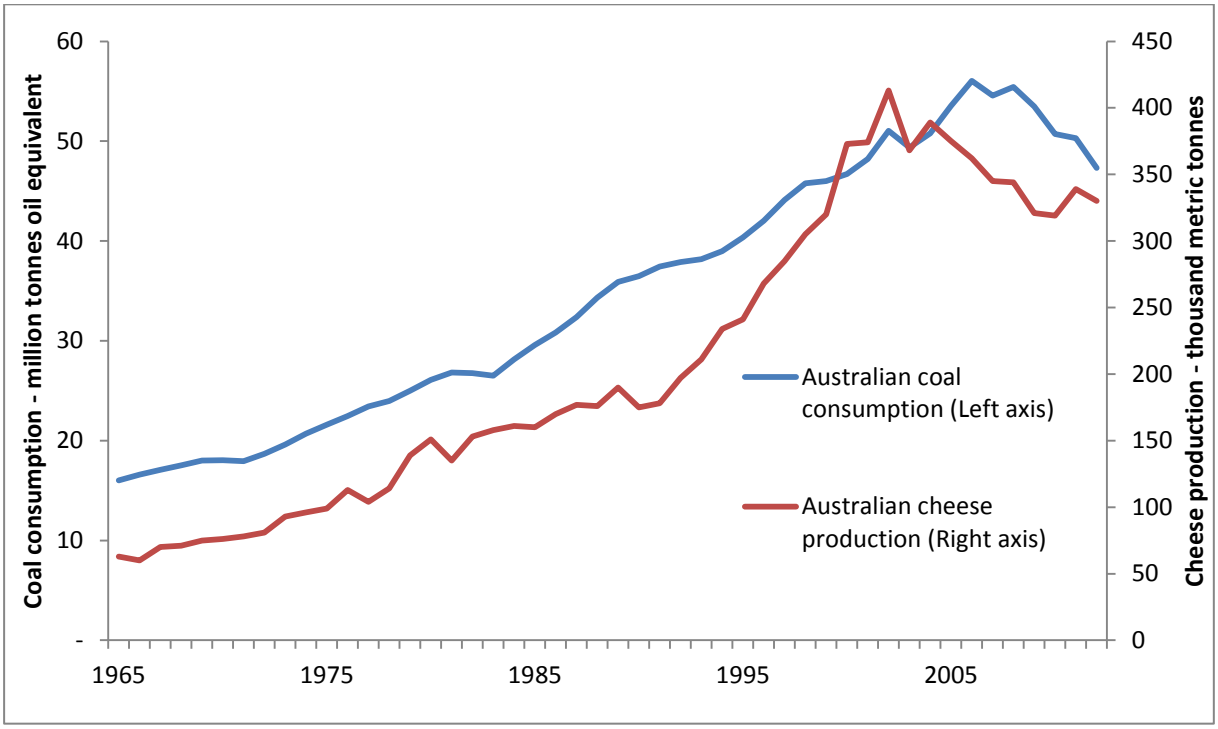
In making claims that coal "drives", "delivers", "fuels" or "catalyses" economic growth, Peabody mistakes causation with correlation. It is not coal use that causes economic growth;

[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]

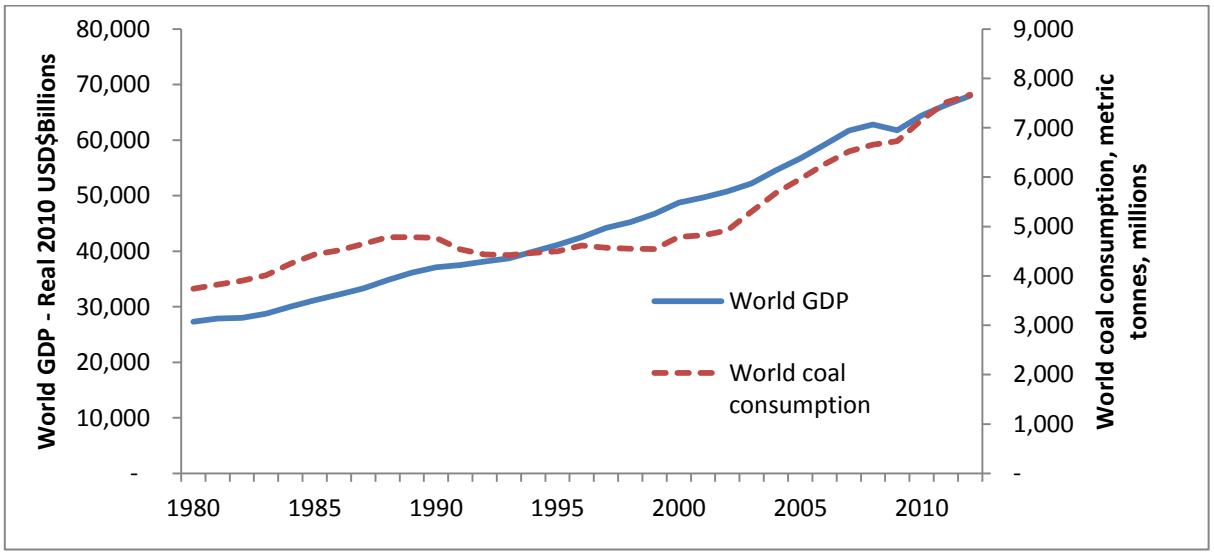
These examples show that it is important to distinguish trends that are correlated, from the factors which are causing the trends. Correlation does not equal causation. Peabody is

[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



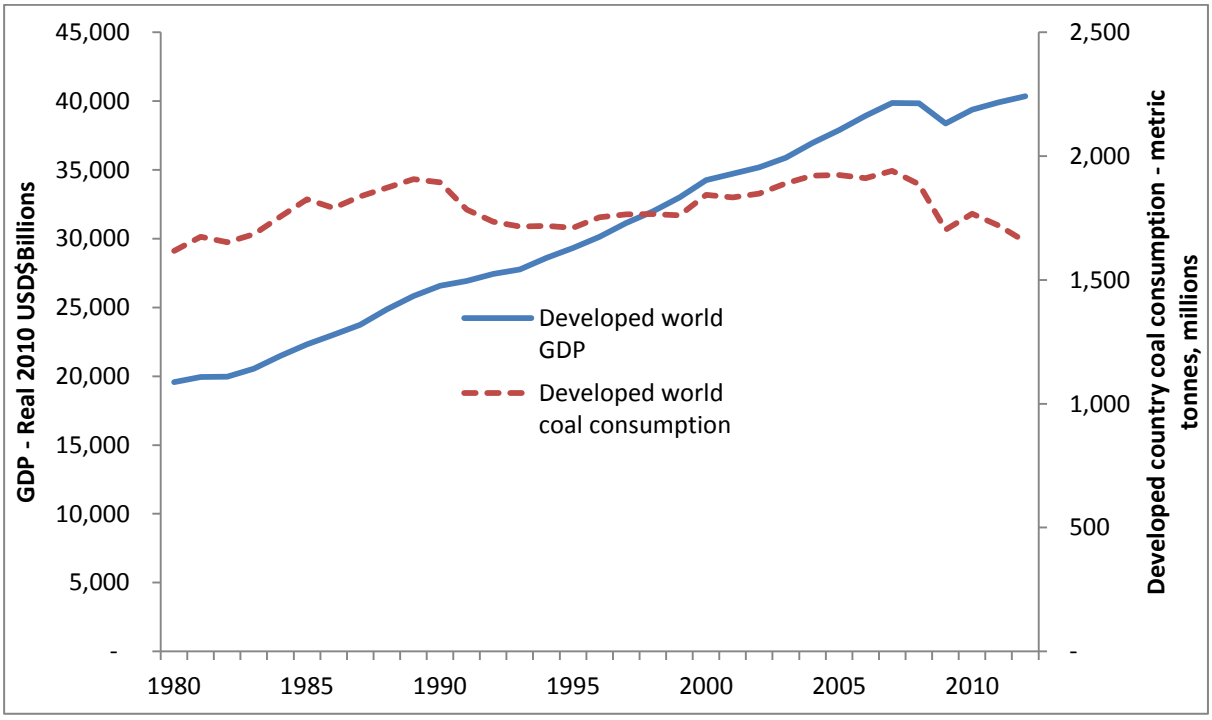
Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset*, United States Energy Information Agency (2014) *International Energy Statistics*

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



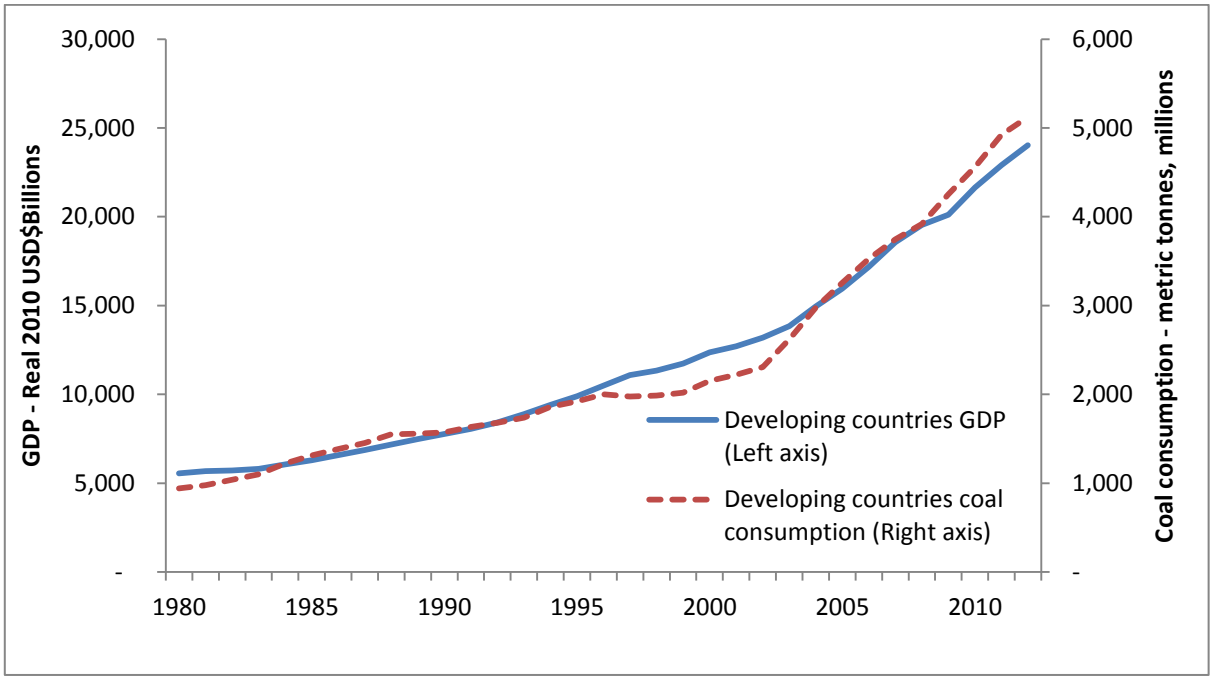
Sources: United States Department of Agriculture Economics Research Service (2014) *International Macroeconomic Dataset,* United States Energy Information Agency (2014) *International Energy Statistics*[58]

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.

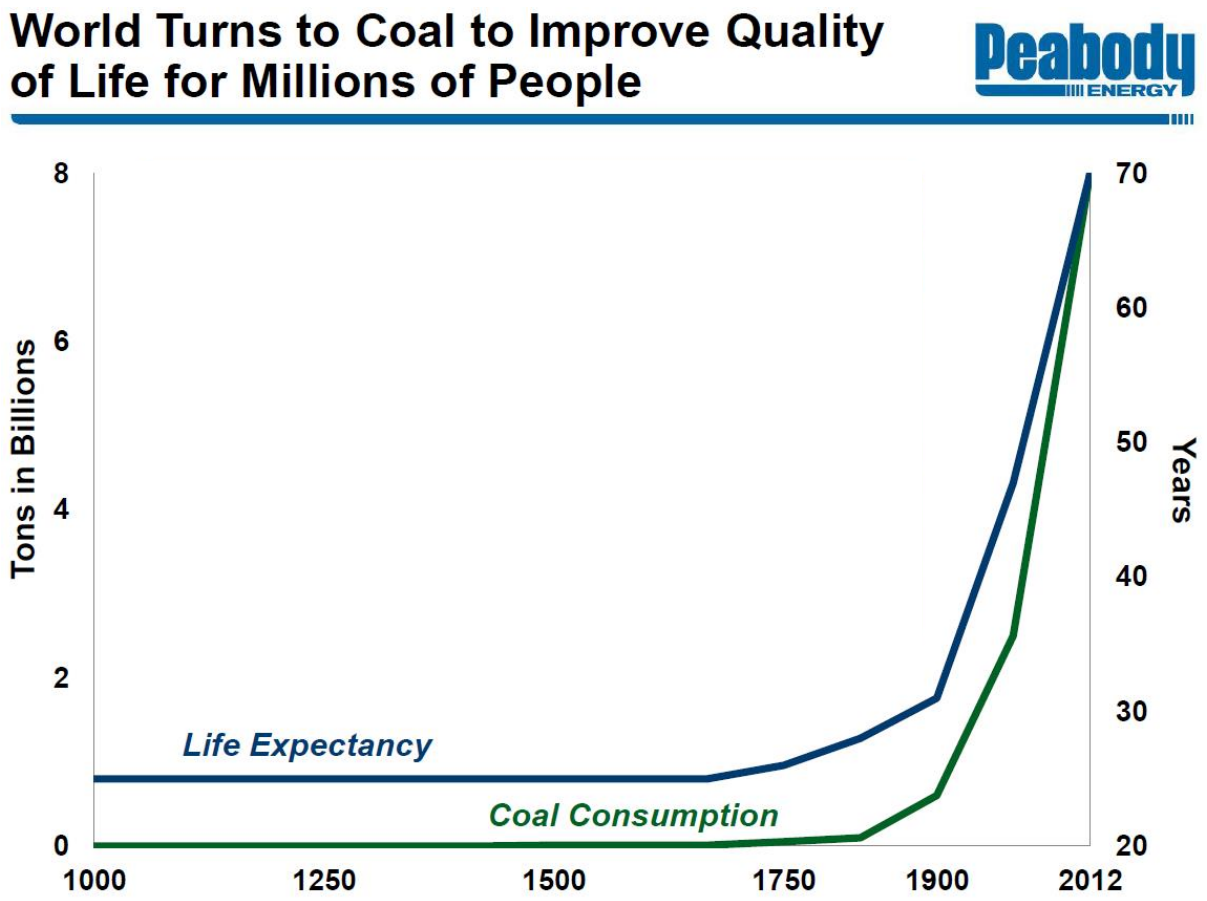
Claim: coal use increases life expectancy

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]

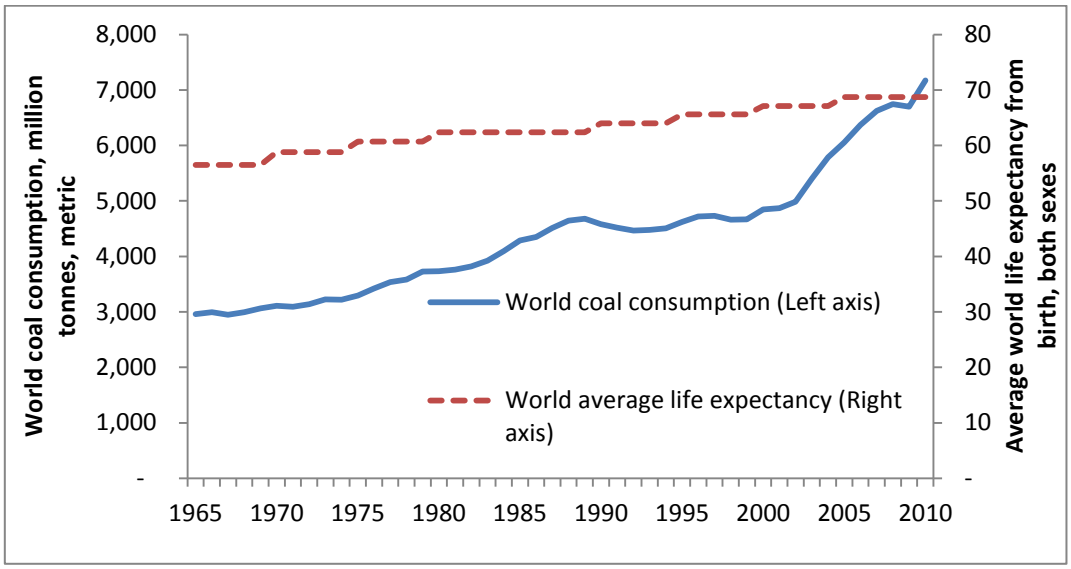
- Burning coal contributes to climate change, which has major implications for human health through impacts on air quality, drinking water, food security and access to secure shelter. The World Health Organisation estimates that between 2030 and 2050 climate change will cause an additional 250,000 deaths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

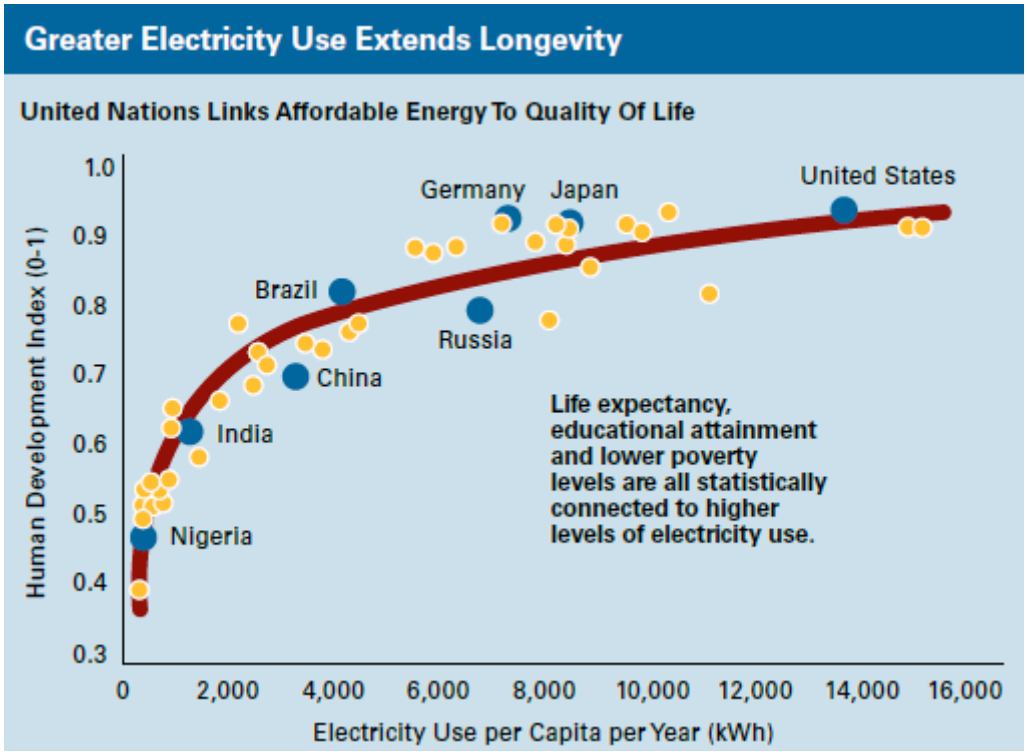
Claim: coal use improves quality of life

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:

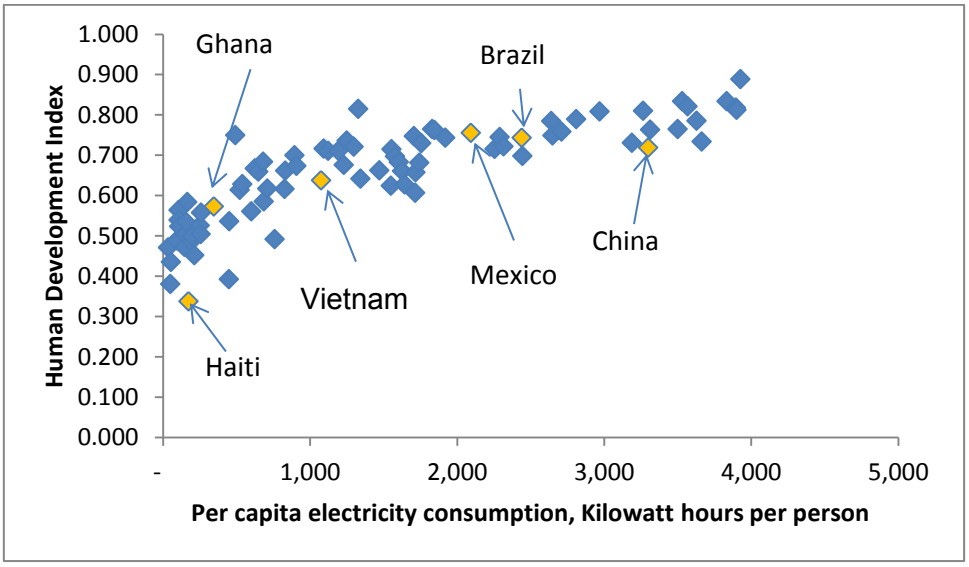
Figure 14: Peabody Energy chart - Human Development Index and electricity consumption



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:

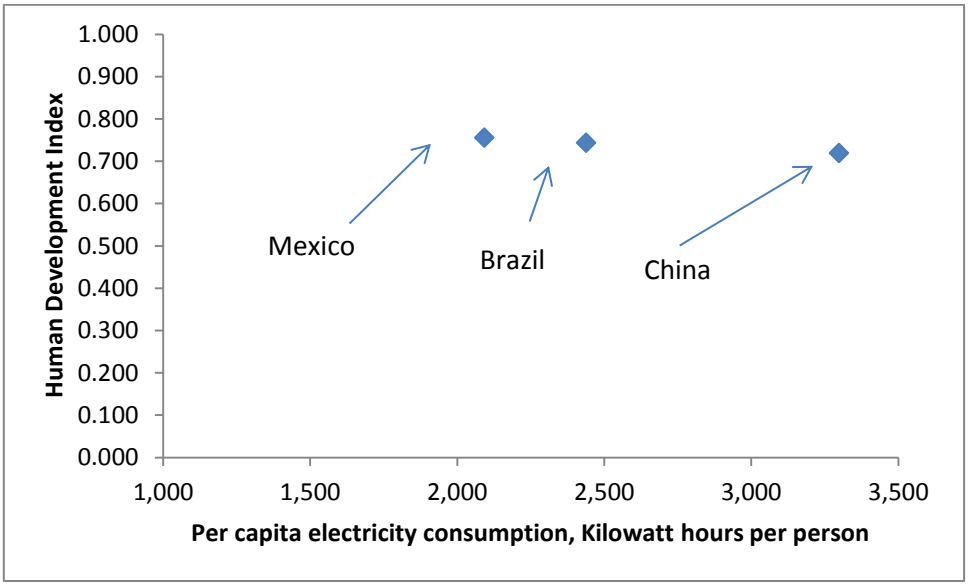
Figure 15: Human Development Index and electricity use up to 4,000 kWh/capita/year



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



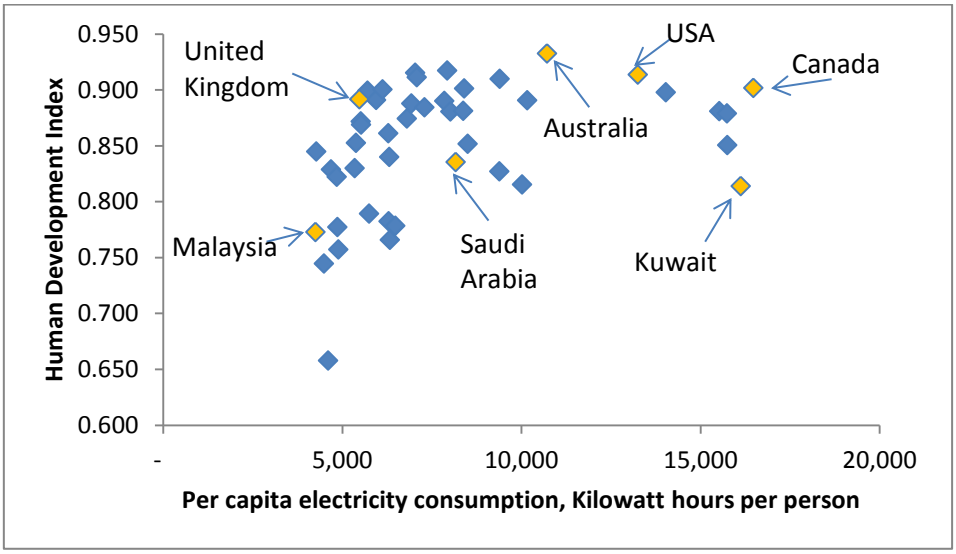
Sources: United Nations Development Program (2014) *Human Development Reports*, World Bank (2013) *Electric power consumption*

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*

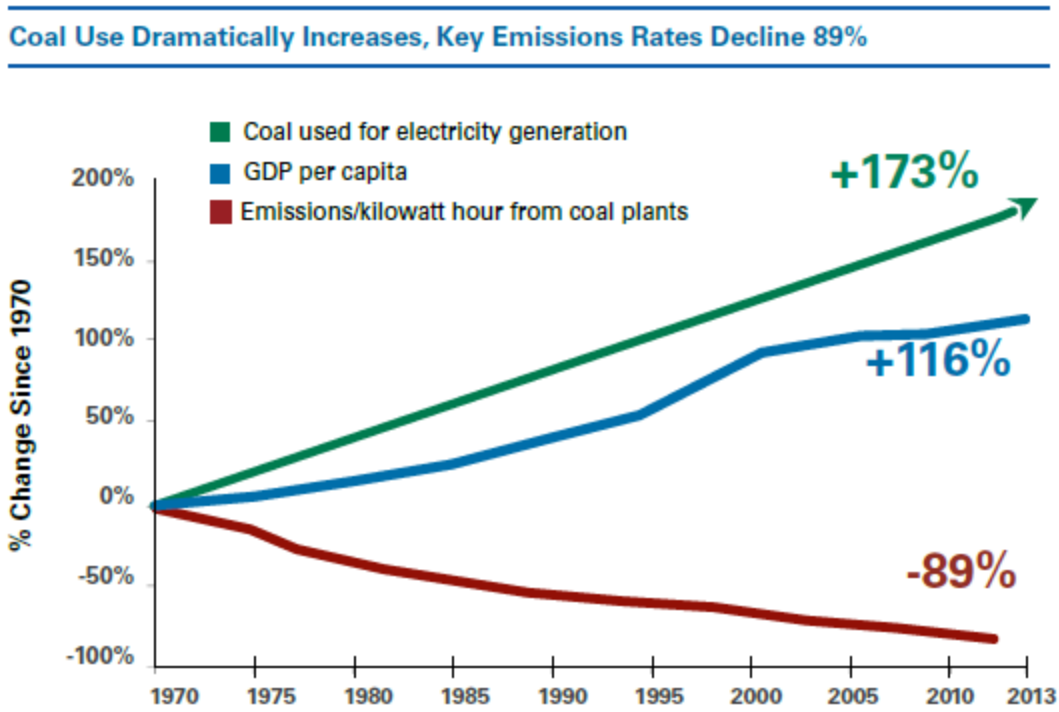
Figure 17 shows that while the UK and Malaysia use similar amounts of electricity per person, the UK scores much higher on the HDI than Malaysia. Canada and Kuwait also use similar amounts of electricity per capita but Canada scores much higher on the HDI. Both Australia and the USA use less electricity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

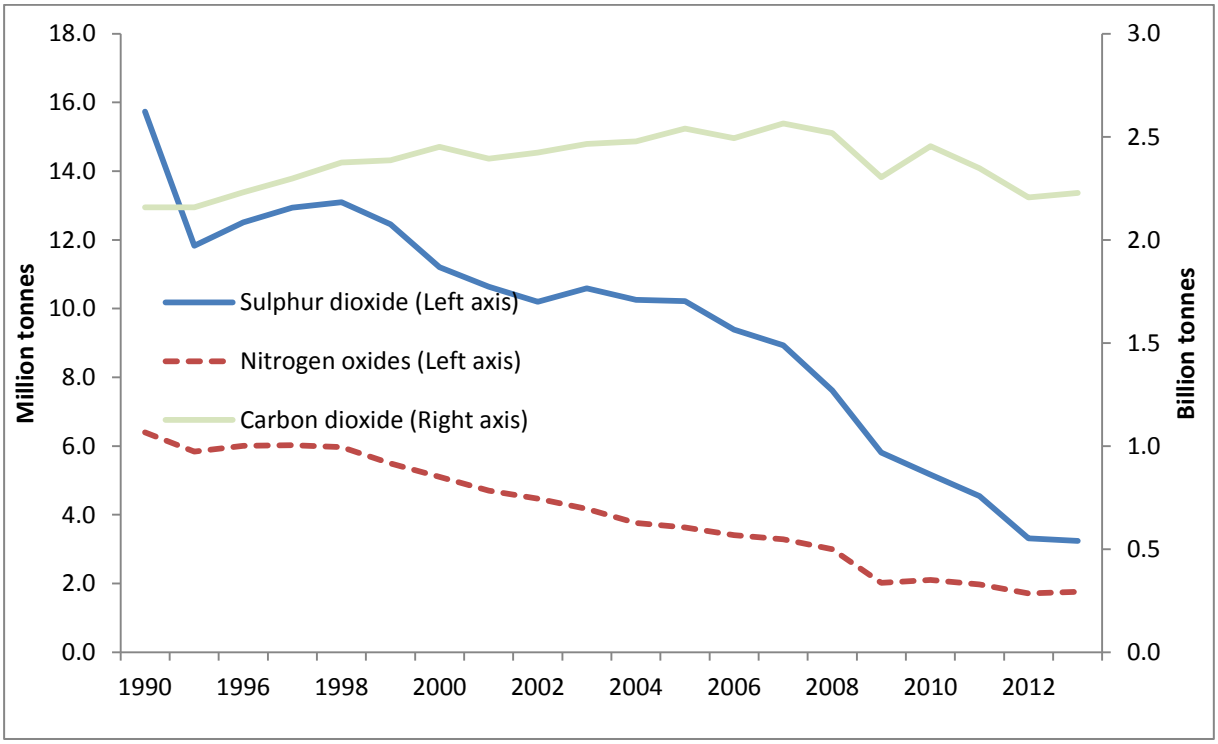
Figure 18 purports to show that since 1970 coal use for electricity in the USA has increased by 173 per cent and that GDP per capita has increased by 116 per cent, while at the same time emissions from coal-fired power plants have decreased by 89 per cent on a per kilowatt basis. Variations on this chart 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/