BRIEFING NOTE

INDIAN POWER PRICES

May 6 2014

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IEEFA BRIEFING NOTE- INDIAN POWER PRICES

MAY 2014

In this briefing note, the US Institute for Energy Economics and Financial Analysis (IEEFA) provides a review of the cost disparity between domestic and imported thermal coal—fired power generation in India. The required wholesale power price for imported coal is prohibitive relative to domestic coal or renewable energy. The proposed new coal generation plan is showing signs of significant financial stress and is likely to deliver far lower than expected levels of new supply over the next five years.

Financial Modeling Shows Using Imported Coal from the Galilee Basin in Australia for Indian Power Generation is prohibitively expensive

Financial modeling shows the cost of imported Galilee coal-fired power generation in India is double the current average wholesale cost of electricity. Renewables are a lower cost, cleaner solution, particularly when the deflationary impact of wind and solar is incorporated.

Executive Summary

- The Government of India (GoI) introduced a partial privatisation of the generation sector over 2006-2009, initiating a series of tenders for the construction, ownership and operation of large scale thermal power plants, including the 4 Gigawatt (GW) Ultra Mega Power Projects (UMPP).
- The power purchase agreements (PPA) underpinning the coal-fired UMPP were generally priced at Rs2-3/kWh for terms of up to 25 years, with at best partial inflation indexation.
- Many of these huge power plants have been unable to source discounted domestic Indian market supplies of coal. This leaves two equally unappealing options – operating well below designed utilisation rates, and/or sourcing significantly more expensive imported coal.
- In 2010 Adani Enterprises Ltd (Adani) acquired the Carmichael Coal deposit, and in 2011 the GVK Group (GVK) acquired the Alpha, Alpha West and Kevin's Corner Coal thermal coal mining proposals in the Galilee Coal Basin in Queensland Australia. IEEFA analysis shows that both projects are likely to prove uncommercial.
- This financial modeling project evaluates the required wholesale electricity off-take pricing required to justify the importation of coal into India from the Galilee Basin. We model the cost structure of a new 4,000 megawatt (MW) power plant to be built in coastal India, taking into account 100% imported thermal coal sourced from the Galilee.
- We estimate that a PPA of Rs5.4-5.70/kWh would be required, plus price indexation of 4% pa to justify the construction of such a US$4bn coal-fired power project.
- This is double the last reported average sales price of electricity across India of Rs3/kWh and treble the domestic coal-fired power PPA signed over recent years.
- Wind, solar and hydro facilities can be built faster and / or at lower PPAs. Additionally, the use of renewable energy incorporates a zero fuel cost, such that there is an inbuilt deflationary driver – i.e. zero indexation. Given the recent drive by the Reserve Bank of India (RBI) to prioritise the sustained reduction in inflation, renewables support a series of GoI / RBI targets. Importing thermal coal achieves none of these goals, and more likely contradicts them.

The Ultra Mega Power Projects

Privatisation of the Power Generation Sector

Faced with the prospect of a significant rise in electricity demand, from 2004 onwards the Government of India (GoI) renewed its focus on a partial power sector privatisation. This program involved putting out to private market tender a large number of electricity power purchase agreements (PPA), most priced in the range of Rs2-3/kWh. Many Indian firms diversified into the coal and gas-fired power generation sector on the back of US$1-4bn commitments to build greenfield power plants. The GoI launched its Ultra Mega Power Projects (UMPP), that involved building massive 4.0 GW coal-fired power generators on a single site.[i]

25 Year PPAs at Rs2-3/unit

A key aspect of this large scale coal-fired power expansion was the contractual agreement to supply power at the tendered price for up to 25 years. Examples include:

1. Reliance Power has signed PPA at Rs 3.70 with UP Discoms and Rs 2.50 with MP Discoms for the Chitrangi Thermal Power Plant.
2. Reliance Power's 3,960MW Sasan UMPP with a mine pit head location signed a Rs 1.20 per unit PPA with this project being progressively commissioned over 2013/14.[ii] [iii]
3. Reliance Power has signed PPA at Rs 2.33 for its 3,960MW Krishnapatnam UMPP.[iv] Reliance Power suspended work at the Krishnapatnam project in 2011, stating that the fuel supply at benchmark prices made the project unviable and lenders were unwilling to fund the plant.
4. Abhijeet Group has signed a PPA at long term fixed rates of Rs 2.60-3.50 for its Chandwa Thermal Power Plant and another 33 year PPA at the initial rate of Rs 2.97 for its 272MW Mihan Thermal Power Plant.[v]
5. East Coast Energy Pvt Ltd has signed a PPA with AP Discoms at Rs 2.97 for its Kakrapalli Thermal Power Plant.[vi]
6. Adani Power's Mundra coal-fired plant had two PPAs with Gujarat – one at Rs2.35 for 1,000 MW power supply, and one for Rs2.89/unit for 1,000 MW plus two PPAs for Rs2.94/unit with two Haryana utilities for total capacity of 1,424 MW, with supply due to commence progressively over 2010-2013.
7. Adani Power's 1,320 MW Tiroda coal-fired power plant signed a PPA for Rs2.64/unit commencing Aug'2012.
8. Tata Power's 4,000 MW power plant at Mundra at Rs2.26/unit for 25 years.[vii]

Long term PPAs with Little Inflation nor Currency Protection

The PPA contracts were generally long term in nature (15-25 year terms) and included little scope for price indexation to cover for inflation. At the time, the associated fuel (coal and gas) was expected to be supplied predominantly from domestic Indian sources. However, even where there was an expectation that some imported coal would be required to balance supply sources, the presumption was that cheap coal supplies could be sourced from Indonesia, often via captive partly owned greenfield coal mine developments. With Indonesia implementing coal export taxes, Tata Power looking to sell its Indonesian coal JV[viii] and Adani Enterprises' consistently unable to deliver on its Indonesian production goals, this strategy is being reconsidered. Signatories to these contracts were not provided tied coal supply agreements nor protection from exchange rate volatility. This last issue was then compounded by UMPP financings often being denominated in US$.

Loss-making Power Companies

Unable to source sufficient domestic thermal coal, these power companies have been faced with the dilemma of either running their coal-fired power plants at well below optimal utilisation rates, and / or sourcing expensive US$ denominated imported thermal coal.[1] Either choice has resulted in many of the private listed power companies reporting operating losses over a sustained period of time. For example, Adani Power reported a loss of US$87m in the Dec'2013 quarter. GVK Power & Infrastructure Ltd (GVK) reported a loss of US$7m and Tata Power lost US$12m in the Dec'2013 quarter.[ix]

Vertical Integration into Coal Mining – An Expensive Proposition

In Aug'2010 Adani Enterprises Limited (Adani) spent A$525m to acquire the rights to develop the Carmichael Coal project.[x] In Sept'2011 GVK spent US$1.26bn to acquire the rights to develop the Alpha, Alpha West and Kevin's Corner Coal and Infrastructure projects, also in the Galilee Basin, Queensland, Australia.[xi]

Both acquisitions were based on the logic of vertically integrating upstream into coal mining, thereby attempting to reduce fuel and foreign currency cost volatility. However, the traditional concept of vertical integration is building a power station next to a coal mine, ideally connecting the two with a conveyor belt. The Galilee Basin strategies of Adani and GVK require the construction of 400-500km of greenfield railway lines and construction of 50-60Mtpa coal export terminals, plus construction of high voltage power lines over 300km. Operation of the project requires not only construction of Australia's largest coal mine project, but then the transportation of coal by rail from Central Queensland to the coast, then shipping

[1] Beyond shipping cost differentials, energy adjusted thermal coal pricing in the seaborne market means it is immaterial to India if coal imports are sourced from South Africa, Indonesia, Australia or America.

across the Indian Ocean. We estimate the transportation costs alone at A$35-40/t (A$15-20/t rail[xii], A$6/t for port loading, A$16/t (US$15/t) shipping[xiii]).

Both the Alpha and Carmichael Galilee Coal Basin proposals are running 3-4 years behind schedule, with neither financing in place nor construction commenced. Despite attempts to sell down their equity holdings,[xiv] [xv]both proponents claim they remain committed to these twin US$10bn greenfield thermal coal projects.

We question how building the two biggest Australian thermal coal mine projects in Australian history will actually help solve India's electricity sector quagmire. As IEEFA's earlier analysis details[xvi], the Alpha, Kevin's Corner and Carmichael thermal coal deposits are extremely isolated. The rail, power, water and port facilities required to enable these mines to operate are non-existent. The cost of building the required infrastructure means the combined capital and operating costs of the coal mines will be un-commercial. The coal is lower than Australian benchmark quality in terms of calorific value, relatively high in ash and the strip ratio for tonnes of overburden removal per tonne of coal produced is 17:1. In all a very expensive proposition.

We estimate these Galilee projects would require a delivered to India coal price of US$89-92/t (US$74-77/t FOB and US$16/t shipping/importation costs) in 2014 terms – with coal cost inflation of 1.5% pa, this rises to US$94-98/t by full production by 2018. This includes a minimum US$7-10/t interest and profit contribution to provide a return on the A$4-5bn capital cost of each of the GVK Coal and Carmichael mines.

The calorific value (thermal energy content) of the GVK coal is estimated at 5,600kcal, whilst the Carmichael coal is estimated at 5,260kcal (both stated on a Net As Received (NAR) basis). The Australian benchmark price for thermal coal (Newcastle, NAR, 6,000kcal) is currently US$75/t – a four year low. Given the 10-15% lower energy content of the Galilee coal, it is materially cheaper and lower risk to source imported coal into India from the open market than to vertically integrate into these Galilee Basin proposals. However, this would still result in massive inflationary electricity pressures and / or wider Discom losses.

Modeling the Required Wholesale Price of Electricity using Imported Galilee Coal

Market Forces of Australia[xvii] commissioned **Equitorials**, an Indian energy focused financial analysis firm in Mumbai to evaluate the question of what wholesale electricity price would be required to justify the construction of a greenfield electricity plant on the coast in India that was to be fueled by thermal coal sourced from the Galilee Basin in Australia. The modeling assumes a UMPP, given this conservatively offers the lowest cost coal-fired power generation tariff. A smaller scale project would involve higher average costs.

Figure 1 details the key assumptions for the coal fired power plant i.e. 4,000 MW at a cost of Rs242bn[xviii] (US$4.0bn or US$1m/MW of capacity), with a commissioning over 2017, such that 2018 is the first full year of production, plant life of 40 years and an assumed Plant Load Factor (PLF, average availability rate) of 75%.[xix] This assumes the standard level of pollution controls required in India, rather than the best in class standards that are starting to be enforced in the US, China and Europe. An assumed 8% of power generated is consumed onsite in the process (i.e. an 8% auxiliary consumption rate[xx]).

Figure 1: UMPP - Key Power Plant Assumptions

Power Plant Life (Years)	40
Power Plant Capacity (MW)	4,000
Plant Load Factor (PLF, %)	75%
Project Cost (Rs Bn)	242
Cost per MW (Rs Mn)	60.5
Cost per MW (US$ Mn)	1.0
Commissioning Date	2017
Auxiliary consumption	8.0%

Figure 2: Key Power Plant Financing Assumptions

Equity Funding	25.0%
Debt Funding	75.0%
Indian Corporate Tax Rate	33.0%
Equity Guaranteed Rate of Return	15.5%
Interest Cost (%)	12.0%
Depreciation rate (%)	5.3%

Figure 2 details the key assumptions on financing of this project in India, namely that 75% project finance will be available at a cost of 12% pa for 10 years duration.[xxi] This presumes a very low 25% equity finance share[xxii], that the regulated return available on equity is 15.5% pa[xxiii], after tax is charged at 33%. Depreciation is presumed to be taken straight line at 5.3% pa, an allowable life assumption of 19 years relative to the likely effective operating life of 40 years.[xxiv]

Figure 3 details the key coal import cost assumptions assuming coal is supplied from Adani's Carmichael Coal mine in the Galilee Basin, Queensland. The heat rate of the coal-fired power plant is assumed to be 2,375Kcal/kWh,[xxv] while the coal from Carmichael has a calorific value of 5,260Kcal NAR. A free-on-board (FOB) Abbot Point Coal Terminal (APCT) 2014 price of US$77/t (fully costed, at 5,260kcal/kg) rises to US$92/t when shipping costs of US$15/t are included. The

Figure 3: Key Coal Import Cost Assumptions – Carmichael Coal

Heat Rate (Kcal/Kwh)	2,375
Calorific Value Imported Coal (Kcal/kg)	5,260
FoB coal cost Australia (US$/t) - 2014	77
Australia port to India port (US$/t)	15
Indian Landed Coal Cost (US$/t) - 2014	92
Initial Exchange Rate (A$/US$) - 2014	$0.93
Initial Exchange Rate (Rs/US$) - 2014	Rs60
Fuel Cost Escalation (US$, % pa)	1.5%
Exchange rate Devaluation (Rs/USD, pa)	4.0%

modeling assumes a 1.5% pa nominal US$ thermal coal price escalation (i.e. a marginal real thermal coal price decline over time). With inflation, US$77/t FOB and US$15/t shipping in 2014 rises to US$82/t and US$16/t respectively by 2018. The modeling takes the current exchange rate of 60 Rupee per US$, A$/US$0.93 and assumes a 4% pa depreciation. This presumes some narrowing of the current inflation implied risk differential of 10 year government bond rates of 2.9% for the U.S. vs 8.9% for India.

Figure 4: Key Coal Import Cost Assumptions – GVK Coal

Heat Rate (Kcal/Kwh)	2,375
Calorific Value Imported Coal (Kcal/kg)	5,597
FoB coal cost Australia (US$/t) - 2014	74
Australia port to India port (US$/t)	15
Indian Landed Coal Cost (US$/t) - 2014	89
Initial Exchange Rate (A$/US$) - 2014	$0.93
Initial Exchange Rate (Rs/US$) - 2014	Rs60
Fuel Cost Escalation (US$, % pa)	1.5%
Exchange rate Devaluation (Rs/USD, pa)	4.0%

Figure 4 details the coal importation costs from GVK's proposed Kevin's Corner Coal project. While this project is an extra 100km from the port (500km vs Carmichael at 400km), the additional rail costs are offset by the plan to exploit the shallower coal deposit seams. GVK coal is reported to have a 5% higher energy content relative to Adani's Carmichael coal, whilst its ash content of 8-10% is materially lower than Carmichael coal which is estimated at 25% ash. A free-on-board (FOB) Abbot Point Coal Terminal (APCT) price of US$74/t (fully costed in 2014 dollars, at 5,597kcal/kg) rises to US$89/t when shipping costs of US$15/t are included.

Required Wholesale Price of Electricity in 2018: Rs5.41-5.73/kWh

Using the US$77/t fully costed thermal coal price from Carmichael (FOB APCT, Queensland, 2014 terms) gives a landed price in India of US$92/t, which equates to Rs6,929/t (based on a modelled Rs70/US$ by 2018). This requires a wholesale Indian electricity tariff of Rs5.73/kWh in its first full year post commissioning (2018) – refer Figure 5. Using the 5% higher energy and lower ash content GVK coal, a first full year wholesale tariff of Rs5.41/kWh would be required.

This puts the cost of imported coal-fired power generation 40-90% above the current Indian wholesale price of electricity of Rs3.00-4.00/kWh and two-to-three times the PPAs written over 2006-2009 on proposed coal-fired power plants.

There is scope for the blending of cheap domestic coal with this imported coal to lower the average fuel input cost. However, India is committed to expanding domestic coal production as fast as it can, and despite this, coal imports have risen from 10% to 20% of total usage over the last four years. This in part reflects Coal India's inability to deliver on its stated production growth targets. As such, we have priced the cost of that portion of coal-fired power generation that will be based on

imported fuel, given this represents the marginal source of additional fossil fuel production, given it is this higher cost product that more domestic wind, solar, hydro or biomass capacity is well positioned to replace.

Across India, the wholesale cost of generating wind power in India is around Rs4.60/kWh – refer Figure 6, again materially below the cost of imported-coal fired power generation.

The Phase II Batch 1 solar auction of Feb'2014 was completed with a maximum feed-in-tariff on offer of Rs5.50/kWh, admittedly after a government investment subsidy of up to 30% of the initial installation cost.[xxvi] By 2020 at the latest this solar subsidy will have served its purpose and will no longer be needed. The cost of solar electricity generation in India has fallen 65% over the last three years alone. The latest auction alone should see 750MW of new utility scale solar installed by 2015.

Figure 5: Wholesale Electricity Costs – Imported Coal vs Wind vs Solar

	FY2018	FY2020	FY2025	FY2030
Tariff (Rs per kWh)				
Supplied using Carmichael Coal	5.73	5.99	6.85	8.31
Supplied using Alpha Coal	5.41	5.62	6.37	7.68
Wind power - 2015 commissioning	4.60	4.60	4.60	4.60
Solar power - 2015 commissioning *	5.50	5.50	5.50	5.50
Solar power - 2018 commissioning *	4.00	4.00	4.00	4.00
Tariff inflation (yoy)				
Supplied using Carmichael Coal	6.0%	2.3%	3.1%	4.9%
Supplied using Alpha Coal	6.0%	2.0%	2.9%	4.8%
Solar power - assumed deflation pa	**10.0%**			
Relative cost of Renewables vs Imported Coal				
Wind vs imported coal - 2015 commissioning	80%	77%	67%	55%
Solar vs imported coal - 2015 commissioning	96%	92%	80%	66%
Solar vs imported coal - 2018 commissioning	70%	67%	58%	48%

** Assumes continuation of the upfront 30% investment credit from Solar Energy Corp India.*

With continued economies of scale, technology gains and learning by doing, we would conservatively estimate that the installed cost of solar (and hence cost of solar electricity generation) will decline by another 10% annually over the next three years. This is consistent with the five year strategic roadmap outlined and updated by First Solar in Mar'2014.[xxvii] This would see a further 28% reduction in the cost of generating electricity from solar, such that for solar farms commissioned in 2018 it is fair to expect a cost of electricity of around Rs4.00/kWh, 30% below the required cost of imported-coal fired power generation.

We note that this solar tariff assumes a continuation of the 30% capital grant by the GoI, but note that coal is likewise subsidised through the non-pricing of externalities (relocation of traditional owners, huge water demands, air pollution, and the associated health costs), plus the provision of subsidised land, water and diesel (used for both coal extraction and transportation).

Electricity Cost Escalation – 4% pa for imported coal, Zero for Wind and Solar

A key difference between coal fired power generation and that from renewable energy is the issue of inflation. **Equitorials**' financial modeling shows that with an estimate 1.5% pa increase in the nominal cost of US$ thermal coal prices, 2% increase in annual shipping costs and with a 4% pa annual depreciation of the Rupee vs the US$, the 10 year average price escalation requirement of imported coal equates to 4.0% pa in Rupee terms.

The standard terms of Indian solar and wind PPAs is a fixed price contract with zero inflation escalation over the 25-year life.

To illustrate the impact of inflation of electricity costs over time, we contrast the expected cost of Carmichael sourced coal-fired power generation of Rs5.73p in 2018, rising to Rs5.99 by 2020, Rs 6.85 by 2025 and Rs 8.31/kWh by 2030. By contrast, wind commissioned in 2015 would be flat throughout at Rs4.60/kWh, meaning electricity costs would be 20%, 23%, 33% and 45% cheaper than the Carmichael sourced coal-fired power generation in 2018, 2020, 2025 and 2030 respectively.

For solar commissioned in 2018 would be flat at Rs4.00/kWh, electricity costs would be 30%, 33%, 42% and 52% cheaper than that produced from imported coal in 2018, 2020, 2025 and 2030 respectively. This illustrates the massively underestimated deflationary impact of renewable energy.

The Reserve Bank of India (RBI) has announced it is actively targeting CPI of 8% by end-2014, and 6% by end 2015 and 4% in the third year as a key priority.[xxviii] Building thermal power generation capacity that is more expensive that the current retail price of electricity and that locks in a 4.0% pa inflation-linked increase for the next decade is only going to make the RBI target harder to deliver, while the increased cost of imported fossil fuels will likewise increase pressure on the current account deficit and hence the exchange rate.

Figure 6: Wind Feed-in-Tariffs in India are below coal tariffs

Source: HSBC Apr'2013[1]

India's Weakening Economic Position

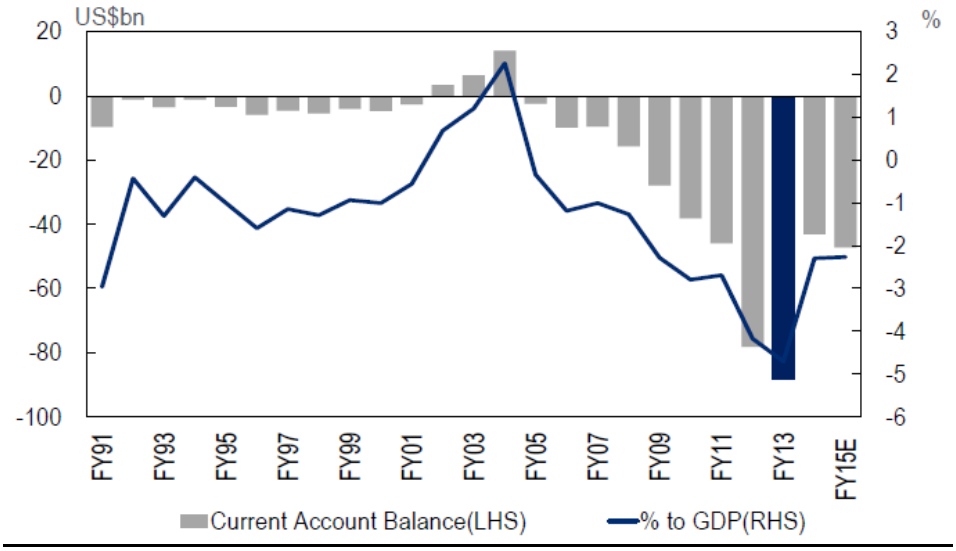
The current economic profile of India is challenging. The Government of India (GoI) is running a major fiscal deficit. Consumer inflation is running at 8-10% year-on-year (yoy), resulting in central bank borrowing costs of 8%, which means there is negative real interest rates and so financial saving rates are low and falling. The banking system has been caught funding infrastructure and energy projects geared for an economy expected to sustain GDP growth of 8-10% pa, but with growth having slowed to half this rate, non-performing loan rates are now approaching 10%. India's Feb'2014 industrial production growth of +0.1% yoy highlights the stress of the industrial sector in India overall – Figure 7.

Figure 7: India's Industrial Production growth has stalled

Source: Capital Economics, Thomson Datastream.

A major component of this economic pressure relates to the deteriorating external sector profile. Over the decade to 2006, India's current account was close to balance. However, associated with the acceleration of economic growth was the rising current account deficit – Figure 8. This culminated in a devaluation of the Indian Rupee by some 30% from its mid-2011 peak vs the US$.

Figure 8: India's Current Account Deficit (US$bn, % of GDP)



Source: RBI, Citi Research[1]

India's Unhealthy Reliance on Imported Fossil Fuels

Rising imports of oil, gas and increasingly coal

A key strain on the current account deficit for India has been the reliance on imported fossil fuels. Historically, India has imported 80% of its oil needs. With strong economic growth, crude oil imports reached US$144bn 2012/13. In a bid to diversify its electricity system over the last decade, India has built over 20GW of gas-fired electricity capacity. However, with a rapid decline in domestic gas production since 2011, half of this newly installed generating capacity stands idle, and the domestic shortfall has seen gas imports rising to 40% of total consumption.

Slower than expected growth in domestic coal production

Over the last four years, India's domestic coal production has been growing at 3.2% pa (exceeding 500Mtpa in 2013/14); insufficient to keep up with total coal consumption growth of 6-7% pa.

Domestic Indian coal production growth has been below plan[xxix]because of a number of pressure points[xxx]:

1. Resistance to new coal mines due to the environmental implications on traditional owners, forests, pollution and the risk to water catchments;
2. Poor regulatory planning structures, with different Government Ministries working at cross-purposes;
3. Legal challenges to coal block allocations, plus associated claims of corruption in the allocation process;
4. The exhaustion of the higher quality, shallower coal resource deposits; and
5. Poor railway infrastructure, limiting capacity to move coal from mines to power stations.

The recent failure of Coal India (CIL) to complete the next phase of its privatization effort suggests that its investment rationale has deteriorated since its successful 2010 IPO. CIL was unable to raise a planned US$3bn in new a stock offering. Instead the company paid out US$3bn in a special dividend to its shareholders. The fiscally troubled Government of India is the majority owner and received short term relief from the distribution.[xxxi] Since the dividend was announced the stock price of Coal India has continued to perform poorly[xxxii] and the company has once again announced it will fail to meet its production targets.[xxxiii]

Growing pressures from imported thermal coal

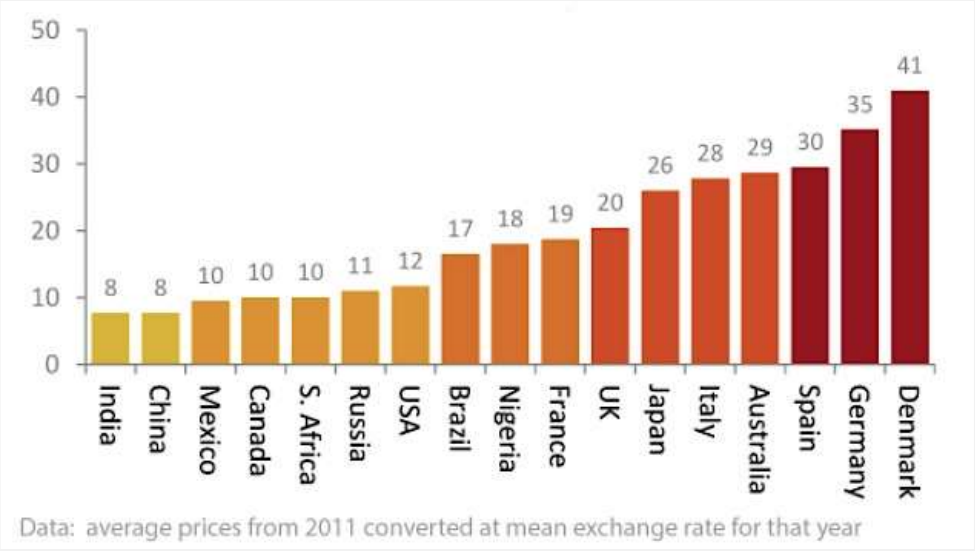
As such, in just four years India has seen imports of thermal coal double from 54Mt or 10% of India's total consumption in 2009/10 to over 20% share in 2013/14, resulting in a US$12bn annual import bill. On the Coal Ministry's current forecast, coal imports could double again to approach US$24bn by 2016/17 (say US$80-100/t @ 200-240mtpa).

India's Retail Electricity Price, Low and Subsidised

Government subsidies for Electricity

India has one of the world's lowest retail electricity prices as well – refer Figure 9. At US8c/kWh in 2011, this is 50% lower than electricity prices in Europe.

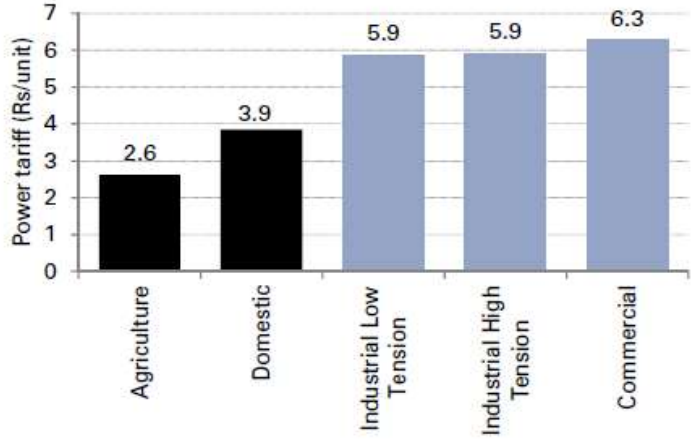
Figure 9: Average National Electricity Prices Globally (2011, USc/kWh)



Source: IEA, EIA, National Electricity Boards, OANDA[xxxiv]

Within the Indian electricity market, the agriculture and domestic residential prices for electricity are half the rate charged to industrial and commercial users in India – Figure 10. Agriculture and domestic consumption combined accounts for one third of all Indian electricity usage. In order to stem distribution company losses, the State governments have been significantly reducing the electricity price subsidy to the agricultural and domestic sectors over the last few years. This is increasing the financial stress on those least able to afford it.

Figure 10: India's Commercial and Industrial Sectors Cross-Subsidise Agriculture and Domestic Electricity Supply (2013/14 estimate)



Source: CEA, CERC, Goldman Sachs Global Investment Research

Grid Transmission and Discom Losses

A key difficulty in examining the Indian Electricity Sector is the inconsistency of data, and the significant inter-regional variances across the Indian States. The Ministry of Power published a Feb'2014 overview of the Power Sector[xxxv] that detailed the average cost of power supply was Rs3.78/kWh in 2010/11, and that the average price realised on sale was only Rs3.01/kWh, a 20% discount to the purchase cost. If the cost of supply estimate of Rs3.78/kWh is net of grid transmission losses of 23.2%, then the gross power purchase price in 2010/11 averaged Rs2.90/kWh across India across all generation types.

Figure 11: India's Average Cost of Supply and Average Price Realisation

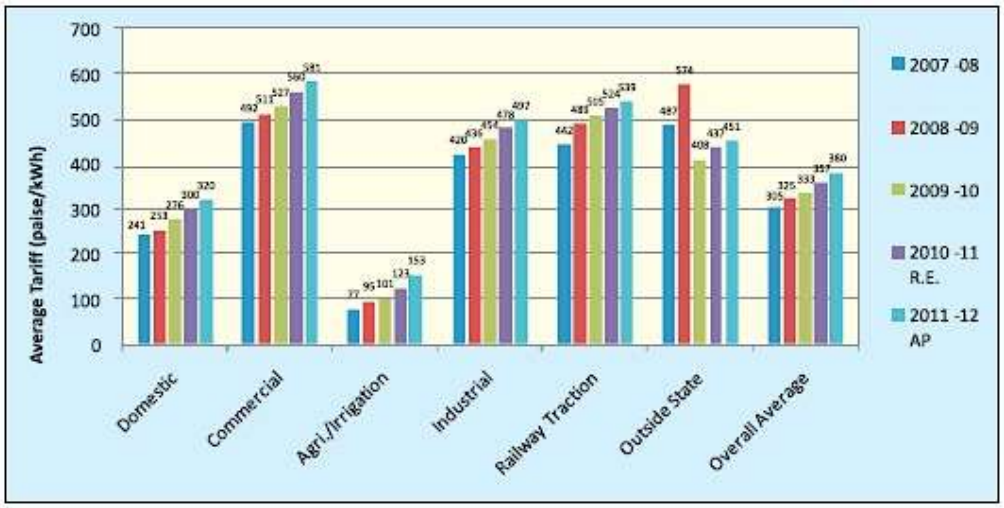
(Rs/kWh) Year	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
Cost of supply	2.39	2.54	2.60	2.76	2.93	3.40	3.55	3.78
Average price realisation - All	2.03	2.09	2.21	2.27	2.39	2.63	2.68	3.01
Average price realisation - Ag	n.a.	0.76	0.76	0.74	0.77	0.87	0.89	1.15
Average sale price/cost	85%	82%	85%	82%	82%	77%	75%	80%

Source: CEA Feb'2014[xxxvi]

Figure 11 also details the widening trend of losses across India, with the average sale price to cost ratio of 85% in 2003/04 deteriorating to 80% in 2010/11. This is despite a decade of attempted GoI electricity sector reform focused specifically on the massive accumulated losses in the Indian state Discoms.

System figures for 2011/12 and 2012/13 are not available as yet, but the tariff concessions in several major states announced in 2014 pre-election have reversed a significant portion of the power price increases implemented in the prior 18 months (Figure 12), suggesting the situation has not materially improved.

Figure 12: Consumer Tariff for Electricity by Category (paise/kWh): 2007-08 to 2011-12



Source: Planning Commission Annual Report 2011/12, GoI[xxxvii]

The key point is that retail electricity prices in India are considerably lower than the level required for the profitable generation of imported coal-fired power, particularly when that coal is sourced from isolated deposits with none of the required infrastructure in the middle of Queensland. The inflationary consequences, both immediately and locked in over the life of the 15-25-year PPA are prohibitive. Consideration of the deflationary impacts of renewable energy, plus a greater focus on energy efficiency and reduced grid transmission losses, provide an increasingly economically rational alternative.

Given the relatively low penetration of renewables in India to-date, intermittency of electricity supply is not a material constraint. Increased solar in particular is likely to improve the supply demand balance given the co-incidence of solar and peak demand, particularly as it pertains to industry and agriculture. With the rapid cost reductions evident in storage, any perceived barrier of intermittency as a cap to renewable energy penetration is likely to be removed within the next three years.

Important Information

This report is for information and educational purposes only. It is intended solely as a discussion piece focused on the topic of GVK and the Adani Group and their Australian coal infrastructure proposals, and the implications for the Indian electricity sector. Under no circumstance is it to be considered as a financial promotion. It is not an offer to sell or a solicitation to buy any investment referred to in this document; nor is it an offer to provide any form of investment service.

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Acknowledgement – Financial Modeling by Equitorials, Mumbai

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[ix] http://www.tatapower.com/investor-relations/pdf/q3-results-31dec13.pdf
[x] Remote Prospects: A financial analysis of Adani's coal Gamble in Australia's Galilee Basin – November 2013. http://www.ieefa.org/adani_coal_report/
[xi] Stranded: A Financial Analysis of GVK's proposed Alpha Coal Project in Australia's Galilee Basin – June 2013. http://www.ieefa.org/report-stranded-alpha-coal-project-in-australias-galilee-basin/
[xii] Ibid.
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[xv] http://www.livemint.com/Industry/JNNG4lMMqicPSCyfdQBnbK/As-bets-sour-firms-rethink-overseas-mining-assets.html
[xvi] http://www.ieefa.org/adani_coal_report/
[xvii] http://www.marketforces.org.au/
[xviii] http://www.pfcindia.com/writereaddata/WhatsNew/CTNPL_RFQ_UMPP_26-Sep-13.pdf (Section 1.1.1) - Indicative Project Cost (INR 242,000m); also http://www.projectsmonitor.com/daily-wire/power-engineers-federation-writes-to-cea-regarding-poor-performance-of-sasan-umpp/ (INR230,000m);
http://www.pfcindia.com/writereaddata/WhatsNew/Response%20to%20OIPL%20Queries.pdf (Section 1.1.1) (25/09/2013) Odisha UMPP: Indicative Project Cost: INR252,000m.
In Odisha UMPP RFP/RFQ, bidders would have to take equipments from Indian players. Can't take cheap equipments from China.
[xix] India's average PLF to-date is around 67%, rising to 2011-12 at 75% and then 2012-13 at 70%. For more information please refer: http://www.ntpc.co.in/images/content/investors/AnalystMeet2013.pdf
[xx] Draft CERC guidelines 2014-19: For Steam boiler with natural draft cooling tower: 6%; or with induced cooling tower: 6.5%. However, real plant data for reference average 7.5-9.0%.
[xxi] Most of the term loans for GVK and its subsidiaries are taken @ 10.5% - 13.5% (Annual Report 2012-13)
[xxii] Based on the CERC guidelines: Equity above 30% is taken as normative debt for tariff purposes, but the Sasan UMPP project was undertaken on 25:75 equity to debt.
[xxiii] http://www.motilaloswal.com/site/rreports/HTML/634539218015182898/index.htm (Tata Mundra: 15% while the expectation was 24%).
[xxiv] CERC guidelines 2009-14: 5.28%, Draft CERC guidelines 2014-19 (Appendix II): 5.28%.
[xxv] 2,425 Kcal/kWh as per CERC guidelines (2009-14), 2,375 Kcal/kWh as per draft CERC guidelines (2014-19).
[xxvi] http://www.bloomberg.com/news/2014-01-22/india-solar-auction-draws-goldman-s-renew-first-solar.html
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[xxviii] http://in.reuters.com/article/2014/02/18/india-economy-finmin-idINDEEA1H04C20140218?feedType=nl&feedName=inmoney
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