

Changing Dynamics in the Global Seaborne Thermal Coal Markets & Stranded Asset Risk

“Climate Change poses risks to which financial market regulators and company boards have, to-date, given little attention.”

Dr Martin Parkinson, August 2015

Tim Buckley, Director of Energy
Finance Studies, Australasia

Japan Renewable Energy Foundation
(JREF)



Institute for Energy Economics
and Financial Analysis
IEEFA.org

March 2016

AGENDA

The Global Electricity Market Transformation

1. **Global seaborne thermal coal demand in structural decline**
 - China
 - India
 - Japan
 - America
2. **Equity Markets show coal companies are increasingly pricing in structural decline risks**
3. **Renewables are deflationary**
 - Technology gains and economies of scale
 - Batteries will transform distributed solar on rooftops from 2018.
4. **Stranded Assets Risk is Increasing**



1. A long cyclical downturn or structural decline?

China, India, the US and Japan are the four largest coal consuming nations globally.

Each are undergoing a rapid electricity transformation, away from coal.



1.1 China's Electricity Sector

China's
thermal
coal's share
of electricity
generation:

2012 76.4%
2014 72.2%
2020 59.8%

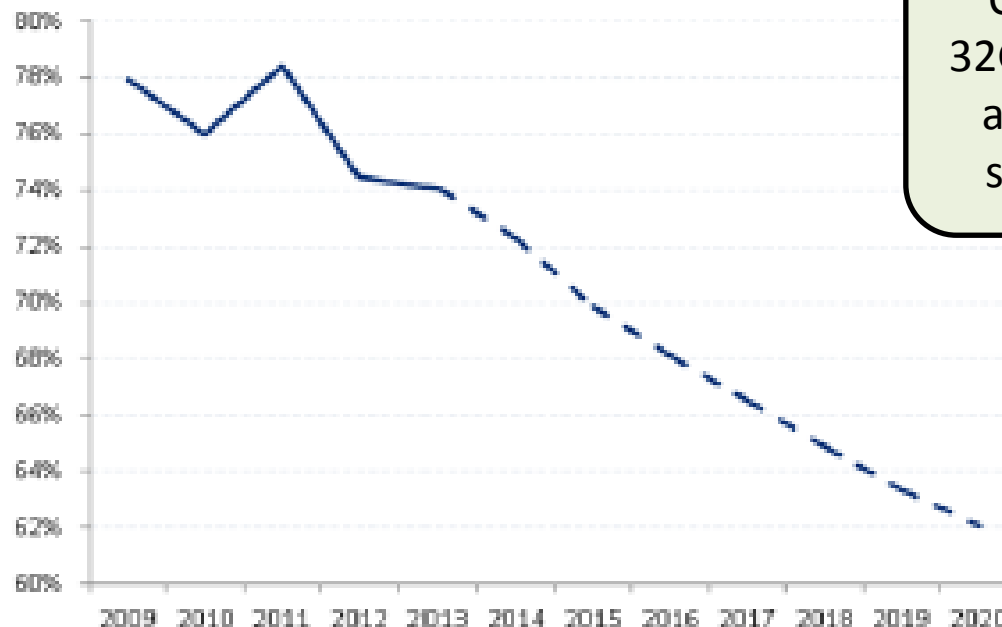
China's Power Industry

Installed Capacity (GW)	End 2014		2020	
	GW	%	GW	%
Thermal (coal)	855	61.8%	983	52.3%
Thermal (gas)	53	3.8%	78	4.1%
Biomass / CHP / EfW	9	0.6%	27	1.4%
Hydro	304	22.0%	384	20.4%
Nuclear	20	1.4%	46	2.4%
Wind - Onshore	111	8.0%	240	12.7%
Wind - Offshore	1	0.0%	9	0.5%
Solar - Utility Scale excluding distributed	32	2.3%	114	6.0%
Total Generation Capacity	1,385		1,881	
CAGR in coal-fired power generation for 2014-2020 (TWh)			-0.3%	
CAGR in power demand for 2014-2020 (TWh)			2.8%	
CAGR in power capacity for 2014-2020 (GW)			5.2%	
GDP Growth for 2014-2020 (%)			6.3%	

1.1 China's Electricity Sector Transformation

Coal's share of China's electricity generation mix is set for a steep decline

Year to Dec 2015:
China GDP +6.9%
Electricity +0.5%
Domestic coal -4.1%
Coal imports -30%



China added
32GW new wind
and 18GW of
solar in 2015

1.2 India

India's Energy Minister Goyal stated November 2014:

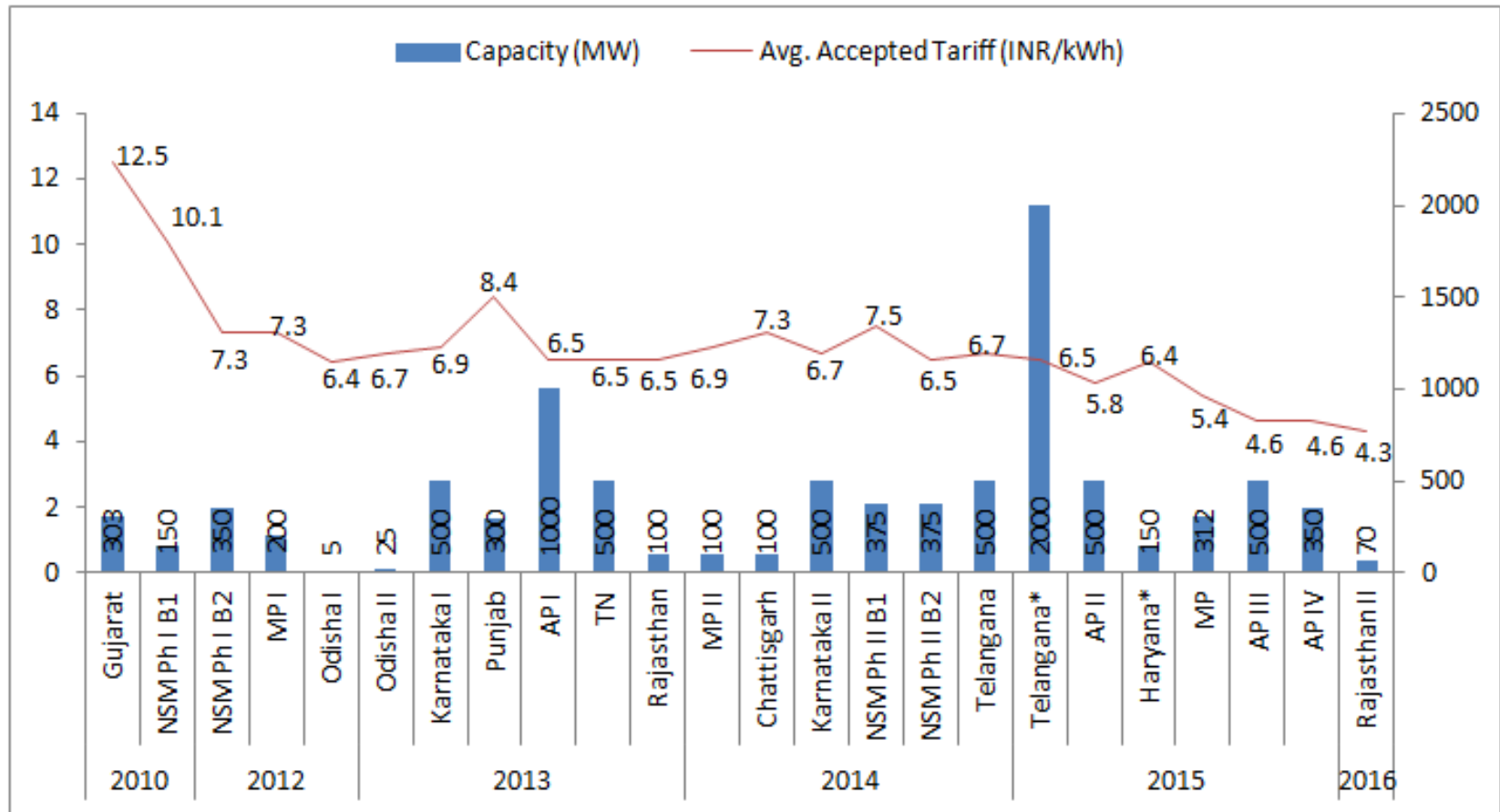
1. *Plans to transformation of the entire Indian electricity system with 175GW of renewable energy installs by 2021/22. This involves a doubling of wind installs to 6GW and lifting solar installs tenfold to 10GW pa.*
2. *A plan for a US\$50bn national grid upgrade to drive grid efficiency.*
3. *Plans to more than double India's domestic coal production to 1.5Bn tpa by 2021, requiring a massive investment in rail infrastructure, coal handling and preparation plants plus major new mine development.*
4. *Goyal: "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."*

1.2 India

- India has seen global firms commit over US\$100 billion to the Indian solar sector in 2015.
- SoftBank (Japan) and Foxconn (Taiwan) tied up with Bharti Enterprises (India) and committed US\$20bn to Indian solar over five years.
- The Adani Group has committed US\$16bn to numerous solar projects across India in 2015, and is due to commission the world's largest solar project in Tamil Nadu next month – a US\$650m investment to build a 648MW project (only commenced in January 2015).
- Reliance Power has cancelled 14GW of thermal power project proposals to focus on 6GW of solar and 5GW of hydro instead. RattanIndia Group has made a similar move.

http://ieefa.org/wp-content/uploads/2015/11/IEEFA-India-Electricity-Sector-Transformation_Global-Capacity-Building_11112015.pdf

1.2 India – Solar Tariffs Are Falling Rapidly



Jan 2016: A new low utility solar of Rs4.34/kWh (US\$64/MWh) was set: zero indexation for 25 years.

1.3: Japan

Japan's thermal coal demand outlook: down 3% pa

1. **Energy efficiency** – 12% decline in electricity demand from 2010-2015 despite 0.6% pa GDP growth (a 3% pa reduction in electricity intensity)
2. **Nuclear restart** – The key question is the rate of restarts for 42GW of nuclear capacity – US\$50bn of idle assets. Third restart done.
3. **Solar surge** – Japan installed 10GW in 2014 and 9GW in 2015; part of a 50-70GW pipeline of approved projects. Offshore wind plan post 2020.
4. **LNG vs coal vs oil** – relative price moves, Japanese LNG pricing has halved in US\$ terms over 2015. Japan has signed over 1000Bcf/year of new US LNG supply contracts due online by 2020.

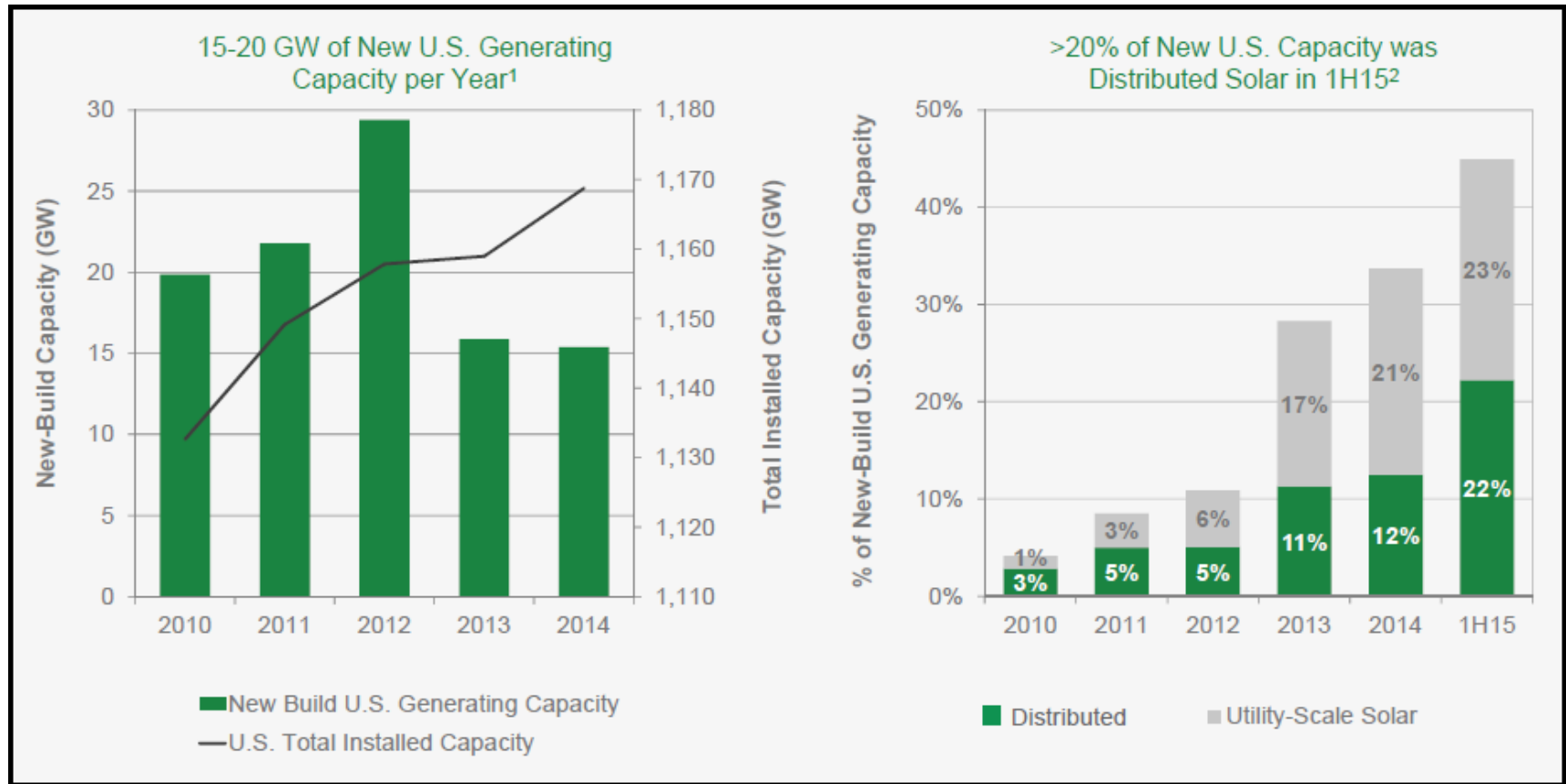


1.4 US

America's thermal coal: down 45% by 2016 vs 2008 peak

1. ***Collapsing US coal exports*** – too expensive on the global cost curve, and the US\$ strength vs all major coal exporters.
2. ***Coal power plant closures*** - >70GW of coal-fired power plants slated for closure by 2020 due to EPA air, water and ash pond pollution rules and the Clean Power Plan. 15-20GW of coal plant closures in 2015 alone due to the Mercury and Air Toxics Standard, with no new coal additions.
3. ***Renewables*** – US push into wind (9GW in 2015) and solar (9GW in 2015) rapid and accelerating, until 2017 at least (PTC/ITC cliff?). Oct 2015 saw a solar utility PPA in Texas signed at US\$40/MWh flat, the lowest ever (yet!).
4. ***Domestic gas vs coal*** – the US\$ Henry Hub gas price collapse over 2012-2015 has improved gas competitiveness, with over 100GW of new gas-fired capacity in the US planning system. US domestic coal volumes are -30% yoy 2016 YTD. UBS forecasts a 45% decline in coal from 2016-2030.

1.4 US Gross Capacity Expansion

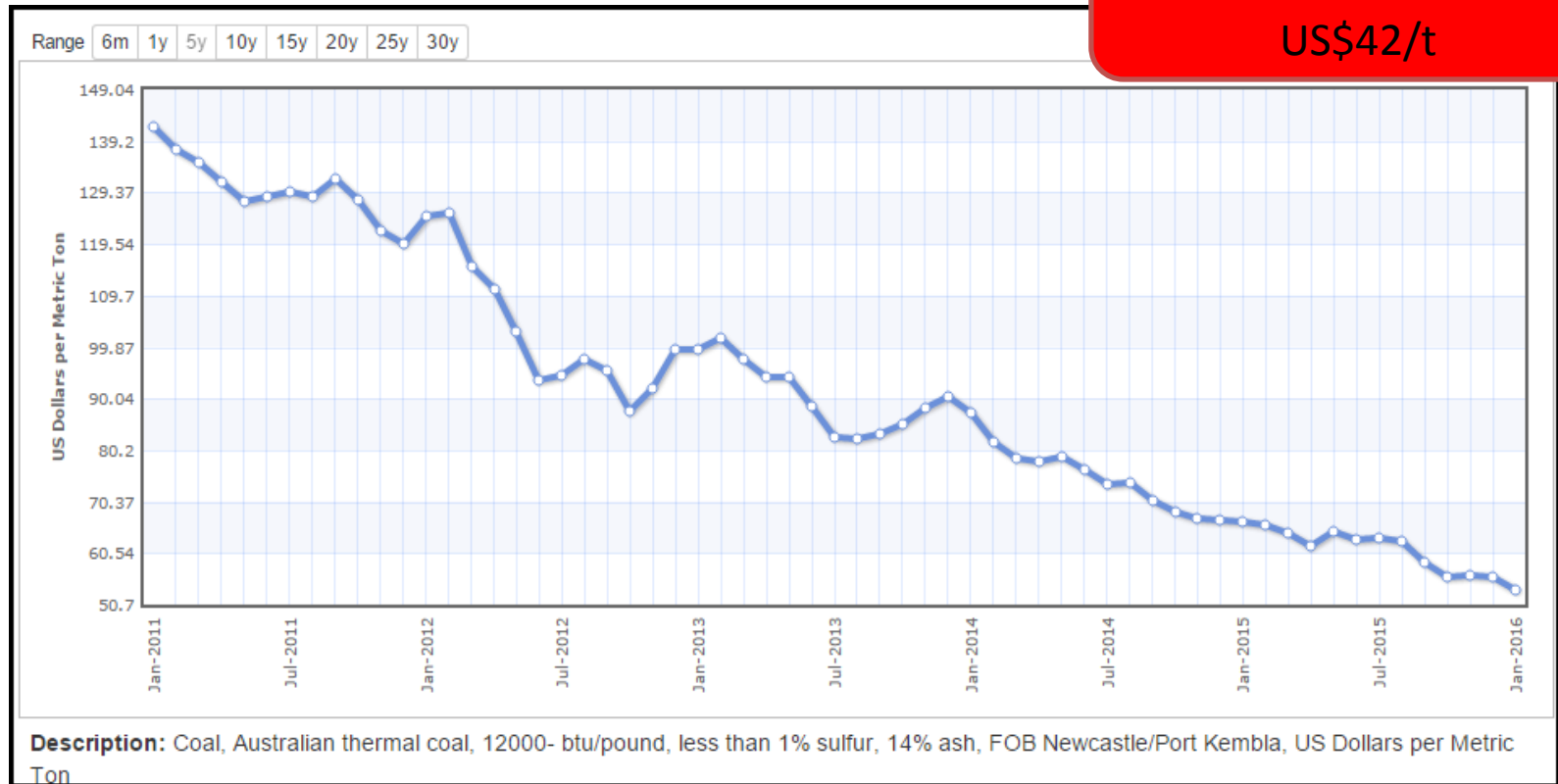


Source: SolarCity Investor Presentation, Dec 2015

1.5 Thermal Coal Export Price Collapse

Newcastle Export 6,000kcal Thermal US\$/t – at a decade low

Forwards out to October 2022 have thermal coal US\$42/t



<http://www.indexmundi.com/commodities/?commodity=coal-australian&months=60>

<http://quotes.esignal.com/esignalprod/quote.action?symbol=NCFQ-ICE>

1.5 Thermal Coal Export Price Collapse

Newcastle Export 6,000kcal
Thermal US\$/t – decade low
of US\$42/t by 2022

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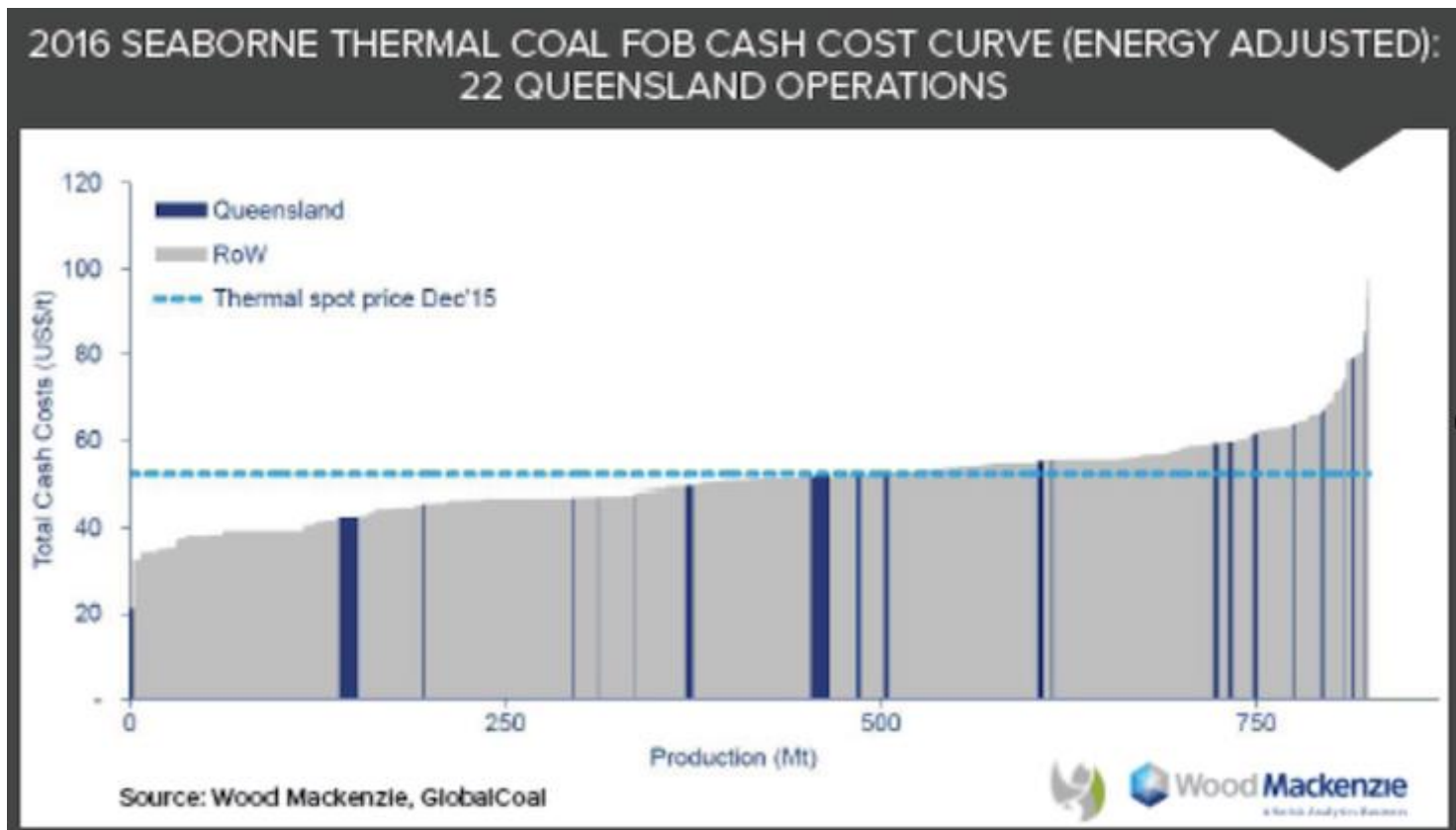
Quote Board

Contract (Symbol)	Month	Last	Change	Chg %	Open	High	Low	Time
NEWCASTLE COAL-QUARTERS (NCFQ 6J-ICE)	Apr'16	47.42 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 6N-ICE)	Jul'16	44.20 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 6V-ICE)	Oct'16	43.10 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 7F-ICE)	Jan'17	42.05 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 7J-ICE)	Apr'17	41.05 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 7N-ICE)	Jul'17	40.05 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 7V-ICE)	Oct'17	39.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 18F-ICE)	Jan'18	39.55 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 18J-ICE)	Apr'18	39.55 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 18N-ICE)	Jul'18	39.55 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 18V-ICE)	Oct'18	39.55 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 19F-ICE)	Jan'19	38.95 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 19J-ICE)	Apr'19	38.95 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 19N-ICE)	Jul'19	38.95 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 19V-ICE)	Oct'19	38.95 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 20F-ICE)	Jan'20	39.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 20J-ICE)	Apr'20	39.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 20N-ICE)	Jul'20	39.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 20V-ICE)	Oct'20	39.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 21F-ICE)	Jan'21	40.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 21J-ICE)	Apr'21	40.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 21N-ICE)	Jul'21	40.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 21V-ICE)	Oct'21	40.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 22F-ICE)	Jan'22	41.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 22J-ICE)	Apr'22	41.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 22N-ICE)	Jul'22	41.70 y	--	--	--	--	--	18:08:18
NEWCASTLE COAL-QUARTERS (NCFQ 22V-ICE)	Oct'22	41.70 y	--	--	--	--	--	18:08:18

Delayed data retrieved on Feb 17 2016 21:16:05 EST
Market data delayed per exchange rules, except where indicated otherwise.
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s - Settlement Price y - Yesterday's Settlement Price e - Estimated

1.5 Thermal Coal Export Profit Collapse

The global seaborne thermal coal market is operating at gross cashflow breakeven on average – the current coal price is lower than Dec'2015 dashed line



1.6 International Thermal Coal – Key Markets

A 30% decline
in global
demand

Calendar Year	Actuals					Forecasts						
	1990	2000	2010	2013	2014	2015	2016	2017	2018	2019	2020	2021
COUNTRY												
China	11	8	126	246	224	148	118	90	60	30	0	0
India	0	10	81	145	182	174	140	114	89	65	42	24
Japan	42	93	128	142	143	145	141	137	133	129	125	121
Korea	12	45	90	96	98	100	102	104	106	108	111	112
Taiwan	14	40	58	61	63	63	65	66	67	69	70	71
South East Asia (1)	4	14	53	60	63	75	81	87	94	102	111	121
Western Europe (2)	48	80	98	128	114	97	93	90	87	83	79	76
United States	2	10	16	7	7	9	9	10	10	10	10	10
Russia	53	25	24	23	23	21	19	19	19	19	19	19
Rest of world	191	150	172	194	196	200	202	204	206	207	208	208
Total World	378	476	846	1,102	1,112	1,030	970	921	871	821	774	762

(1) This includes only Thailand, Philippines, Malaysia, Pakistan and Vietnam

(2) This includes only United Kingdom, France, Germany, Spain and Italy

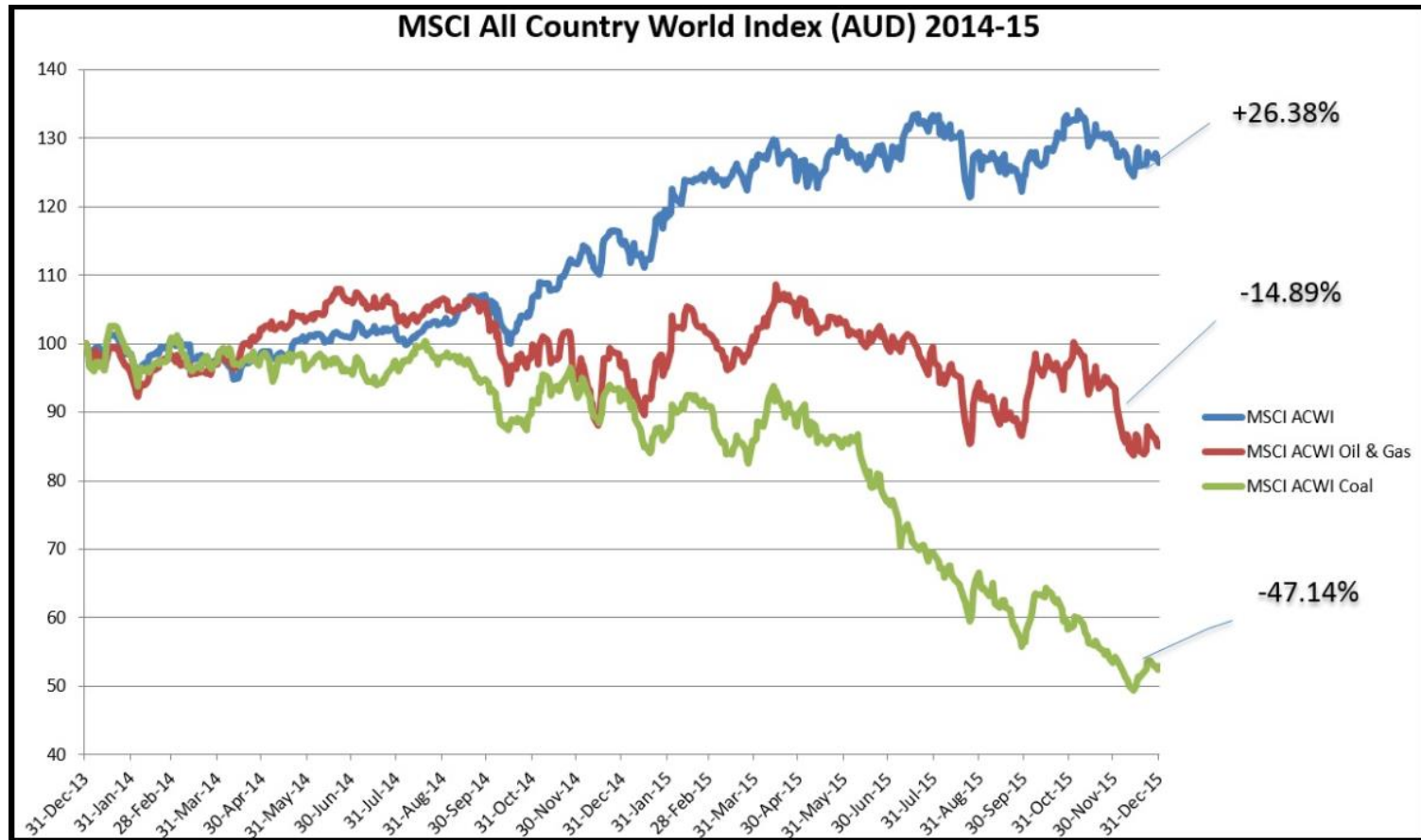
(3) Note - This is global traded thermal coal including lignite, and inclusive of non-seaborne trade.

2. Structural decline?

The Equity markets are factoring in structural decline as an increasingly likely probability.

Coal Equities are proving to be a wealth hazard!

Fossil Fuel



Source: Yahoo Finance

2.1 USA: Peabody Energy

Peabody Energy Corporation (BTU) - NYSE

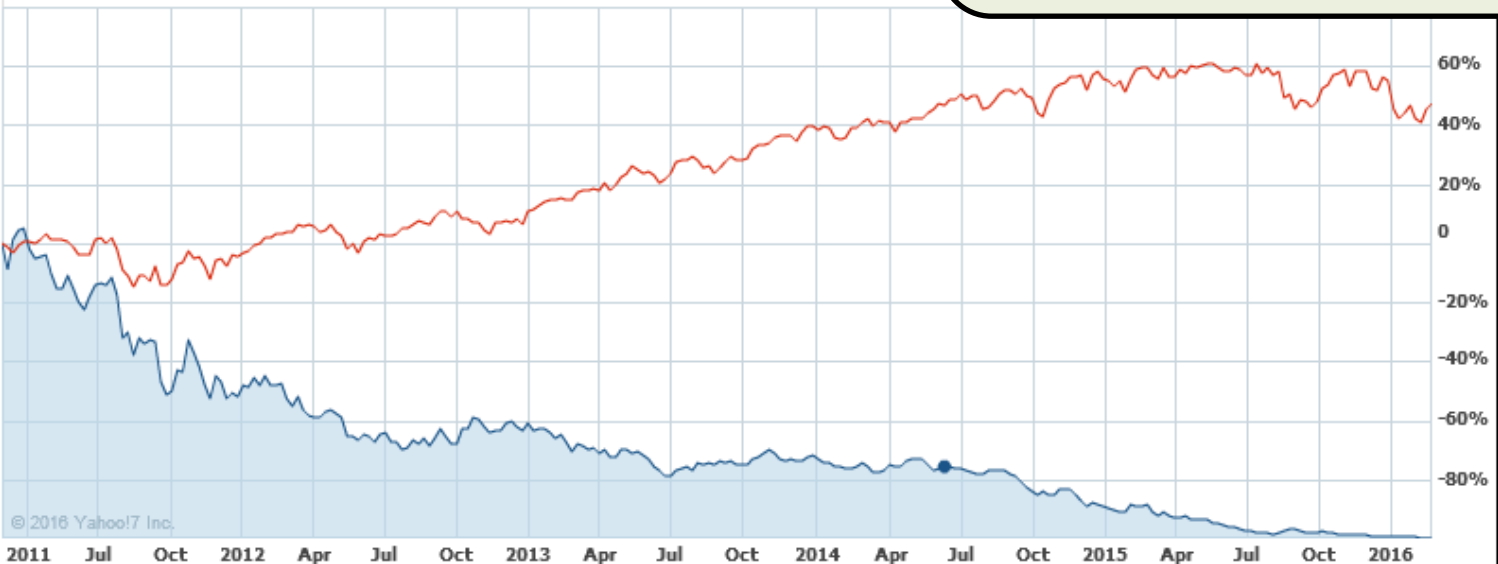
2.21 ↓0.10(4.33%) 27 Feb 08:02

Enter name or symbol

GET CHART

COMPARE

Week of 9 Jun 2014: ■ BTU 251.85 ■ ^GSPC 1936.16



■ Volume: 411,240



1D 5D 1M YTD 3M 6M 1Y 2Y 5Y Max

FROM: 28 Feb 2011 TO: 22 Feb 2016 -99.79%

Patriot Coal, Walter Energy and Alpha Natural Resources each entered Chapter 11 in May, July and August 2015 respectively, plus Arch Coal in January 2016.

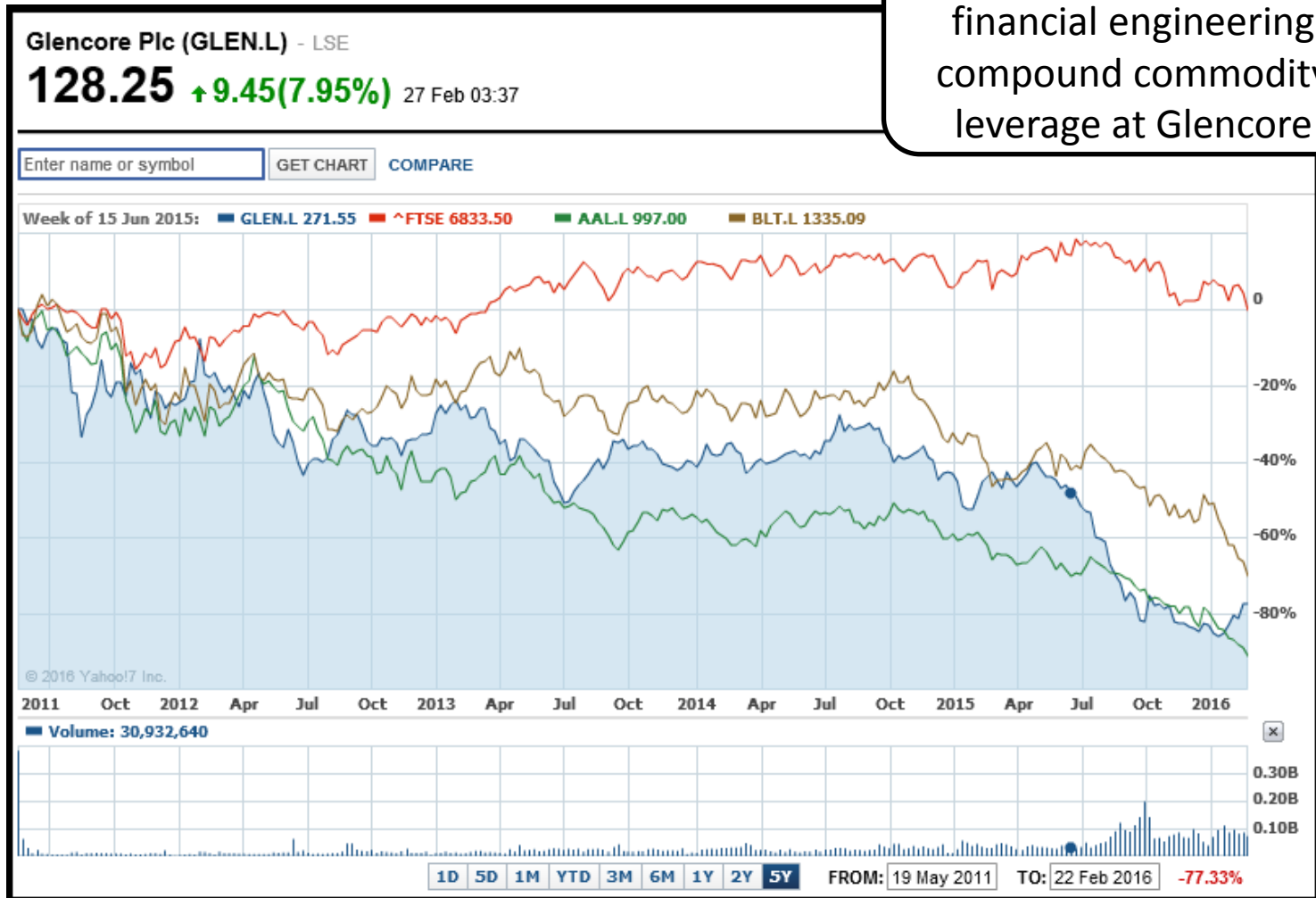
Australia: Whitehaven, Yancoal, Cockatoo, New Hope



Bandanna Energy (Oct 2014) and Cockatoo Coal (Nov 2015) in administration.

2.3 UK: Glencore, Anglo vs BHP Billiton

Financial leverage and
financial engineering
compound commodity
leverage at Glencore



Source: Yahoo Finance

3 Renewable Energy is deflationary

Global clean energy investment 2004-15, \$bn



Source: Bloomberg New Energy Finance

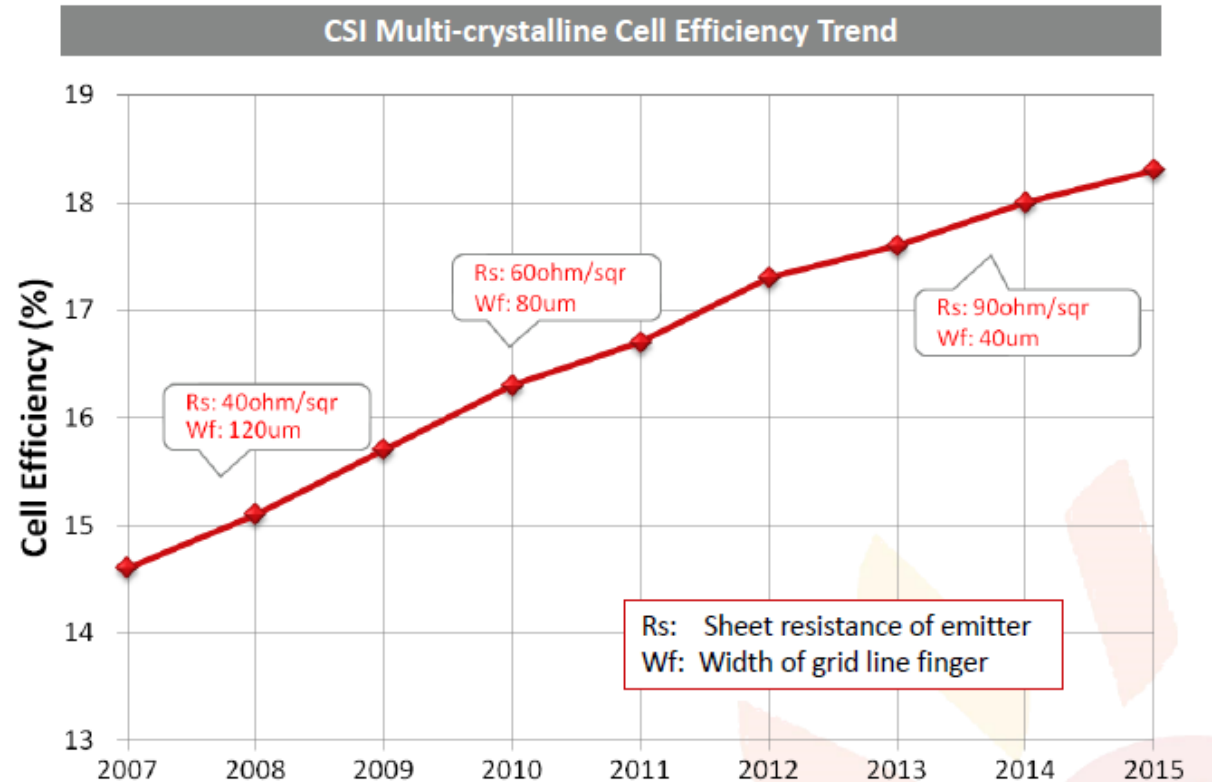
3 Renewable Energy is deflationary

Canadian Solar Multi-cell efficiency progress

Solar technology gains are continuing to build: unstoppable.

The best modules by 2017 will be 22-23% vs global average of 15% in 2015.

Oct'2015 saw a Texas solar PPA at US\$40/MWh flat, thanks to the ITC, and India saw a US\$64/MWh PPA.



☀ Cell efficiency improved at a rate of 0.5% (absolute) each year

4.1 Structural decline means Stranded Assets

Examples of Stranded Assets in Australia:

1. WICET: a \$3bn coal port and \$1bn rail line, 100% debt financed. ToP liabilities put Bandanna Energy in administration Sept'2014. Cockatoo Coal admin in 2015.
2. Newcastle Coal Port: Westpac and China Merchants bought this for 27x EV/EBITDA in 2014. T4 A\$4.8bn 70Mtpa capacity expansion stranded.
3. CLP A\$435m writedown of Yallourn, Feb'2014: "Yallourn has suffered from declining demand and oversupply of base load energy in Victoria".
4. Lanco's Griffin Coal: In 2011 Lanco of India made a \$740m WA coal acquisition that has lost money at the EBITDA level ever since. Lanco is in financial distress.
5. China Shenhua: Has spent A\$700m since 2008 on the Watermark coal proposal, over A\$1bn of capex and payments to NSW govt. still to go (\$500m rehabilitation).
6. Isaac Plains – Sumitomo Corp of Japan: sold a 50% stake acquired for \$430m in 2011 for \$1 in July 2015, possibly avoiding \$30-40m of rehabilitation liabilities in the process.

4.1 Structural decline means Stranded Assets (cont)

1. GVK Power: Spent US\$1.26bn for Hancock's Alpha, Galilee proposal in 2011, was unable to make final US\$560m payment in Sept'2014. Totally stranded, cant write project off.
2. Adani Enterprise Carmichael proposal: Still to raise A\$10bn of capital. SBI refused US\$1bn loan. Sacked 6 engineering firms and 90% of staff in July 2015. CBA and Standard Chartered advisory mandates gone.
3. Queensland LNG export terminals: following a halving of US\$ Asian LNG prices post oil collapse, this US\$75bn investment will not deliver the expected returns forecast.
4. Whitehaven Coal: A\$1.4bn debt refinance March'15 trading at 80c/\$.
5. Mining Services: The implication of a sustained downturn in the resources sector has dramatic flow-on implications for the mining services sector, from Downer EDI, WorleyParsons to Wesfarmers' Industrial Supplies.

Appendix A: Korea

Korea's thermal coal outlook: 2-3% pa growth to 2020

1. **Energy efficiency** – *In contrast to Japan, electricity demand has grown 5.3% pa from 2000-2013, higher than the average 4.4% pa real GDP growth (a 1% pa expansion in electricity intensity).*
2. **Nuclear resistance**- *Post Fukushima, public opposition to nuclear is limiting the growth in the existing 21GW of nuclear capacity (27% of mix).*
3. **Renewables** – *Again in contrast to Japan, Korea has made no material progress in renewable energy installations. Hanwha Solar is now a top 10 global solar industry supplier. Offshore wind plan from 2020.*
4. **LNG vs coal** – *Korea's US\$16/t coal tax in June 2014 (raised to US\$21/t in July 2015) and the Jan'2015 commencement of the National ETS at US\$8/t combine with the collapse of US\$ LNG prices over 2014 to improve LNG's relative competitiveness.*

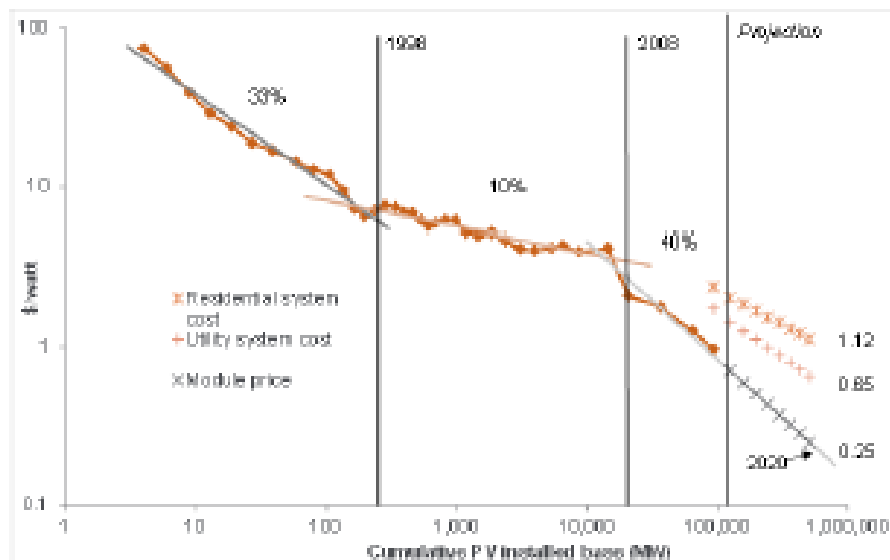
Appendix B: EU

European Union thermal coal outlook: down 3% pa to 2020

1. ***Collapsing UK coal use*** – Total 2014 UK coal demand was 48.1Mt, down 20% on 2013. UK coal-fired generators now have to pay the CPS tax (in addition to the EU carbon price) of £18/ton of CO₂ for 2015/16 (up vs 2014's £9/t CO₂).
2. ***Collapsing French coal use*** – Output from French coal-fired plants fell in 2014 to its lowest level since at least 2007. Coal-fired output in 2014 fell to 8.4TWh, down 58% from 19.9TWh in 2013, accounting for only 2% of the energy mix. Coal-fired power in 2007 generated 26.7TWh, 5.3% of electricity generation.
3. ***Coal power plant closures*** – Net coal plant closures continues across West Europe (Poland and Turkey are exceptions) driven by the Large Combustion Plant Directive. German black coal mining to cease by 2018.
4. ***Renewables*** – The EU's wind energy push continues. Wind generated 10.2% of EU electricity in 2014 vs 8% in 2013 (6.3% in 2011). Offshore wind is building. Germany targets 40-45% renewable electricity by 2025 and 55-60% by 2035.

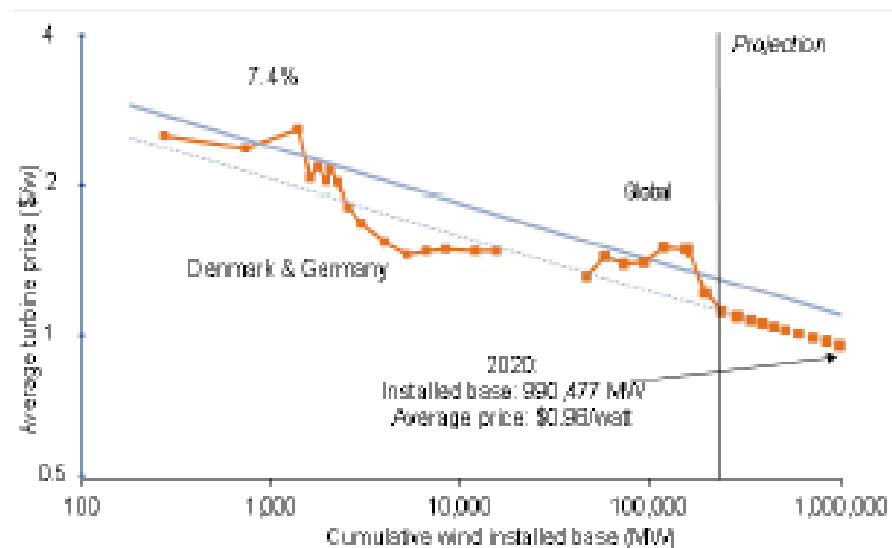
Renewable Energy is deflationary

Solar exhibits potentially rapid learning rates

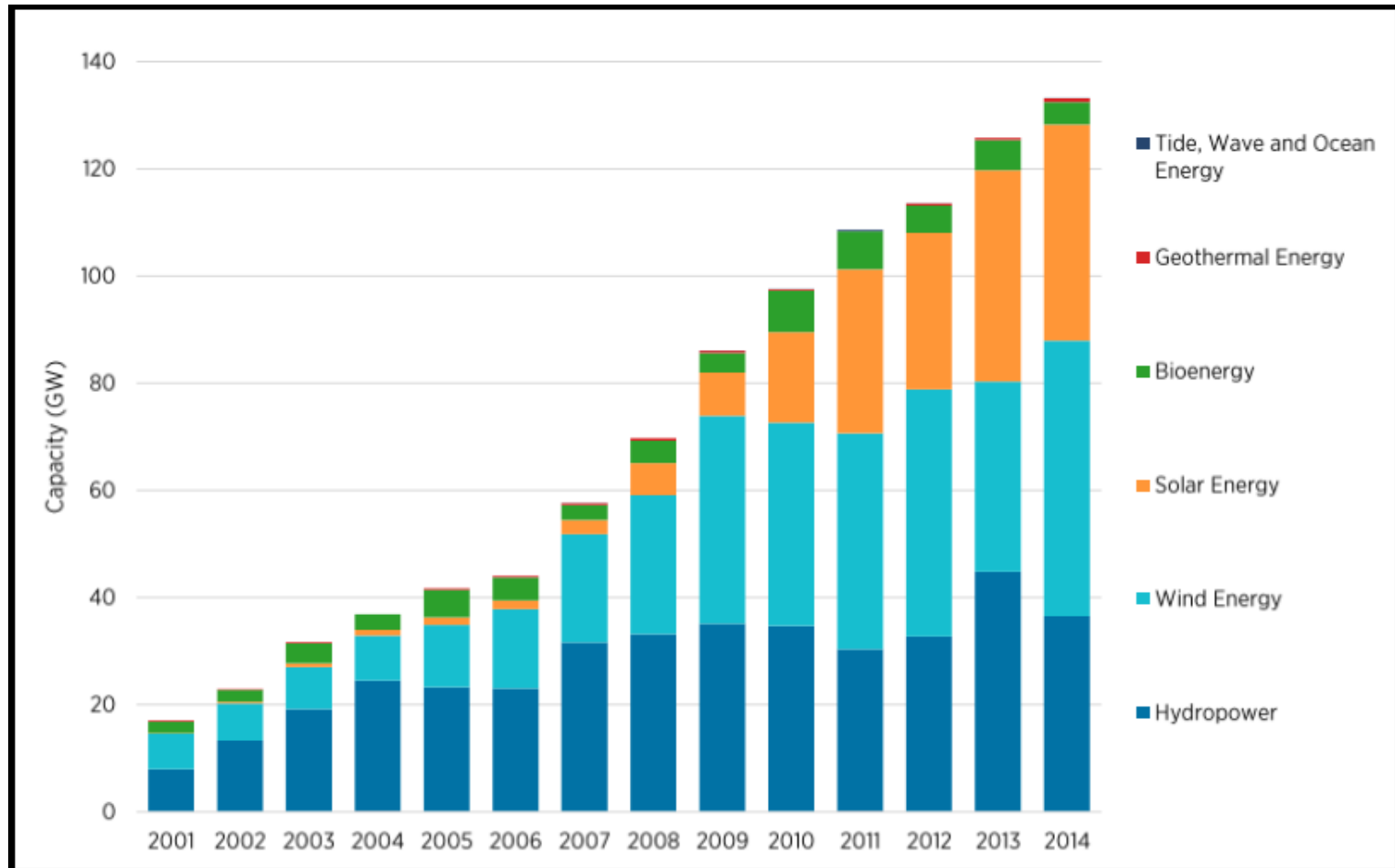


IEA's new solar roadmap has solar halving by 2030. IEEFA views this as still too conservative.

Learning rates of Wind

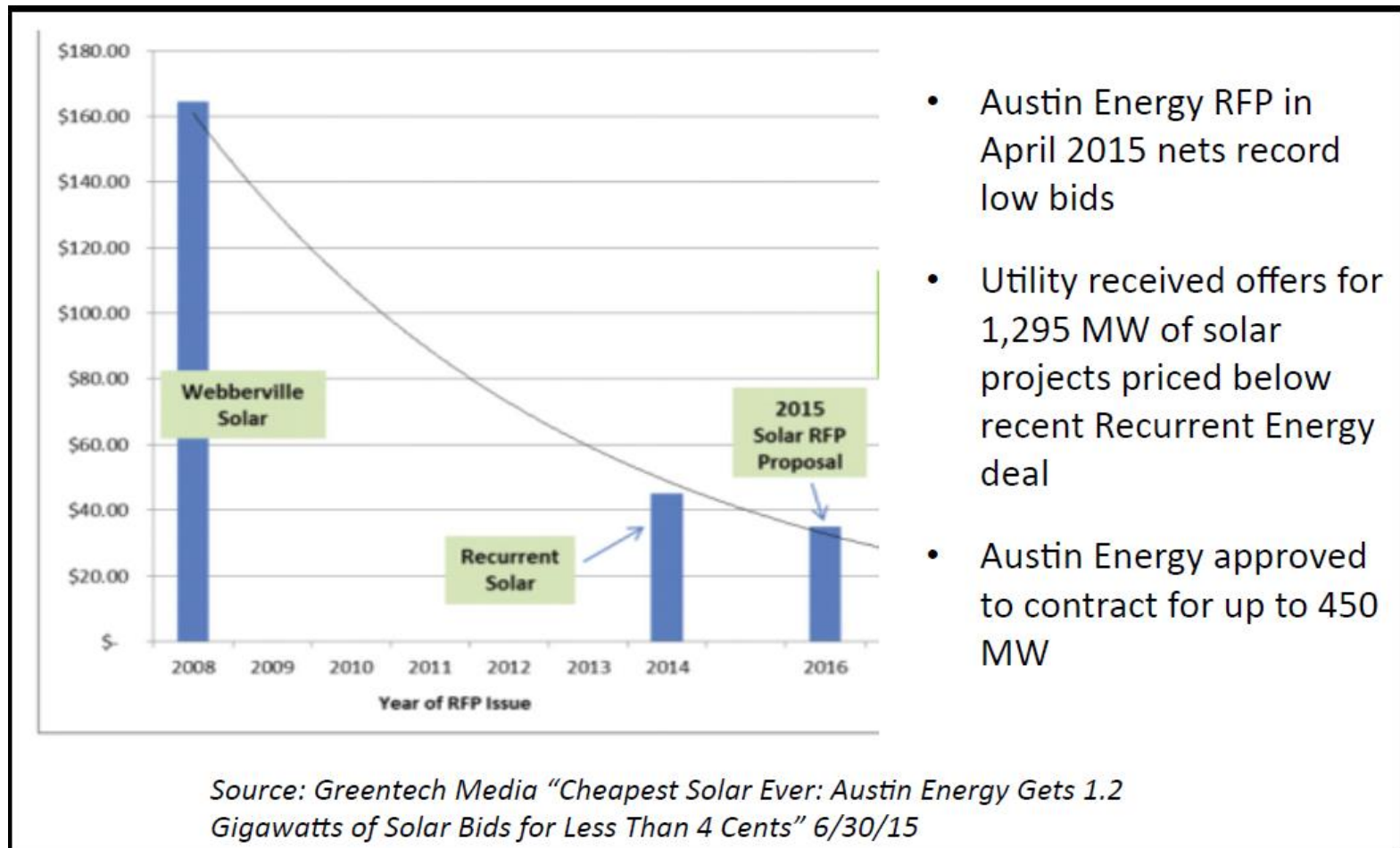


Renewables are spreading



Source: IRENA 2015

Texas Utility Solar Costs down 80% 2008-2016



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