The IEA's World Energy Outlook 2016

IEEFA's Take – Summary of main points

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Background

The International Energy Agency (IEA) annually releases a comprehensive review of the global energy markets, covering key policy, technology and financial trends across oil, gas, coal, nuclear, renewables, energy efficiency and electricity markets.

The IEA models **three scenarios:**

- A baseline assuming no policy developments is presented in the Current Policies Scenario;
- A central estimate is presented in the New Policy Scenario (NPS), which factors in all key proposed policy developments, including all the commitments of the Nationally Determined Contributions (NDC) that result from the entry into force of the Paris Climate Agreement (COP21);
- The 450 Scenario represents a model estimate where energy markets transform sufficiently to meet the likely requirement to hold the world on track for a 2 degree climate outcome.

The IEA releases the World Energy Outlook (WEO2016) this week. It provides an exceptionally thorough analysis of global energy markets and clearly highlights the acceleration of an energy transformation that is already well underway.

WEO2016 provides a detailed review of the policy and forecasting complexities of this transformation in terms of the nexus of energy-water-climate-pollution, as well as calculations of the capital investment required out to 2040.

The WEO2016 highlights the dramatically lower than expected costs and faster technology innovation for renewables that have accelerated global deployment well ahead of forecast.

A similar positive story has emerged with energy efficiency, driving a sustained and very promising decoupling of energy demand from economic growth.

A history of IEA underestimation of technology change has been partially remedied, but the IEA solar and wind forecasts can at best be described as still very conservative.

The WEO2016 now acknowledges a point IEEFA has long argued, namely that China passed 'peak coal' back in 2013 and, along with India, is accelerating the global transformation from coal to alternative energy sources, especially solar. With the new 450 Scenario estimate revealing a precipitous fall in thermal power's share of global

electricity generation to just 24% by 2040, the lesson for governments and investors is simple – those who exit fossil fuels and embrace solar and wind will reap financial rewards and avoid major stranded asset risks.

In the unlikely event that the short-term tailwind for the coal sector in the US continues and we see a slowdown in renewable energy deployment as a result of the new administration, the IEA analysis shows that emerging economies are now well placed to assume global low-carbon technology leadership.

In this scenario, we will see the rise of China and India as new clean energy superpowers, outflanking the US, dodging stranded asset risk and powering their economies from limitless energy sources. Developments over 2016 suggest Europe, as well as countries as diverse as Mexico, Taiwan, Chile, Africa and Dubai are increasingly well placed to replicate this transformation.

The report also acknowledges the decoupling of economic activity from energy demand growth, largely through the rising impact of energy efficiency. All of these trends are demonstrated most starkly by the rate of change in China's electricity sector relative to even recent IEA projections.

The IEA has again expanded its assessment of emerging energy markets, and IEA case studies covering India (WEO2015) and Mexico (2016) show how falling costs in implementing these changes has induced more countries to get on board.

The IEA is at pains to highlight the forecaster's dilemma. The entry into force of the Paris Agreement sets a global policy consensus for aggressive transformation, with the 1.5-2 degree target. It commits governments to more ambitious action than even the IEA's 450 Scenario, which itself requires transformational outcomes.

The IEA report reveals that the aggregation of all Nationally Determined Contributions in the NPS falls far short of the rhetoric. **With the timeframe for urgent action now very short, policy action in aggregate must tighten to accelerate the rate of change.**

The implications for stranded asset risks are very clear: the IEA assumes that under the 450 Scenario **thermal power's share drops to just 24% of global electricity generation by 2040**, less than half the 52% share estimated in the NPS.

The WEO2015 had thermal power's share in the 450 Scenario at 29% by 2040, an estimated market share decline of five percent.

Put another way, the WEO2016 estimates thermal power generation is 18% or 1,744TWh less than that forecast just one year earlier. Current policy trajectories in line with the NPS mean financial markets currently price in a failure of the COP21 agreement to be achieved. A successful implementation of COP21 means a 60% lower usage of thermal electricity generation by 2040 than the world is currently planning for.

The six big changes in WEO 2016

IEEFA examines six of the biggest changes in IEA's position in the WEO2016 relative to their position and estimates of the prior year:

1. The enormous success of China's transformation, including already passing peak coal in 2013

In the WEO2015, the IEA wrote an op-ed questioning if China's coal consumption could peak by 2020, concluding it was possible but unlikely. The WEO2016 stance has changed dramatically (page 65), concluding**: "China's coal use is likely to have peaked in 2013."**

China's coal reliance is modeled to fall from 73% of 2014 electricity generation to just 43% by 2040 in the NPS (and just 16% in the 450 Scenario) as China continues to diversify extremely rapidly into more gas, hydro, nuclear and renewables. On the IEA's own NPS modelling, **China has the equivalent of 200GW of stranded coal fired power plants already built. Another 185GW in planning will just add more stranded assets.**

2. A global decoupling of energy demand from economic activity

Decoupling of energy and economic activity: The IEA has extensively expanded its modelling into the impact of the structural composition of economic growth and the power of energy efficiency, incorporating the decoupling of energy demand from economic activity.

To illustrate with China, total primary energy consumption grew 7.6% annually from 2003-2013, but has slowed to just 1-2% pa over 2014-2016. This decoupling has given the IEA the confidence to model just 0.9% annual China energy system growth under the NPS to 2040.

The average global energy intensity improvement to 2030 reaches 1.9% annually in the NPS, halving energy system growth requirements. This makes energy efficiency an absolutely key tool in facilitating global decarbonisation.

3. India's changing dynamic as it looks to replicate China's transformation

India: **The WEO2016 models a dramatic and unexpected decarbonisation of the Indian electricity grid, with coal fired power generation falling** from 75% in 2014 to 52% by 2040 in the NPS, and a radical 12% by 2040 under the 450 Scenario.

Following the well-established path of transformation evident in China, India's electricity strategy is one of rapid grid and energy efficiency gains combined with diversification from coal into all alternative sources available. **Beyond the policy implications of the energy-water nexus plus the health and climate change drivers, the financial driver of increasingly cost competitive renewable energy has become clear over 2016**.

A second key economic motivation for India improving domestic self-sufficiency is detailed by the IEA (page 88): **Under the NPS India's oil and gas imports are**

forecast to drain an annual US$460bn from the economy by 2040, an unaffordable sevenfold increase on US$65bn in 2015.

The IEA details the **8.1 million people employed in renewable energy sector globally in 2015** (Page 407), and the estimate that **China has gained the greatest benefit to-date by securing 45% of these jobs.**

India at 416,000 already is now seeing exponential job growth from the energy transformation program as part of its Make in India program.

4. Massive price deflation across solar and wind allowing cost effective deployment at far faster than anticipated rates

Renewables deflation: The IEA's conservatism on renewable energy has seen it consistently underestimate deployments rates and cost declines. **The WEO2016 admits the solar cost deflation over 2010-2015 has achieved in five years what the IEA estimated would take 15 years.**

While modelling technology disruption is always difficult, IEEFA sees this as remaining a key IEA modelling error. At its starkest, the IEA assumes offshore wind in Europe will fall to average US$110/MWh by 2040. The record low Vattenfall tender win of November 2016 at US$55/MWh[1] is a contractually verified price half that of the IEA figure, for delivery 20 years earlier.

Likewise the IEA assumes Indian solar installed capital costs will fall 30% in the decade to 2025 to US$1.0m/MW – yet this cost was achieved in 10GW of non-domestic content tender awarded in India during 2016. From a lower starting point, **IEEFA forecasts global solar tariff deflation of 8-10% pa this coming decade, twice that of the IEA's 4% pa estimation.**

In WEO2016 (page 452) the IEA identifies two key reasons for this. First, they assume no cost of capital differentiation by financial markets between technologies. IEEFA would argue this misses the fact that financial markets are doing so already, and will increasingly apply a rate of return differential to reflect policy intent plus air, particulate, emissions, water and health externalities of thermal power use relative to renewables.

Second, the IEA acknowledges but then fails to model in the exceptionally low reverse auction solar tariffs evident in 2016 in Dubai (US$24/MWh), Chile (US$29/MWh) and Mexico (US$35/MWh) and onshore wind in Morocco (US$30/MWh) and Texas (US$30/MWh).

The IEA explains these amazing auction results reflect long dated tariffs secured by bankable counterparties. Given these are a key part of the market structure providing exceptional price stability for consumers, IEFFA models a rapid expansion of similarly structured market bidding. In contrast, the IEA assumes this practice will cease.

Yet **the IEA makes no reference to the point that most import coal fired power plant proposals in Asia rely on capital guarantees and long dated interest rates subsidised by Export Credit Agency funding**. A removal of fossil fuel subsidies like this is a key demand of the IEA, but this practice currently continues in the IEA

modelling till 2040. Both are a reality that exists, ignoring one and pricing in the benefit for coal gives an erroneous result.

5. Dramatic upgrades to renewable energy deployment rates are the result

Renewable energy deployment upgrades: By 2020 the NPS forecasts an installed solar base tripling from 2014 levels to reach 481GW globally. The IEA estimates renewables will generate 599TWh pa by 2020, more than 20% higher than estimated in WEO2015. **The IEA models solar tripling again in the two decades to 2040 – IEEFA would suggest this could happen twice as fast as the IEA models.**

In the NPS wind capacity by 2040 is estimated to generate 3,881TWh pa, 315TWh more than in WEO2015. In the 450 Scenario, the wind uplift by 2040 is over 1,000TWh or 20% higher than the IEA estimated just one year ago. Combined with lower demand due to energy efficiency improvement, this gain comes directly at the cost to the thermal power sector.

6. The dire outlook for thermal coal if the 450 Scenario is implemented.

Coal in structural decline: For thermal coal, the high marginal cost source of supply once built, even in the NPS, the stranded asset impact is clear: the WEO2016 has shaved 430TWh or 5% off global coal fired power use by 2020 relative to their estimate of just one year ago.

By 2040, the IEA's NPS estimate for coal is down 1,080TWh or 10% on WEO2015. The IEA sees Chinese thermal coal consumption falling 15% and thermal imports falling 85% by 2040, with the caveat that China could well return to being an opportunistic net thermal coal exporter in order to protect domestic employment (IEEFA concluded this in 2014[2]).

This financial market risk is massively accentuated by the difference between coal in the NPS and 450 Scenario, with the later modelling a collapse to just 2,518TWh pa by 2040, just a quarter of that in the NPS.

To conclude, global energy markets are transforming rapidly, driven by technology, policy and financial market developments. The developments in terms of electric vehicles and rooftop solar with storage are accelerating. Stranded asset risks in the thermal energy sector are rising. The IEA WEO2016 gives a comprehensive review that increasingly reflects these changes.

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ABOUT IEEFA

IEEFA conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy and to reduce dependence on coal and other non-renewable energy resources.

More here on IEEFA research: http://ieefa.org/category/subject/reports/

[1] https://corporate.vattenfall.com/press-and-media/press-releases/2016/vattenfall-wins-tender-to-build-the-largest-wind-farm-in-the-nordics/

[2] http://www.carbontracker.org/wp-content/uploads/2014/09/Coal-Demand-IEEFA.pdf