Moving to a Sustainable Low Carbon Future & Energy Security
Fossil Fuels ~v~ Renewables and the Paris Agreement

Dr Ted Christie, ***24 October 2016***

Disclosure Statement

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OVERVIEW

1.0 Divergent scientific opinion held by competing energy interests exists over *renewables -v- fossil fuels* for power generation and the most effective mix of sources for achieving energy security.

2.0 **Because of the potential impacts of energy security on global climate change, the boundaries for the scientific evidence for resolving this information conflict are set by International Climate Change Treaties.**

3.0 The Paris Agreement 2015, charts a new course in the global effort to combat climate change. Its purpose is to accelerate and intensify the actions and investment needed for a sustainable low carbon future.

4.0 Evaluation of *Nationally Determined Contribution* mixes of fossil fuels and/or renewables as options for power generation, must be based on relevant and reliable scientific evidence - *and complies with the framework of the Paris Agreement* - to ensure the validity of the conclusions.

5.0 The evaluation of sustainability must be a flexible one.

Its focus must be on equity – as well as the accepted principles and methodologies of the relevant scientific community: Ecological *e.g. emission reduction targets*; Economic *e.g. cost competitiveness*; Social *e.g. protecting the most vulnerable;* and Cultural *e.g. providing financial and technology capacity-building support for developing countries for preparing their NDCs.*

6.0 The Paris Agreement enters force on 4 November 2016. But, as at 24 October 2016, less than 50% of the 191 Signatories to the Paris Agreement had ratified it.

This situation has implications for COP22, Marrakech, in November 2016; as, for the first time, targets to reduce GHG emissions will apply equally to both developed and developing countries.

The **Australian Energy Update for 2015** summarised the share of fuel types for electricity generation for Australia in 2014:

i. **Fossil Fuels: 85.1%** - *Black Coal 42.6%, Brown Coal 18.6%, Gas 21.9%; Oil 2.0%*
ii. **Renewables: 14.9%** - *Hydro 7.1%, Wind 4.1%; Solar PV 2.0%, Bioenergy 1.4%, Geothermal 0%*

However, some Australian States have higher renewable targets than the above national average e.g. wind (33%) and solar (6%) provides 39% of the energy for South Australia's power grid.

But, a one-in-50-year storm with tornado-like winds that swept through South Australia last September, **plunged the entire State into darkness.** Power returned to most of Adelaide in hours; for some regional areas, more than a day.

One outcome was for public debate to be fuelled over the extent that relying on intermittent energy and renewables had contributed to the blanket blackout. Competing energy interests had divergent opinions on the most effective energy sources for ensuring a stable energy grid.

At the core of this issue is energy security and the **meaning and significance of the economic term, "baseload power"**. That is: -

"The power sources that consistently generate electrical power, and so meet minimum demand.

The minimum demand for electrical power from an electrical grid is referred to as the baseload requirement".

Baseload power is an issue for some renewables. Wind and solar do not generate electricity continuously. Generation is intermittent because of factors that cannot be controlled: Wind speed variability affects wind generation; shading, due to cloud, affects solar generation.

Two alternative pathways have been advanced to address energy security and baseload power - fossil fuels ~v~ renewables:

- Fossil-fuelled[1] baseload electricity to be supplied by means of coal-fired power stations operating continuously at full power: Or by developing generation projects that move towards a natural gas-dominated electricity system.

- One area of support, ***based on need,*** for coal-generated energy to remain as part of any future global mix emerges from **World Coal Association** statistics: Coal provides 30% of global primary energy needs, generating over 41.1% of the world's electricity; estimates of coal reserves are for 110 - 120.7 years of coal output.

- *An alternative pathway for energy security calls for new forms of baseload power by transitioning to 100% renewables: The need is for global energy security to move away from outdated reliance upon fossil-fuelled baseload power.*
- *One area, **based on need**, to support renewable energy having a significant role in the future global mix, is that electricity is generated from sustainable sources with little or no pollution or global warming emissions.*

Because of the potential impacts of energy security on global climate change, the boundaries for the scientific evidence for resolving this information conflict are set by International Climate Change Treaties: In this regard, the Paris Agreement 2015, because it charts a new course in the global effort to combat climate change.

The Significance of the Paris Agreement 2015 and Nationally Determined Contributions[2] ("NDCs")

The 2015 Paris Agreement is the most recent step made under the United Nations Framework Convention on Climate Change ("UNFCCC").

The **threshold for entry into force** for the Paris Agreement was achieved on 5 October 2016: At that date, 55 of the 197 Parties to the UNFCCC had ratified the Paris Agreement – and accounted, in total, for at least an estimated 55% of total global GHG emissions.

The Paris Agreement enters into force on 4 November 2016. As at 24 October 2016, 84 Parties to the UNFCCC had ratified the Paris Agreement.

But, as there are 191 Signatories to the Paris Agreement, this represents ratification by less than 50% of the Parties!

Ratification of the Paris Agreement means a Party becomes legally bound by this Agreement e.g. by imposing a legal obligation to achieve the GHG reduction targets to be implemented in their NDCs to combat climate change and to limit future climate risks.

This obligation is significant for achieving the **purpose of the Paris Agreement** as, for the first time, targets to reduce GHG emissions will apply equally to both developed and developing countries.

The Purpose of the Paris Agreement

*"The Paris Agreement seeks to accelerate and intensify the actions and investment needed for a **sustainable low carbon future**.*

*Its **central aim** is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.*

The Agreement also aims to strengthen the ability of countries to deal with the impacts of climate change".

Non-Renewable Fossil Fuel Energy and the Future Global Energy Mix

For coal to remain as part of any future global energy mix - including the provision of baseload power - the prudent path to take would be to consider coal-fired energy and its compliance with the long-term goals of the Paris Agreement, in both time and space, in terms of:

- The international trade in coal;
- The diffusion, adoption and effectiveness of low carbon energy technologies for achieving CO_2 reduction targets in NDCs; and
- Sustainable development.

In 2013, the world's top seven countries that exported coal and the top seven countries that imported coal contributed 63.7% of global CO_2 emissions.

The pathway for coal-generated baseload power to become part of a sustainable, low carbon future, should commence with a ***global commitment by all countries involved in the international trade in coal*** to effectively

comply with the long-term goals of the Paris Agreement *e.g. by their actions and investments to reduce CO_2 emissions, sustainably.*

For example, *such* a commitment is a relevant consideration for the **top ten coal producers in 2014**: -

PR China *(3,747.5 Mt)*
United States *(916.2 Mt)*
India *(668.4 Mt)*
Australia (491.2 Mt)
Indonesia *(470.8 Mt)*
Russian Federation *(334.1 Mt)*
South Africa *(253.2 Mt)*
Germany *(186.5 Mt)*
Poland *(137.1 Mt)*
Kazakhstan *(115.5 Mt)*

However, as at 24 October 2016, only China, the United States, India, Germany and Poland have already ratified the Paris Agreement.

Australia, Indonesia, the Russian Federation, South Africa and Kazakhstan have yet to do so.

All Parties involved in the international trade in coal need to take the lead to ratify the Paris Agreement at the time of COP22 at Marrakech in November 2016. They all must set CO_2 reduction targets in their NDCs that they intend to implement to be consistent with their emissions profiles.

Such a step would not only enhance each Party's trustworthiness, but also, their influence, prestige and good reputation.

Looking to the future: -

- Whilst clean coal technologies - such as *'High Efficiency, Low Emissions'* coal plants and *Carbon Capture, Use and Storage* - have the potential to reduce GHG emissions, there is concern whether this will be on a scale large enough and within the required NDC time frames *[of the Paris Agreement]* to combat climate change.

- The expansion of the Liquefied Natural Gas ("LNG") industry offers an opportunity for LNG as a substitute for some base-load coal-fired power stations. Technical knowledge of the generation systems based in LNG are well known and established. But concern exists whether all projects may fulfil their objectives in time and within budget as commercial aspects and market conditions have a significant influence for the likelihood of success.

Renewable Energy and the Future Global Energy Mix

Following the after-math of the recent impacts experienced on the energy grid of South Australia, three areas of concern that would have high priority in ranking issues using a scoping process, can be identified:

- *Whether a large-scale electricity generation system, based on a 100% mix of different types of renewable sources of energy, can replace a conventional fossil fuel electricity generating systems - and be just as reliable?*
- *Whether some renewable energy sources can supply baseload power that replicates baseload of fossil-fuelled power stations, such as coal and gas - power stations designed to run continuously whether, or not, their power is needed?*
- *Cost-competitiveness of fossil fuel power generation compared to renewable power, for the time periods set by the Paris Agreement?*

Dr Mark Diesendorf, *Centre for Energy and Environmental Markets, University of New South Wales, Sydney*, believes the goal of transitioning to 100% renewables is possible - but will require a greater mix of different types of renewable energy sources to ensure a stable energy grid. The following reasons are advanced to support this position in two of his recent articles[3]: -

- ❖ *That in the longer term, there is no technical reason to prevent renewable energy from supplying 100% of grid electricity; and to be just as reliable as the fossil-fuelled system.*
- ❖ *That there are a range of renewable energy sources with different types of variability in output over time. Some of these renewable sources have*

similar variability to coal e.g. bioenergy[4], geothermal[5], and so can provide base-load electricity to the grid.

- *That the future focus on renewable energy should not only be on energy efficiency – but also on flexible generation and demand management. Electricity demand is variable - not fixed. Smart grid technologies required variable sources of supply with variable sources of demand to be counter-balanced.*
- *Renewables can provide base-load electricity to the grid - as well as supplying power flexibly according to demand.*

Managing the Fossil Fuels ~v~ Renewables Information Conflict

Conflict management, used as a discrete process, provides the framework to understand and resolve the scientific information conflict over intermittency, baseload power and energy security – and, in turn, to facilitate the integrity of the decision-making process that follows for global energy and climate change.

Full disclosure of all scientific information at COP22, and meaningful involvement of all Parties that have ratified the International climate treaties, are its cornerstones.

KEY WORDS: Climate change; Paris Agreement; ratification; energy security; Nationally Determined Contributions; COP22; fossil fuels; renewables; intermittency; sustainability; information conflict

END NOTES

[1] Uranium is not a fossil fuel, but it is classified as a non-renewable fuel.

[2] "The Paris Agreement requires all Parties to put forward their best efforts through **'nationally determined contributions' (NDCs)** and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. ***In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs.***
There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties".

[3] Articles by Dr Mark Diesendorf: **"The Base-Load Fallacy"** and **"Dispelling the nuclear 'baseload' myth: nothing renewables can't do better"**

[4] **Bioenergy** is the single largest renewable energy source today, providing 10% of world primary energy supply. It is energy derived from the conversion of biomass where biomass may be used directly as fuel, or processed into liquids and gases.
The deployment of advanced biomass cook stoves, clean fuels and additional off-grid biomass electricity supply in developing countries are key measures to offset past adverse health and environmental impacts and to achieve universal access to clean energy facilities by 2030.

[5] **Geothermal energy** is the energy stored as heat in the earth. Energy is brought to the surface by extracting hot water that is circulating amongst the sub surface rocks, or by pumping cold water into the hot rocks and returning the heated water to the surface, to drive steam turbines to produce electricity.
Geothermal energy holds the promise of being a renewable energy source that can operate 24 hours a day, providing critical large scale baseload power.
Most current geothermal projects in Australia are still at proof-of-concept or early demonstration stage.