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KYOTO, FUKUSHIMA AND NUCLEAR POWER

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Overview

30 countries (all signatories to Kyoto Protocol) currently use nuclear power as a component of their baseload electricity generating capacity. The World Nuclear Association's upper scenario for 2030 shows 51 countries with nuclear generating capacity. The Fukushima accident (March 2011) has had an impact on the future global scale and timing for nuclear and therefore on the quantity of CO_2 abatement previously expected from nuclear. By the time of this presentation the degree of change will be better quantified. Allowing for growth in global population, increased industrialisation, increased electrification and a resolve to reduce Greenhouse Gas (GHG) emissions we need to examine the future for nuclear power under the three scenarios described by the World Nuclear Association; Upper, Reference and Lower.

The Three Mile Island (1979) and Chernobyl (1986) accidents and the subsequent recovery of the nuclear industry provide real experience to draw on in assessing the future for nuclear post Fukushima. In the former cases the industry took some years to examine the issues, make changes to technology, equipment and management and then to resume an increasing nuclear dependency. It is suggested that the final assessment of Fukushima will also be followed by improvements to siting, plant design and architecture in some countries. There will then be a resumption of growth.

If nuclear power fails to reach its upper projections the world will be faced with an accelerating increase of GHG, not a reduction as promulgated by those most concerned about anthropogenic CO_2 and climate change. Increasing dependence on low carbon renewables will be an essential component but can they fill that gap?

Kyoto in the title covers all that has flowed from the UNFCCC and Protocol aimed at the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

Most scientists support evidence of climate change and note its likely anthropogenic cause. There is however an increasing strident scientific dissent by those who claim that climate change is yet to be proven and if present then it is more likely due to changes in solar activity than anthropogenic causes. Both sides of this growing debate need to be heard.

The growth of nuclear power will depend on many elements including its comparative economics. Currently it is said that an impost on coal equivalent to A$40/t of carbon should bring fossil fuel costs into line with nuclear costs.

The price for natural gas is escalating due to global demand and that will diminish gas usage to just remote small to medium sized generation and load peaking applications. We should not forget that burning gas is a more efficient thermal process than burning coal but it is also a source of CO_2 at well-head and combustion point.

If carbon capture and storage (CCS) becomes mandatory then costs of coal and gas fired generation will far exceed nuclear.

Baseload generation will be best supplied from coal, hydro, nuclear and possibly solar molten salt plants and geothermal. Whilst intermittent and variable wind power will contribute to the grid at times it needs to be backed up by one of the former sources.

Prospective renewables such as geothermal and wave power are yet to be demonstrated commercially in Australia. Any shortfall in base load supply cannot be filled by intermittent and variable sources such as wind.

The Three Mile Island, Chernobyl and now Fukushima accidents have had an impact on what otherwise would have been a comprehensive nuclear contribution to base load electricity generation. However with each of these incidents society has learned from the experience, regrouped and proceeded with a nuclear contribution.

This presentation will look at the lessons learned and the likely profile for nuclear power to the year 2050.

Methods

The author will draw on his experiences from 40 years of association with uranium, the nuclear fuel cycle and global nuclear power generation. Due to his past Chairmanship of the Uranium Institute (World Nuclear Association) he has access to all WNA publications. The global nuclear industry and the nuclear debate in Australia were impacted by both the TMI and Chernobyl accidents and subsequently by the recovery of the industry. Lessons from those events have application to the assessment and recovery after Fukushima.

The elements in an assessment of the life-cycle CO_2 generation for each of coal, gas and nuclear are diverse but achievable. These will be outlined in the presentation.

The growth profile for nuclear 5 years before and after Three Mile Island and Chernobyl will analyzed. These precedents will then be applied to the industry profile 5 years before and after Fukushima.

The prospect for nuclear power in Australia will require an understanding of local generation, distribution and usage. Long transmission distances and the energy losses prescribed by Ohm's Law are real and need to be addressed.

Results

Preliminary assessment after Fukushima suggests that the upper scenario for global nuclear power generation will be delayed and reduced to some degree. The impact of Fukushima on each nuclear country will be made available. The most impacted countries are Japan and Germany. Importantly the very large China construction program is continuing unchanged.

Australia should continue to assess its need for nuclear power. Of the three largest grids the eastern states' NEM is now large enough to absorb nuclear units each of say 1000MWe. The south west of Western Australia (SWIS) is expected to grow more rapidly than the eastern states and could absorb its first 1000MWe plant by 2030. The Pilbara area (NWIS) will be the area that grows faster than any other due to mining and industrial growth, increased electrification, grid consolidation and development of one or more regional centres. NWIS could also become prospective for nuclear generation in the by 2030s.

Conclusions

The significant Fukushima nuclear power plant accident will cause some delay and/or downsizing of the upper scenario for global nuclear power generation. However WNA's post Fukushima assessment of expected carbon abatement from that revised nuclear capacity of 790GWe by 2030 could be 5,700,000,000t CO_2 annually. This is worth fighting for!

Australia should not abandon this opportunity for some dependence on low carbon nuclear powered baseload electricity generation and could have its first nuclear power plant on line by 2030.

References

Back up data will be drawn from several sources including the World Nuclear Association http://www.world-nuclear.org/