Renewable Energy: The Only Solution

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One major asset for any country when combating Climate Change and achieving sustainability, energy, water and food security as well as eradication of poverty, is the investment and use of renewable energy.

As a matter of clarification nuclear energy is not a renewable source of energy. The energy sources which come under the umbrella of “renewable” are photovoltaic (PV), solar thermal, wind energy, biomass and biofuel, geothermal, hydrogen and fuel cells, hydropower, and ocean energy.

In photovoltaic technology, production has doubled every year since 1985. In 2011 PV cell production reached 27 GW, and is expected to rise to 32 GW by the end 2012. Investment in this area alone is more than 87 billion dollar. The leaders in this field are Germany and China. The cost PV power per Watt has dropped from US$ 7 in 1985 to 0.65 in 2011, and cell efficiency has improved from 14% to 21% for crystalline PV.

Many projects are in excess of 50 MW has been installed in the US and Europe while in other countries manufacturing facilities has reached remarkable levels. Malaysia, for instance produces 2000 MW a year, while India produces 6000 MW a year, and Qatar produces 1000 MW. Examples of various large scale PV plants can be found in: National Solar Power partners in the US are installing a 700 MW facility in Florida, plants of 60 MW in Spain, 70 MW in Italy, 80.7 MW in Austria, 100 MW in Jordan, 143 MW in France and 2000 MW in China. It is worth bearing in mind that one MW is enough to supply electricity to between 1500-3000 homes.

**Figure 1A:** 44 MW - amorphous silicon produces 80 GWh of electricity a year. (1)

United Solar, global manufacturer of light-weight, flexible thin-film solar modules, is installed the first thin-film solar demonstration installation at the University of Notre Dame in South Bend,

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Indiana. It includes 36 UNI-SOLAR PVL-144 laminates representing 5.1 kW of the total installation. The flexible UNI-SOLAR laminates are adhered directly to the roof surface through a peel and stick adhesive, requiring no roof penetrations. The entire solar PV installation is expected to supply over 12,000 kilowatt hours (kWh) of electricity per year, helping to meet the buildings energy needs. See figure 1B.

Figure 1B: Peel and Stick light weight flexible thin-film. (2)

In the US, renewable energy industries have created jobs for more than 100,000 persons. Let us look at the solar thermal technology, heating and cooling systems have progressed to become cost effective, attractive and plentiful. Evacuated tube collectors are being produced in their millions, mostly in China, Taiwan, South Korea, Japan, Germany, Denmark and UK, while cooling technology is being pursued in Germany, Australia, France, USA, Brazil and UK. Concentrating Solar Power (CSP) is widely used in many parts of the world with 490 MW in operation, 500 MW under construction and 900 MW in advanced development. The cost is 5000 € / kW electric, investment total more than 50 € billion.

Figure 2: Concentrating Solar Power, parabolic concentrator system.
At present wind sourced electricity is cheaper than fossil fuel and its reliability has improved. Wind turbines have steadily increased in size and efficiency over the years with machines of 5 and 6 MW are in operation in Europe and the US. If wind speed is 5.5 m/sec or more then electricity cost is 800 € / kW. The cumulative power generated in 2010 was 194.40 GW, also in 2010 installation, China having the biggest share of 16.5 GW. Another important development has been offshore wind farms and in this the UK has the biggest share amongst European countries. In 2012 it reached in excess of 2200 MW. As of February 2012, UK offshore wind farms are set to be the largest in the world, namely: the Walney Wind Farm - 367 MW, followed by Thanet Wind Project (300 MW). The London Array (630 MW) is the largest project under construction. These projects will be overtaken by subsequent wind farms that are in the pipeline, including Dogger Bank at 9,000 MW, Norfolk Bank (7,200 MW), and Irish Sea (4,200 MW). In the meantime roof-top wind turbines and turbines incorporated within buildings have started to make sense, see figure 3.

Figure 3: Offshore floating wind farm near Bahrain building
Fukushima, Japan, 18 MW, at a cost of incorporated Turbines of 675 kW
Fukushima, Japan, 18 MW, at a cost of Bahrain Tower US$ 261 million, (3)

It is estimated that 14% of all energy consumption is derived from biomass. Most European countries now blend hydrocarbon produced from sustainable biomass and organic waste to produce fuel. The present recommendation of the EU states that no more than 7% of biofuel can be added to conventional fuels, however, other areas such as the US, can exceed 10%. This ratio by 2020 could reach 20%. Global bioethanol production started in 2003 with 33,514 million liters, growing to 105,608 million liters by 2011 at a compound annual growth rate (CAGR) of 15.4%, and is forecast to grow at a (CAGR) of 4.4% during 2011-2020 to reach 154,962 million liters in 2020. The global bioethanol trade increased from 1,257 million liters in 2006 to 1,754 million liters in 2010. Global production of biodiesel started in 2005 with 4,854 million liters, growing to 23,579 million liters by 2011 at a CAGR of 30.1%. Production is forecast to grow at a CAGR of 3.5% during 2011-2020, reaching 32,164 million liters in 2020. In 2010, the global biodiesel trade increased to 17,950 million liters from 14,927 million liters in 2009.

Biofuel is an area of high potential and economical benefit to many countries which do not have enough fossil fuels to sustain their growth, moreover recycling vegetable oils, and ‘waste-to-energy’ have become big business in both Europe and the US and could easily become a global resource. In 2010, Austria, Denmark, France, Germany, Hungary, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and UK generated 33,000,000 kWh thermal and 40,761,000 kWh electrical. And it is now possible for biofuels to be used in aircraft.

Through research and modernisation geothermal energy is rapidly catching up with other forms of renewable energy. Presently there is 10.9 GW in operation. The US has the largest geothermal capacity, now just over 3.1 GW (28.4% of the
world total), followed by the Philippines (2.0 GW), Indonesia (1.2 GW) and Mexico (1.0 GW).

Meanwhile hydrogen energy and fuel cells have progressed in many parts of the world, particularly in the US and Europe. The six types of fuel cells available in the market are: Alkaline, Proton Exchange Membrane, Direct Methanol, Phosphoric Acid, Molten Carbonate and Solid Oxide. Several of them are used in heavy-duty vehicles and small applications in space, electric utility, military applications, back-up power and small generation. Research in fuel cells has gained momentum resulting in cleaner energy in transport and small power generation.

20% of the world’s electricity now comes from hydropower. The World Bank Group has supported more than 70 projects with more than US$8.5 billion of investment resulting in electricity generation of more than 10,000 MW.

Ocean energy is a vast untapped source of energy. Wave and tidal energy are both a very large energy potential which is essential and should be utilized. At present it is seen as an initially expensive form of energy but it is clean and reliable and in the long run will repay the investment. A notable example in the UK is the City of London which is utilizing the river Thames tidal potential to generate 50 MW of electricity.

Let us be clear - nuclear energy is not an option. Wherever it is built it requires considerable investment to protect it from sea-level rising and tsunamis, earthquakes and other natural phenomena. There is the on-going problem of the storage of radioactive waste and spent fuel. Construction costs are astronomical to take into account all the safety measures required, and the return on the investment cannot be realised for more than a decade since nuclear power stations take more than 10 years to build. This results in a cost of a minimum of US$12 Billion to generate 1000 MW. Uranium is not only expensive it is also a finite resource.

Attempts to adapt nuclear power to climate change will entail increase expenditure for construction, operation, waste storage and decommissioning, all at a significant cost to the environment, public health and welfare.

Renewable energy is natural, clean, affordable and abundant. Utilisation of renewable energy would alleviate much of the world’s poverty by creating jobs, improving the standard of living, enhancing and not destroying the environment and reducing our dependence on fossil fuels. We recommend that every nation invest in Renewable Energy. Let us take hope from the courageous example of Denmark which has pledged to use renewable energy so that according to the recent announcements made by its government that by the end of this decade it will produce a third of its energy requirement from renewable sources and by 2050 their goal is to have the entire energy needs met by renewable energy. That is from wind, solar and biomass.

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