TECHNOLOGY FACTSHEET

SMART GRID TECHNOLOGY FOR WIND & SOLAR INTEGRATION WITH HYDRO[1]

1. Sector: Energy Supply

2. Introduction

The potentials for wind based electricity generation and solar PV based electricity generation in Sri Lanka are very large. Each of the above technologies could generate many times the total electrical energy presently generated in the country. However, the development of these two technologies to meet grid-based electricity generation are not proceeding due to the reluctance on the part of the national electric utility due to the frequent and rapid variations in the level of outputs of power plants based on these two technologies. The cost of storing electricity generated by these sources to mitigate the fluctuations in outputs is prohibitively expensive.

Many developed countries have resolved this problem by adjusting the demand of energy in the system and output levels of hydropower plants to match the variations in the outputs of wind and solar PV power plants.
Such adjustments are feasible only by incorporating Smart Grid/ Smart Meter technologies.

3. Technology Name: Smart Grid Technology for Wind & Solar Integration with Hydro

4. Technology Characteristics: (Feasibility of technology and operational necessities)

Feasibility of Technology:

These technologies have been already implemented in many developing countrues in the Europe, Japan and North America. Details are avail in the references given.

5. Operational Necessity

Without deploying this technology, it would not be technically feasible to appreciably increase the share of wind and solar PV based electricity generation in the national grid.

6. Country Specific Applicability:

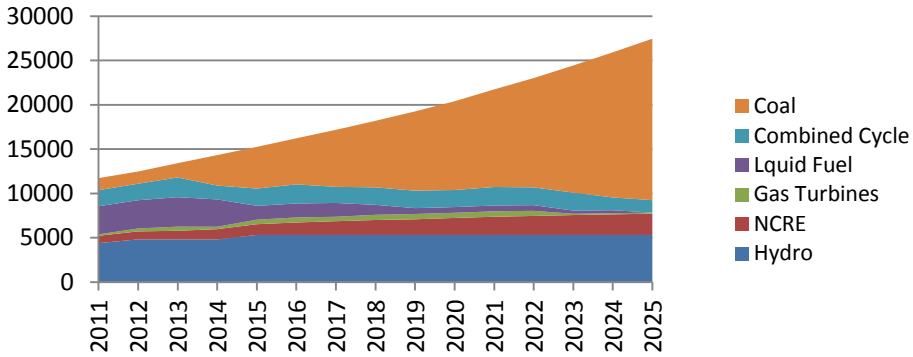
Electrical Energy Supply Sector

The data provided by the Sri Lanka Sustainable Energy Authority (SEA) in their web: www.energy.gov.lk show that the present the national peak electricity demand is 2033 MW (28th

[1] **This fact sheet has been extracted from TNA Report – Mitigation for Sri Lanka. You can access the complete report from the TNA project website** http://tech-action.org/

September 2011) and the corresponding daily electrical energy consumption is 33.35 GWh/ day. The same data published during this year (2011) also show that the annual electricity peak demand growth is growing at about 400 MW per year and the daily electrical energy demand is growing at around 8 GWh/day/year.

In order to meet the above mentioned growth, the Ceylon Electricity Board (CEB), the sole utility responsible for the generation and distributing most of the electricity generated to the final consumers have been annually preparing and releasing their Long Term Generation Plan (LTGP). According to the last published LTGP, most of the future generation of electricity would be generated from coal based power plants as shown in figure 2.



Annual Energy Generation (GWh/y)

In fact as per the above plan, EB has already commissioned and operating a 300 MW coal based power plant. The second phase of coal based power plant with a capacity of 2x300MW is under construction. Action has been initiated to construct another 2 x 500 MW coal based power plant in the country.

While the state owned utility CEB is planning to commission as many coal based power plants as necessary to meet the growing demand for electricity, the Ministry of Power and Energy, through the SEA is encouraging the private investors to develop renewable energy based power plants. In an attempt to generate at least 10% of the electrical energy requirements by the 2015, the SEA has offered an incentive scheme for the private sector to harness renewable energy resources and generate electrical energy and feed the national grid. A concessionary tariff based on the estimated cost of generation has been offered for each of the following technologies:

- Small Hydro: Rs. 13.04 / kWh
- Wind: Rs. 19.43 / kWh
- Biomass: Rs. 20.77 / kWh
- Agro/Industrial Waste: Rs. 14.60 / kWh

- Municipal Waste: Rs. 19.73 / kWh
- Other (Solar PV, Solar Thermal, Wave etc.): Rs. 20.77 / kWh

The solar PV module price and wind based systems , excluding storage batteries and inverters, are reaching US$ 2/ kWp. However, unless the system stability caused by the fluctuations in outputs of these power sources are resolved, it would not be feasible to harness such vast extent of resources.

5. Status of the technology in the country and its future market potential:

Status of Technology in Sri Lanka

A total of 33 MW of wind based power plants and 2 MW of solar PV based power plants have been connected to the national grid. The demand for power in the system during off-peak time is around 800 MW. Hence during off-peak time, the total outputs of solar and wind are approaching 5%. Due to the variations in the outputs of these sources of power, the utility has not stopped accommodating any additional wind or solar power plants. The introduction of Smart Grid based system control technology would be able to address this issue.

Future Market Potential

The on-shore based wind power potential in Sri Lanka is estimated as over 24,000 MW. The solar PV potential is much higher. The present peak demand is only 2000 MW. Hence wind and solar power has great future market potential, if these are properly developed.

5. Barriers: This section will be covered later.

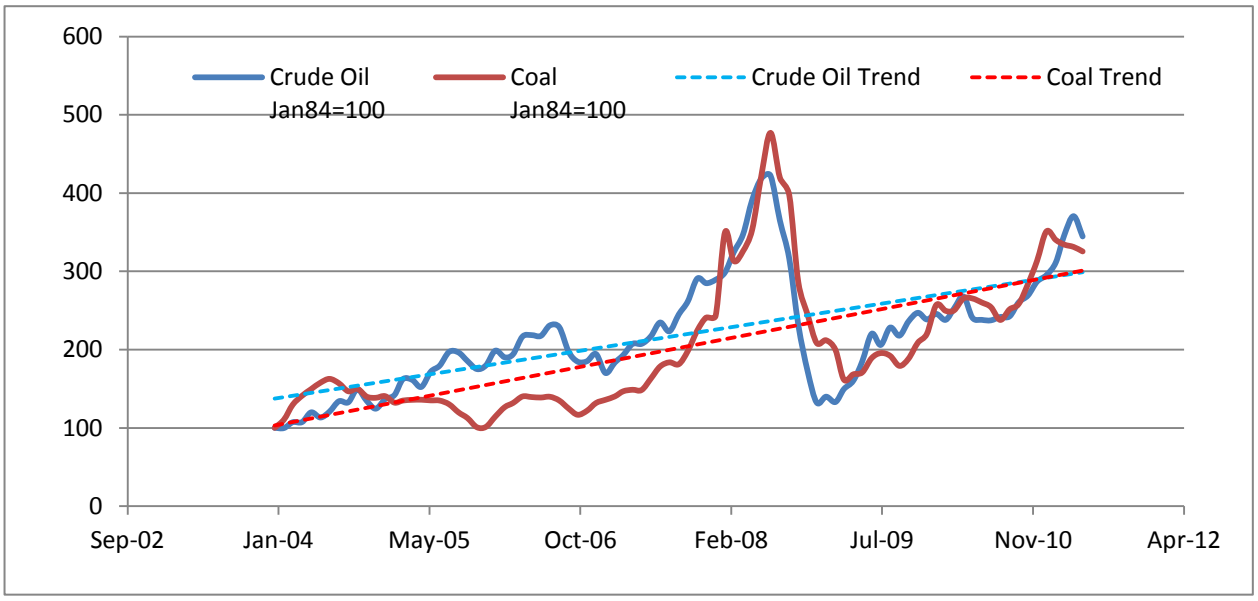
6. Benefits: (How the technology could contribute to socio-economic development and environmental protection)

Social Benefits

The large scale development of wind and solar PV based power development would result in generating significant extent of employment opportunities for all categories of work force in the country.

Economic Benefits

The escalating trends of petroleum and coal prices are bound to have serious negative economic impacts on the power sector in the country in the future. One option available to mitigate these impacts is to generate a significant share of the electricity fron non-fossil fuels. Hence the introduction of large scale expansion of wind and solar PV based power projects would give economic benefits to the country.



Coal and Oil Prices 2004-2011

Environmental Benefits

The large scale development of wind and solar PV based electricity generation projects would result in the reduction of fossil fuel based electricity generation. This would result in the following environmental benefits:

- Reduction on GHG emissions arising from fossil fuel based electricity generating projects.
- Reduction in NOX, SOX, particulate matter, heavy metal and radioactive chemical deposits.

7. Operations: -

8. Costs

Smart Grid/ Smart Meter technologies are nascent technologies. Reliable estimates are not available at present. In any event the cost of establishing smart grid etc. need to be absorbed by the respective power generation technologies.

11. References

1. Standardized Power Purchase Tariff, 2011. Sri Lanka sustainable Energy Authority.
2. Long Term Generation Expansion Plan, 2009-2022. Ceylon Electricity Board. December 2008.
3. Long Term Transmission Development Plan 2005-2014. Ceylon Electricity Board. 2005.
4. Energy Sector Master Plan, Sri Lanka. Interim Report. Asian Development Bank, April 2004.

5. National Energy Policies and Strategies of Sri Lanka. Ministry of Power and Energy. October 2006.
6. Statistical Digest 2010. Ceylon Electricity Board, 2011.
7. Mahinda Chinthanaya: Vision for a New Sri Lanka. A 10 Year Horizon Development Framework, 2006 -2016, Department of National Planning, Ministry of finance and Planning.
8. http://www.energyservices.lk/statistics/esd_rered.htm
9. EUROPEAN COMMISSION – DIRECTORATE, GENERAL ENVIRONMENT, REFUSE DERIVED FUEL, CURRENT PRACTICE AND PERSPECTIVES (B4-040/2000/306517/MAR/E3); FINAL REPORT, WRc Ref: CO5087-4, JULY 2003: www.eu-ecogrid.net