in perspective

Solar desalination to fight climate change

By Saptak Gosh

Records are being created and broken every month in India where a solar revolution of immense proportions is underway. Solar photovoltaic (PV) parks of over 500 MW are being commissioned and similar capacities are being tendered out at record low prices of Rs 2.44/kWh.

As a consequence, India's plans of installing 243 GW of additional coal-based thermal power plants are undergoing modifications, with more than 50 GW already shelved. Recently, reports have highlighted that because of implicit and explicit subsidies being doled out to solar, coal-based power plants will perform at low utilisation factors (<50%) and investors will be marginalised.

Banks will not be able to recover their loans and the whole economy will be impacted adversely. Instead of applauding the central and state governments' efforts to proactively push for solar in an effort to mitigate climate change, the coal industry is recommending that caution be exercised when it comes to solar.

India hopes to install a minimum of 10 GW annually, to reach its 100 GW solar target by 2021-22. The challenges with large scale solar deployment are not the negative financial impacts on coal based generation but are purely technical - reliability and continuity. Solar energy is sporadic and disappears completely after sunset.

It is virtually impossible to meet India's electricity needs with solar alone, since most load profiles of states show that peak demands occur after sunset. Also, during the day when industries need a stable supply, variations in solar radiation will lead to fluctuating supply which will affect heavy machines and associated processes.

The only way to solve this issue is to have a sophisticated balancing and scheduling mechanism so that the grid can absorb intermittent generation and compensate with fast-ramping generation options. Coal-based power generation is firm and stable. However, it takes long to move from one operating point to the next. This is very slow compared to the rate of fluctuations posed by solar energy. Storage is the only option available today.

Amongst storage technologies, batteries have still not proven to be worthwhile at GW levels. Hydropower has one of the fastest response times and can cater to varying demand.

This makes it very suitable for balancing and smoothening out the grid because the power generated can easily be controlled by regulating the flow of water. However, for all practical purposes, water shortage can lead to concerns about viability of this technology.

On the other hand, climate change scientists have hypothesised that rise of every degree in global temperatures corresponds to a 2.3 metre rise in sea-levels. This spells trouble for a country like India that boasts a coastline spanning 7,516.6 km. Studies show that 60% of this coastline is vulnerable to sea-level rise with metropolitan cities like Mumbai and Kolkata at high risk.

Herein arises an opportunity for the think tanks to devise an integrated adaptive solution for the two aforementioned problems - the need for fast-ramping backup for solar to provide reliability, and the looming threat of sea-level rise because of climate change.

In order to pre-empt seawater ingress, plans could be made to channel seawater into reservoirs after sunset at locations along the coastline, based on scientific models which accurately predict sea-level rise and thereby the volume of water that can enter.

Once this reservoir and canal network has been planned, the collected water will need to be desalinated. Desalination processes have long been utilised to convert seawater for utility purposes.

However, conventional desalination is expensive and costs will be prohibitively high if the economic feasibility of this plan is assessed. The beauty of solar energy is in the diversity of its applications - electricity, heat, cooling and desalination.

Solar radiation profiles

Reports have shown that solar desalination processes are cheaper than conventional counterparts. Solar desalination technologies could be implemented in these strategically chosen locations with high solar radiation profiles and suitable load patterns.

While these desalination plants function during the day, large PV parks can simultaneously pump the required amount of water to the reservoirs while the excess can be used for potable purposes. Saudi Arabia is already on the verge of commissioning the first commercial scale solar desalination plant.

and wind plants feeding a smart grid and surplus being used for pumped-hydro which is also fed by solar desalination units - unbelievable, yet possible through meticulous research and planning.

Till such time, although we do not want coal, we still need it today to provide stable power and supply demand. However, we have the opportunity to phase out coal completely with our aggressive solar revolution in the near future.

Sure, the plan proposed here is grand - but it is just a question of how far we are willing to go and how much faith our governments have in the sun being the saviour of Mother Earth.

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