



Global Grid – Harnessing Green Power Round the Clock

Energy interdependence, not independence, will lead to increased cooperation and amity among nations, argues **HIPPU SALK KRISTLE NATHAN**

Almost at the stroke of the New Year, India achieved its tryst with 'one nation'-'one grid'. This integrated power grid is one of the largest in the world with about 232 GW of installed capacity and an additional 15 per cent of captive power. The Southern grid was the last to get integrated and this will offset some of the chronic power shortage in South India. It is also bound to boost the overall power trading in the country. Power would flow from any surplus state/region in the country to other deficit ones resulting in a single efficient market.

Going beyond India, South Asia offers high potential for integrated power grid because of intra region surpluses and def-

icits. Countries such as Nepal and Bhutan are endowed with excess electricity generation potential, whereas India and Pakistan are electricity starved. A robust integrated South Asian power grid can better exploit the vast untapped renewable energy potential in the region comprising hydro, solar, and wind. The call for such a grid was made in recent South Asian forums. During the sixth Meeting of the SAFTA (South Asia Free Trade Agreement) Ministerial Council in 2012, India emphasised on building a \$300 billion South Asia grid which would enable the region to trade in electricity. A transnational grid in the region is expected to have spill over effects on the larger economic and political engagements.

The idea of having an international grid is not new. This concept has its origin in the 1946 'Dymaxion Map' of the inventor, R. Buckminster Fuller and his 1961 creation of World Peace Games—an educational simulation which acts as an alternative to war games. He challenged the prevailing nation-state perspective and offered a 'holistic' world view. He posed the question "How do we make the world work for 100 per cent of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone?" Fuller proposed a global electric grid as the number one priority to solve many of the world's most pressing problems like overpopulation and resource



Source: DeserTEC

disparity. Global Energy Network Institute (GENI) was founded in 1986 to investigate Fuller's idea and to conduct research on global grid.

There are three prime reasons for promoting a global grid. First, the global grid places emphasis on tapping abundant renewable energy resources, particularly from remote locations. It gives an opportunity of faster replacement of fossil fuels by renewable and thereby decreasing CO₂ emissions from power systems. Renewable sources like solar, wind, and hydro are compatible with the electric grid. Unlike fossil fuels, these cannot be transported; rather electricity generated can be transmitted to the demand centres. Additionally demand centres themselves are not endowed with such sources in abundance. So, be it wind and hydro sources in Greenland or solar irradiation on Sahara deserts, global grid promises to link these inhospitable areas and transport the untapped renewable energy to places of need.

One might wonder whether renew-

able sources available in these remote locations would be enough for the world. Actually, the availability is many more times what we require. It is estimated that 0.3 per cent of the sunlight falling on the Sahara desert would be able to meet all of Europe's electricity needs. The Desertec Energy Project directs its efforts towards tapping this solar energy. In December, 2013 Power Grid Corporation of India came out with an integrated plan for desert power development in India by 2050 by utilising 5-10 per cent of desert areas of Thar (Rajasthan), Rann of Kutch (Gujarat), Ladakh (Jammu & Kashmir), and Lahul & Spiti valley (Himachal Pradesh). Though this plan is prepared keeping India in mind, these proposed solar projects can potentially be part of a global grid as all the four desert areas share international borders.

The second advantage of connecting the world through a single grid is that power systems would no longer require storage batteries or reservoirs. Also, the long transmission line would overcome

the intermittent nature of solar and wind power by taking advantage of time zones and seasonal diversity. For instance, since there is a gap of several hours in the peak consumption times in the USA and Europe, it would be possible for energy from renewable sources from Greenland to cater to both peak times without the need of storage.

One might also ask how long can these grid lines be? Thanks to the High Voltage Direct Current (HVDC) technology, the transmission losses turn out to be about three per cent per 1,000 km. In a research article in *Renewable Energy Journal* (January, 2013) entitled 'The Global Grid', the authors argue that HEMC lines are more economic and effective than different storage systems. It is beneficial for the USA to import renewable power from Europe than operate its own fossil fuel power plants. Additionally, for conventional fuel, in the debate of whether to transport primary energy or transmit in the form of electricity, the latter turns out to be a winner.

Desertec Energy Project

This project focuses on the three regions - Europe, the Middle East, and North Africa (EUMENA) to create an integrated power system. The electricity would be generated utilising abundant solar and wind resources in sparsely populated desert lands on the southern shore of the Mediterranean Sea. This will enable MENA countries to not only supply their own energy needs, but also cater to 20 per cent of Europe's electricity demand by 2050, leading to substantial saving in CO₂ emissions. The interconnected, renewable-based power system for EUMENA is expected to create a secure, affordable and clean electricity supply for the region than a weakly interconnected, depleting fossil fuel-based system.

(Source: 2050 Desert Power, Desertec Industrial Initiative consortium, 2012)

Transport or transmit?

An analytical article evaluated the trade off between physical shipping of a fuel and long distance transmission of electricity. This question is valid as sources of primary energy are usually distant from the main load and population centres. By taking three scenarios (coal by rail with a coal fired power plant in the vicinity of the load centre, coal to synthetic natural gas and then by pipeline coupled with a gas fired power plant in the vicinity of the load centre, and coal by wire with a mine-mouth coal fired power plant), the authors showed for a case of 1000 MW transfer over a 1000 km, overhead HVDC lines offer the lowest electricity cost, followed by the pipeline option, whereas coal by rail option turns out to be costliest. This result will not always be true as it depends on (amongst others) the amount of energy to be moved, the distance over which it must be moved, capital and operating costs of the transport system and extent of existing infrastructure.

(Source: Oudalov, A. and Reza, M., ABB Review 1/2008)

Lastly, global grid needs to be promoted for political reasons. Global grid can be seen both as cause and consequence of international cooperation. Summarising the global grid discovery, Fuller had stated aptly that it would "integrate the day-time and night-time hemispheres, thus swiftly increasing the operating capacity of the world's electrical energy system and concomitantly, living standards, in an unprecedented feat of international cooperation." Naturally, energy interdependence, not independence, would lead to increased cooperation and amity among nations. It was argued in a recent paper on 'Pipeline politics' published in Energy Policy journal (November, 2013) that energy interdependence compels nations to protect each other's interests rather than harm them. The authors have termed this as 'mutually assured protection (MAP)' strategy.

In short, global grid is notionally simple and theoretically indisputable. As per Global Energy Network Institute (GENI), global grid has the support of quite a few prominent individuals from different walks of life. The list of supporters includes Al Gore, Boutros Boutros-Ghali, the Dalai Lama, Desmond M. Tutu, and Jonas Salk. Global grid also has endorsements from international organisations

like African Unity, International Union for Conservation of Nature, and United Nations and its agencies, and ministries of some national governments. The assessment studies on global grid projects find them both technically (technologies are mature) and economically (cost figures are comparable to energy sector investments) feasible. However, because of the sheer nature and dimension, these projects involve multitude stakeholders and diverse political and legal regimes, hence suffer from high uncertainties. In the absence of strong global institutions, these multi lateral projects face certain financial (who will invest and why?), operational (who will regulate and how?), and security complexities. Global grid certainly increases the scope of global black-outs. It can be a target of cyber-terrorists. It also suffers from the sensitive cultural aspect wherein the projects are 'imposed' on the region whose land, hydro, or wind is used to supply energy for the more prosperous ones. Irrespective of its challenges, one can argue that as more and more equipment run on electricity and fossil fuels go extinct, the world will inevitably move towards renewable resources

Mutually Assured Protection (MAP)

The MAP concept is proposed in the context of cross border energy trade. 'Joint-ventured, mutually-benefitting' cross border projects can potentially improve relationships among the participating countries and 'increase peace and stability in the region'. The authors have further argued that these projects can create 'economic deterrence, which will discourage the parties concerned from taking adverse decisions against the other'. This concept can be advocated as a positive alternative deterrence strategy to the military strategy of Mutually Assured Destruction (MAD).

(Source: Nathan, H.S.K., Kulkarni S.S., and Ahuja, D.R., Energy Policy, Vol. 62, pp. 145-156)

distributed through global grid.

To conclude, the problem with energy is not its supply, but its distribution. Global grid makes the distribution more equitable as it connects remote locations to other parts of the globe and place emphasis of renewable sources like solar and wind. It broadens the scope by allowing diversification of energy supply and increase in competition so that the mismatch in demand and supply can be better balanced. Since electric grid lines are bi-directional, electricity can be transmitted in either directions depending upon the mismatch. Indeed, electric power grid has the potential to span the world to form 'global energy internet'. This requires countries and regions to have one grid system in the first place. India has achieved the feat of one grid for the entire country, and has pitched for single regional grid for South Asia. The next logical step for India is to try achieving bilateral agreements with all neighbouring countries on inter-connecting grids and support any move towards the global grid for green power.

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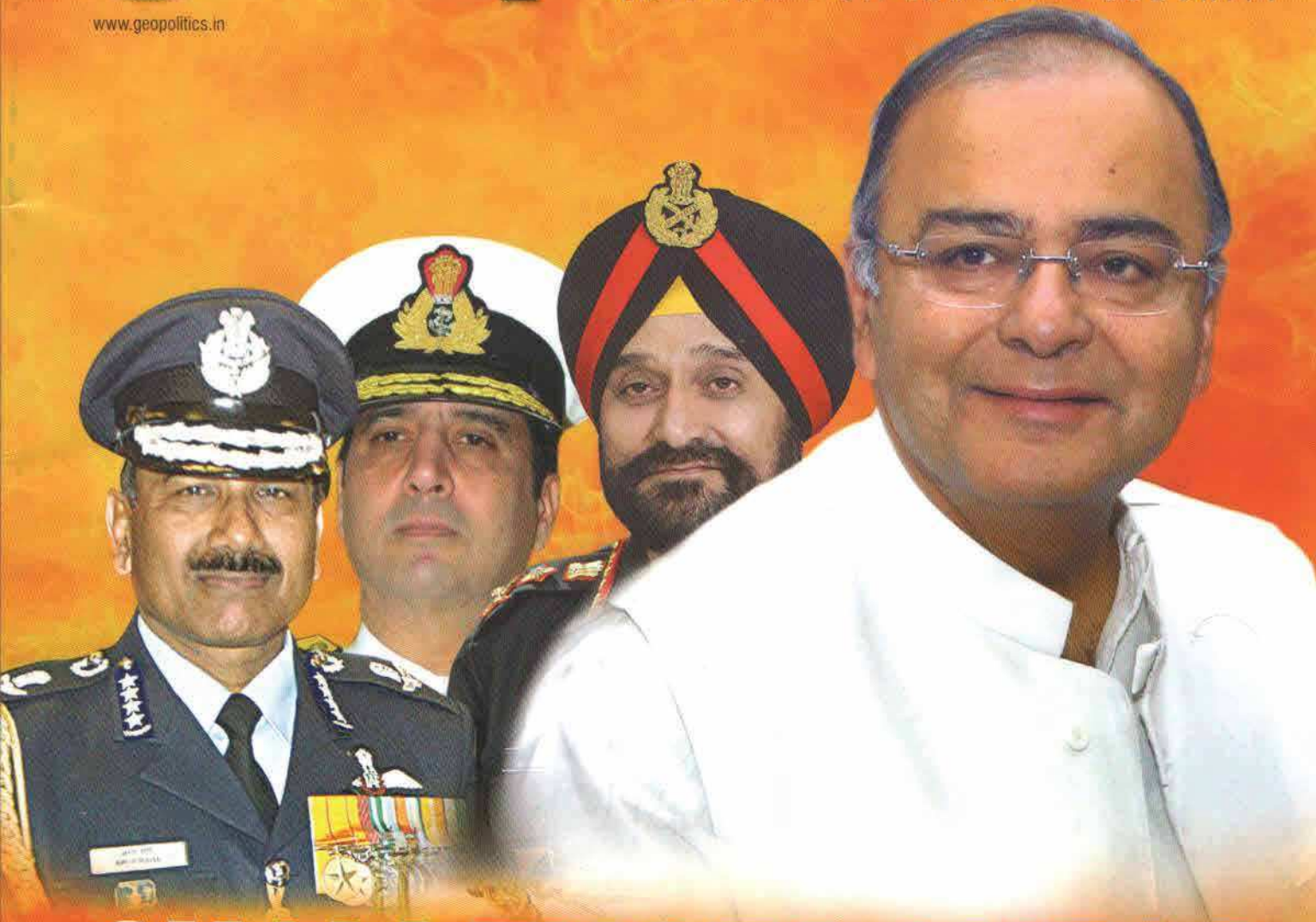
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