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THE PERFORMANCE AND IMPLEMENTATION  
OF ONGOING PROJECTS IN THE ROADS  
INFRASTRUCTURE OF THE COUNTRY**

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# DISPLAY OF OUTSTANDING REGIONAL COOPERATION IN ELECTRICITY GRID MANAGEMENT DURING 9 PM, 9MINUTE EVENT

The following piece by **Mr. V K Agrawal, Technical Director, SARI/EI, IRADe** & **Mr. Rajiv Ratna Panda, Technical Head, SARI/EI, IRADe** elucidates upon the role of regional cooperation shown amongst BBIN (Bhutan, Bangladesh, India, Nepal) countries in electricity grid management during the "9pm, 9min" of candle light event on 3rd April.

The “9 PM, 9minute” candle light event on 3rd April demonstrated both the high resilience of the Indian Grid, as well as the unique level of cooperation amongst the BBIN countries (Bangladesh, Bhutan, India and Nepal) towards operation of the regional grid. The Hon’ble Prime Minister of India Shri Narendra Modi made an appeal to the citizens in India at 9 AM on April 3,2020[1] to switch off the electric lights and light candles, diyas, torches or mobile flashlights for 9 minutes at 9 PM on April 5,2020. It was a symbolic gesture to show the resolve and commitment of the nation towards fighting the COVID-19 pandemic with light and hope. There was a huge response to the Prime Minister Modi’s call, wherein citizens wholeheartedly participated in a show of national solidarity in the fight against COVID-19. There were also reports of people in Nepal joining in this show of solidarity.

This unique event however, posed tremendous challenges for the power system engineers in the country. While there were some apprehensions before the event on the grid security aspects due to such a fast load change, it was eventually managed very smoothly without any untoward incident with the power system parameters maintained within limits. This event also highlighted the successful energy cooperation amongst the countries in the BBIN region, particularly with Bhutan, which played a role in providing fast ramping from its Hydro generation and thereby helping in balancing the grid during this critical period of 9 minutes. It reassures that in the times to come when the high generation of renewable energy integrates within the regional grid, countries in the South Asian region can cooperate to ensure smooth grid balancing and management.

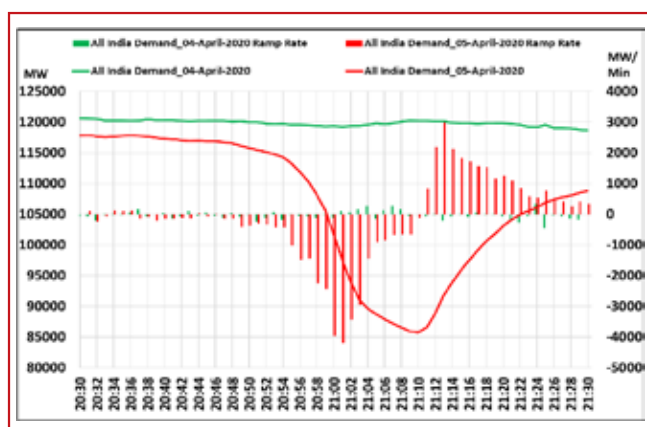


Figure 2 All India Demand Trends during the light of events [2]

During the lights-off event, there was a large reduction in the all India demand of the order of 31089 MW[2]. Error! Reference source not found.[2] shows all India demand trends during the lights-off event. This steep fall in demand was managed effectively by matching fall in generation by backing down in hydro, thermal, gas, and wind generators across the country.

To successfully manage the implications of this event on the grid, elaborate arrangements were made by the country’s

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power system operators led by Power System Operation Corporation [POSOCO]. Detailed exercise and coordination was carried out by POSOCO, the grid operator at the central level. For an operating grid with a load in the range of 120 GW, it is a real challenge to ramp down the generation by around 30 GW to meet the reduced load of around 90 GW, and then again ramp up to the original level within a gap of 9 minutes. A high level of technical and operational planning, along with support from the different generating stations and load despatch centres across the country, was instrumental in successfully tackling this challenge.

During the lights-off event, the antecedent values of thermal, hydro, and gas generation on bar, which could have participated in load balancing were in the range of around 110 GW. Considering a nominal ramp rate, particularly in case of thermal generation, of around 1% per minute and assuming if almost all the units participate in balancing, the available avenues for ramping would have been in the range of around 1000 MW per minute. However, as shown in Error! Reference source not found.[2], the ‘ramping down’ achieved during the 5-6 minutes before 9 PM was in the range of 1000-4000 MW per minute and the achieved ‘ramping up’ in around 20 minutes after 9.09 PM was in the range of 1000-3000 MW per minute. To ensure a successful event, coordinating with the different generating stations to manage such high ramping rates was the real challenge and one of the critical factors. This was carried out through continuous interactions with the different generating stations, changing the droop settings in case of hydro stations to make ramping much steeper and modulating the protection settings of some of the feeders to cut off the identified generation/load in case of violation of the pre-set limits. The Grid frequency during the event remained in the range of 50.26 Hz to 49.70 Hz, which can be considered to be a safe range and the grid voltage was also maintained within limits[2]. Concerted efforts were made by POSOCO to manage the operations, including conducting close meetings and consensus building with the different generating stations, mock operation exercises and issue of advisories, and close coordination with the different State Load Despatch Centres [SLDCs].

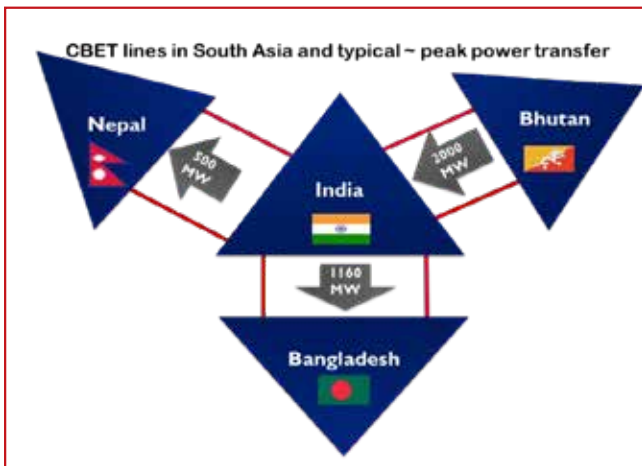


Figure 3 Approximate cross-border electricity trade/exchanges in BBIN countries

**Role of regional cooperation in facilitating the #9pm9minute event**

The Indian grid is connected with other South Asian countries in the BBIN Region through various cross border interconnections, facilitating around ~3563 MW of power transfer. As depicted in Figure 3, Indian grid is connected through AC links with Bhutan and Nepal and through HVDC back to back link with Bangladesh. These connections are at 400KV and 220 KV level, and there are large number of interconnections at 132 KV, 33KV, 11 KV as well, and some of these are radial in nature. Many high voltage cross border interconnections are also being planned among BBIN countries and Cross Border Electricity Trade (CBET) has been increasing in a rapid pace in the region. CBET has increased in the region from ~1350 MW in the year 2012 to almost ~ 3563 MW by 2020 and with the start of trilateral and multilateral trade, it is expected to increase by manifold in the coming years.

In the detailed report on the “#9pm9minute” event issued by POSOCO[2], under the Section 2.3 ‘Coordination with Various Stakeholders’, the possibility of cross border support from the neighbouring countries, especially through the fast change in the hydro generation in Bhutan and modulation of HVDC in Bheramara [Bangladesh] has been explained. In a show of solidarity and demonstrating a spirit of cooperation while at the same time acknowledging the challenges involved in managing this unprecedented event, the support from the National Grid Operators from the neighbouring countries,

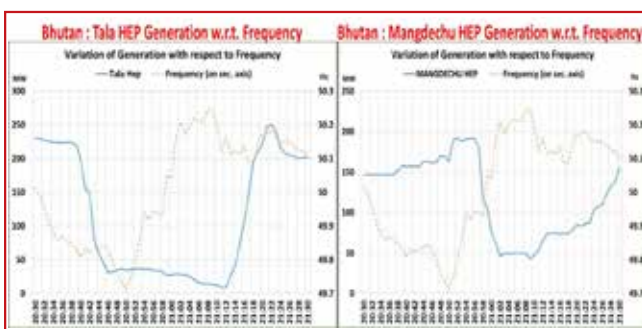


Figure 4 Cross-border Support from Bhutan Hydro Stations: Tala and Mangdechu Generation w.r.t. Frequency [2]

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particularly from Bhutan, has been noteworthy. A generation flexibility of around 400 MW was achieved at Tala and Mangdechu hydropower plants in Bhutan, and the trends of generation at these stations with respect to frequency during the 9 minutes is depicted in Figure 4.

The drivers for energy cooperation and grid integration in South Asia include economic benefits, resource optimization, and exploiting the diversity of regional resources. While the economic and financial benefits of cooperation have often been highlighted, the technical and operational benefits of jointly operating the available generation and transmission capacity and mitigating emergencies, has not received the due attention. However, the management of the “#9pm9minute” event has helped highlight these benefits as well as underline the spirit of cooperation amongst the countries in the region. Events such as these re-emphasize the need for deeper integration of the electricity grids of neighbouring countries in the South Asian region, particularly in the context of large-scale development of renewable energy. The event demonstrated that Cross-Border Electricity Trade can facilitate in grid balancing in an economical manner and manage the intermittency of renewable energy.