Nepal-India Power Exchange: A Critical Review

Subhash K. Mishra

Abstract: Nepal-India power exchange has long been taking place. The effectiveness of the exchange scenario, however, is not very encouraging. The main reason for this is the lack of physical infrastructures and sound power transaction modalities. In this article, Nepal-India power exchange is critically reviewed with regards to the physical infrastructures and in the Nepalese perspectives.

Key words: Power exchange, power pool, transmission lines, grids, AC, HVDC, load shedding, synchronization

Electric Power Exchange

Conventionally, the concept of power exchange emerged with the prospect of minimizing or meeting the electricity shortages of two or more electricity supply systems under the old model of 'cooperation' among the vertically integrated utilities. The current trend of power exchange (better described as 'power trading') in the deregulated environment, however, has become a complex market phenomenon in which electricity is traded like other commodities under competitive market rules; e.g., in the spot market model as in the Nord Pool (the Nordic Power Pool) or other power pools of the world. The concept of power exchange also involves the optimized sharing of the resources (e.g., a system may find it cheaper during some period of time to buy power from another system rather than operating its own generating plants, or the deficit of power in one system may be met economically by importing electricity from the other system). The Nepal-India power exchange has been taking place under the conventional model of bilateral cooperation and, so far, on a small scale.

Nepal-India Power Exchange: The Tortoise Motion

Though Nepal and India have been exchanging power for mutual benefit for more than three decades, the progress has been quite slow and unsatisfactory. And, because of the inadequate generation facilities in Nepal to cope up with the demand, it has been experienced that the 'exchange' is more important and necessary for Nepal than India. Moreover, India has massive demand of more than 100,000 MW (about 25,000 MW in northern region alone) and it is natural that some tens of megawatts that can be exported to India would be like a drop in the ocean. The National Water Plan prepared by Water and Energy Commission Secretariat (WECS) has estimated short term (by 2012) and long-term (by 2027) export potentialities of Nepal as 116.5 MW and 683.6 MW, respectively (the export potential could be expected to increase in the context of the recently introduced '10,000 MW in 10 years' plan). On the other hand, there is lack of cross-border power transmission lines for a considerable level of exchange. These could possibly be the reasons for the slow progress in Nepal-India power exchange. This is why the exchange level of 5 MW set out in 1972 has just reached to a mere 50 MW in the span of about 35 years.

The power exchange scenario for the last 28 years is depicted in Figure 1, in terms of the units of electricity exchanged.

Some sharp rises and falls characterize the curves and a sort of import-export coupling is seen; i.e., for every sharp rise of import there corresponds a sharp fall of export, and *vice versa*. The sharp fall of import in 86/87 may be attributed to the commissioning of Kulekhani II plant, while that of 90/91 and 2002/03 may be attributed to the commissioning of Marsyangdi and Kali Gandaki 'A' plants, respectively. Likewise, the reason for very steep rise in import from 1996 onwards is the establishment of the Duhabi-Kataiya Link (which was badly hit by the Koshi catastrophe last year forcing Nepalese consumers to suffer from additional hours of load shedding).

Existing High Voltage Transmission Links

Though electricity exchange has long been taking place at medium voltage levels (11 and 33 kV) mainly for the supply to a few cities along the border, bulk power carriers (132 kV lines) are only at three places.

a) *Gandak-Ramnagar* (the '*pradan*' or export) Link
   This is the first 132 kV cross-border link (constructed in 1979) and is basically export oriented since it was constructed primarily to transfer power generated by the Gandak power house to India under the Gandak Treaty. Recently, it is learned that the transmission facility is being rearranged for the purpose of import as well.

b) *Duhabi-Kataiya Link* (a gift for the First Democratic Government of 1990)
   This 132 kV link was identified as a result of bilateral discussions in early 1990s for enhancing the power exchange level up to 50 MW. It is reported that the 50 MW-enhancement was *formalized* in 1991 during the visit of the then Nepalese Premier to India. In January 1993 the inter-utility power exchange was decided, to "prepare the modalities" of construction of the link (it also identified another potential link: Dhalkebar-Sitamadhi).
   Then, as an immediate resort to curtail the prevailing load shedding by the earliest commissioning of the link, Nepal rushed to construct the portion in its territory under the IDA loan financing. At the time when more than 75% of works under Nepalese territory (i.e., stringing of 27 km second circuit on existing double circuit towers and construction of 14 km of new single circuit line) was completed, the inter-governmental committee had discussions on March 1995 to 'expedite' the construction of the link as the progress of 3 km long section of the Indian territory had been very slow. Finally, the 17 km long Duhabi (Nepal)-Kataiya (India) Link

was commissioned in January 1996, taking nearly three years for construction. It is seen that the link took almost six years to be in place after it was identified. This clearly shows the pathetic situation of power exchange progress.

c) *Lalpur* (the '*adan*' or import) Link

The 16 km long 132 kV link between Tanakpur (India) and Lalpur (Nepal) (12 km in Nepal territory) commissioned in December 1999 is serving a way for receiving 70 million free units of electricity from Tanakpur Project as per the Integrated Mahakali Treaty. Being operated in the radial mode up to Kohalpur, this link is basically an import link (one way of the 'exchange') owing to the issue of synchronization.

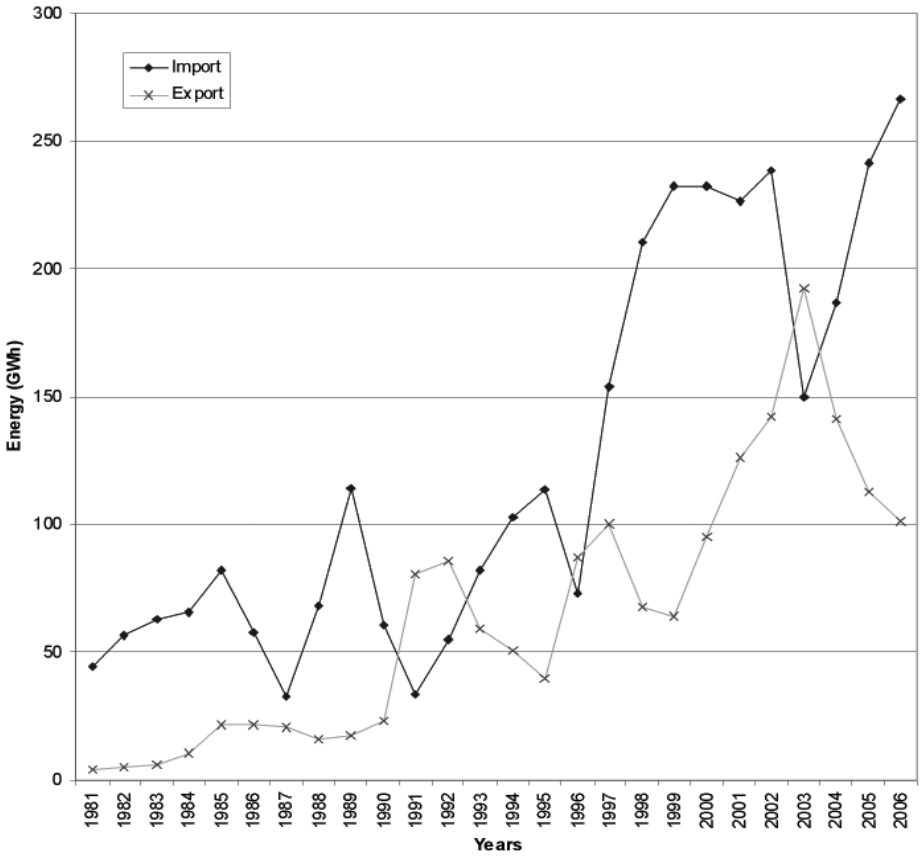

Figure 1. Nepal-India Electricity Exchange (1981-2006)

The Three 132 kV Links: Mingled in Diplomatic Flavor

Just after embarking on Duhabi-Kataiya Link (*c.* 1994), bilateral discussions and proposals on increasing the power exchange level from 50 MW to 150 MW took shape. The power exchange committee, at a 1995 meeting, decided to develop three more new links by the end of 2000.

Thereafter, the two issues – viz. the increase in the level of power up to 150 MW and establishment of the new three links – were constantly repeated in all of the following meetings of Power Exchange Committee "in a cordial atmosphere", more or less in a diplomatic tone, without any concrete results in hand. Only after four years (at the end of 1999) did the exchange sub-committee decide to "recommend to their respective Governments". Subsequently, the sixth meeting of Power Exchange Committee in 2001 confirmed the "in principle approval of both Government to increase the power exchange level from 50 to 150 MW", and the committee further worked on a schedule to construct lines in their territories.

Thus, it is quite frustrating to note that it had taken almost six full years from the conception to formalization of the issues of increasing the level of power exchange from 50 to 150 MW and the identification of three new links. The three links identified as a result of the exercise of nearly six years were: (1) Butwal (Nepal)–Anandanagar (India), (2) Birgunj (N)–Motihari (I) and (3) Dhalkebar (N)–Sitamadhi (I).

Nepal gave top priority to develop the interconnection lines for two reasons: firstly, to export the surplus energy that would have resulted from the then under construction Kali Gandaki 'A' Hydroelectric Project and, secondly, to have a reliable means for sufficient import of electricity to cater a possible power deficit in the years to come. Given the urgency, Nepal started the detailed survey and tendering works without delay and even dropped the idea of seeking funds from donor agencies for Butwal-Sunauli (Nepal's portion of Butwal-Anandanagr Link); thus, Nepal took up the section with its own funds. No details of the progress of the other side has been reported.

For funding the Birgunj–Motihari and Dhalkebar–Sitamadhi Links, Asian Development Bank and the World Bank were approached, respectively, and by the end of 2005 these two vanished quietly from the scene. The third one (Butwal-Sunauli) also appeared to have the same fate as others with additional hard blows of the Environmental Impact Assessment (EIA) that it had experienced initially.

It is very sad to note that after ups and downs of more than ten years the three lines turned out only as a 'mirage'. Nearly a decade-long exercise and efforts were in vain. Nepal is missing them a lot now, in the darkness of load shedding.

The DC Link: Still to Germinate

The Indo-Nepal Power Exchange also attempted to explore the possibilities of DC interconnection between the Nepal and Indian grids. With the DC Link, superior interconnection between two AC systems or back-to-back coupling is possible without having synchronization problems. The preliminary discussions took place in late 1999, and in 2001 it was formally agreed to study the possibilities of interconnection using HVDC technology for future exchanges. However, no further progress in this regard has yet been reported. Given the sizes of the two grids, it is suggested to have the DC interconnections from the synchronization point of view.

The Power Trade Agreement

An important step in the Nepal-Indo Power Exchange is the Power Trade Agreement of 1997. The agreement has provisions for any party in Nepal or India (government, semi-government or private) to enter into an agreement for power trade between Nepal and India. This could be instrumental for power exchanges as it could relieve the time-taking conventional bureaucratic/government model.

The frequent newspaper coverage thereafter gives an impression that Nepal has been putting efforts to trade electricity with India. Nevertheless, the exchange of agreed level of power of 150 MW has still not materialized because of the lack of transmission infrastructures and commercial modalities.

Looking ahead with 400 kV Links: Hope for the Best

The Nepal-India power relation has taken a new turn after 2006. The big power companies of India have jointly organized energy conferences with the Nepali counterparts in Kathmandu, Nepal calling it a 'Power Summit'. The Indian side disclosed their interest towards development of power projects of 100-150 MW range. The Indian Government also agreed to a line of credit of 7 billion rupees for the development of hydropower projects and constructing new transmission lines. Probably, realizing the no-result situation of the earlier planned 132 kV lines, the summit also stressed the need for immediate development of new 220 kV cross-border lines (which was later upgraded to 400 kV lines).

It is learned that steps towards development of three 400 kV cross-border lines (Butwal-Gorakhpur, Duhabi-Purnea and Dhalkebar-Muzaffarpur) are in place, but under a different model – the independent company model. Unlike earlier inter-government exchange modality, the new modality involves the establishment of two transmission companies both in India and Nepal and these companies to develop lines within their territories. This could have been possible by the Power Trade Agreement and, of course, is a positive sign.

It has now been more than two years since the conception of the 400 kV cross-border links. We must be optimistic that these links will not lead to the same situation as in the case of earlier planned three 132 kV link lines.

Power import: The only short-term option

It is clear that the only effective measures for Nepal to take, to avoid load shedding for a few years to come (till a power project of considerable size is commissioned), is power import from India. That is why Nepal has been putting utmost efforts to the early completion of the said 400 kV links and to buy electricity on commercial terms in line with the Power Trade Agreement.

Conclusions

Nepal-India power exchange has a long history, but it has not been effective in the true sense. The exchange level of 5 MW fixed in 1972 has merely risen up to 50 MW at present. Even if the level has been increased, in principle, up to 150 MW around a decade ago, this has not materialized so far, in the absence of the physical infrastructures (the transmission lines) and lack of sound commercial modalities. A lot of discussion, talks, brainstorming, visits, seminars, consultations, preliminary works, etc., took place almost for a decade to construct three 132 kV inter-connections lines; but, unfortunately, none of them is in place. Moreover, other steps such as establishment of a DC Link, trading power in commercial terms, etc., have been formalized but without concrete results.

As a new step in the Nepal-India power exchange, Nepal has embarked on constructing 400 kV cross-border links with the new development modality. There is no other alternative now than to establish these 400 kV links in order to have the effective cross-border power exchanges.

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Notes/Terminology

- *AC system*: Alternating Current Transmission System, a mode of power transmission in which the generators must operate in unison.
- *Grid*: An integrated and strong network of transmission system for transferring chunks of power from one geographical region to another or from one electrical system to another. Grid interconnects various generating stations and delivers power to distribution systems.
- *HVDC system*: High Voltage Direct Current Transmission System, a mode of power transmission in which issue of synchronization does not arise. With this mode, two or more AC systems not operating in unison can also be coupled or interconnected for transmitting the power.
- *Load Shedding*: Process of isolating a part or parts of electricity demand from the integrated electrical system in order to match the available supply and to operate the system stably.
- *Synchronization*: Operating condition of two or more electrical systems in which machines run in unison and electrical parameters are matched.
- *Transmission Line*: A physical infrastructure for transferring bulk amount of electrical power over long distances.

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