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USAID'S URJA NEPAL PROGRAM
CROSS BORDER ELECTRICITY TRADE (CBET) REPORT

For Nepal Electricity Authority (NEA)

September 2021

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ABBREVIATIONS

APDCLs	Assam Power Distribution Company Limited
BPDB	Bangladesh Power Development Board
BREB	Bangladesh Rural Electrification Board
BSE	Bombay Stock Exchange
BSPHCL	Bihar State Power Holding Company Limited
CAGR	Compound Annual Growth Rate
CBET	Cross-Border Electricity Trade
CERC	Central Electricity Regulatory Commission,
COD	Commercial Operation Date
DA	Designated Authority
DAM	Day Ahead Market
DGPCL	Druk Green Power Company Limited
DISCOM	Distribution Company
DM	Dhalkebar-Muzaffarpur
DoED	Department of Electricity Development
DoP	Delegation of Power
EEX	European Energy Exchange
ERC	Electricity Regulatory Commission
ESCerts	Energy Saving Certifications
FDI	Foreign Direct Investment
FY	Fiscal Year
GMR	Grandhi Mallikarjun Rao
GoI	Government of India
GoN	Government of Nepal's
G-TAM	Green-Term Ahead Market
GTD	Generation, Transmission, and Distribution
G to G	Government to Government
GW	Giga Watt
GWh	Gigawatt Hour
HPP	Hydropower Plant
HR	Human Resource
ICICI	Industrial Credit and Investment Corporation of India
IEX	Indian Energy Exchange
INR	India Rupees
IPP	Independent Power Producer
IPPAN	Independent Power Producers Association Nepal
IWRM	Integrated Water Resource Management
JTT	Joint Technical Team
JV	Joint Venture
JWG	Joint Working Group

Km	Kilometer
kV	Kilo Volt
kWh	Kilowatt Hour
KYC	Know Your Client
LDC	Least Developed Countries
LOI	Letter of Interests
LT	Long Term
MD	Managing Director
MoEWRI	Ministry of Energy, Water Resources, and Irrigation
MoP	Ministry of Power
MP	Madhya Pradesh
MT	Medium Term
MV	Mega Volt
MW	Mega Watt
NEA	Nepal Electricity Authority
NHPC	National Hydroelectric Power Corporation
NOC	Nepal Oil Corporation
NPR	Nepalese Rupees
NPTC	Nepal Power Trade Company
NTPC	NTPC limited India
NVVN	Vidyut Vyapar Nigam Limited of India
OA	Open Access
PDA	Project Development Agreement
PEC	Power Exchange Company
PEL	PTC Energy Limited
PFC	Power Finance Corporation
PGCIL	Power Grid Corporation of India
PMITD	Planning Monitoring and Information Technology Department
PPA	Power Purchase Agreement
PRoR	Peaking Run-of -River
PSA	Power Service Agreement
PSMP	Power System Master Plan
PSL	Pranurja Solution Limited
PTA	Power Trade Agreement
PTC	PTC India Limited
PTD	Power Trade Department
PXIL	Power Exchange India Limited
REC	Renewable Energy Certificates
ROR	Run-of-River
RPGCL	Rastriya Prasaran Grid Company Limited
RPO	Renewable Purchase Obligations

RTC	Round The Clock
RTM	Real Time Market
SAARC	South Asia Association for Regional Cooperation
SARI/EI	South Asia Regional Initiative for Energy Integration
SECI	Solar Energy Corporation of India
SJVL	Sutlej Jal Vidyut Nigam
SNA	Settlement Nodal Agency
SOD	System Operation Department
ST	Short Term
SWOT	Strength, Weakness, Opportunity, and Threat
TAM	Term Ahead Market
THyE	Tangsibji Hydro Energy Limited
T&D	Transmission and Distribution
UK	United Kingdom
US	United States
USD	United States Dollars
USAID	United States Agency for International Development
VGF	Viability Gap Funding
WRS	Water Resource Strategy

CHAPTER 1: INTRODUCTION

1.1. BACKGROUND

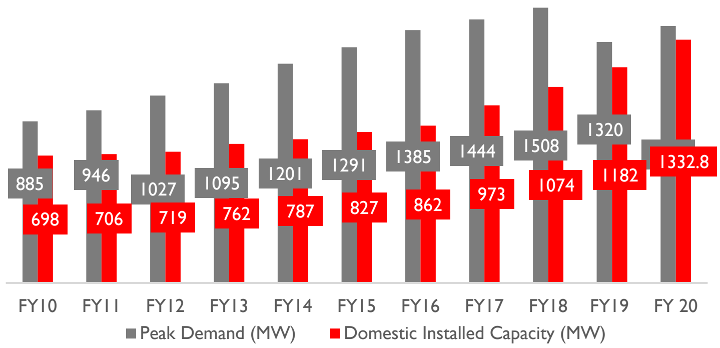
Nepal is one of the richest countries in the world with respect to hydropower resources, largely due to its proximity to the largest mountains in the world and the vast quantities of water that flow from them. The Government of Nepal (GoN) has estimated that there are approximately 42 Gigawatts (GW) of hydropower potential for Nepal. To date, however, Nepal has only exploited approximately 2.5% of its total hydropower potential for power generation. Still, the present hydropower installed capacity of 1.3 GW is the mainstay of the country's installed generation capacity mix and contributes nearly one hundred percent to Nepal's overall energy mix. These facts underline the importance of hydropower in Nepal's power sector.

1.1.1. BACKGROUND AND OBJECTIVE FOR CROSS BORDER ELECTRICITY TRADE (CBET)

From Financial Year (FY) 2010 to 2018, Nepal's peak power demand has grown at a Compound Annual Growth Rate (CAGR) of 7% (from 885 Megawatt (MW) to 1,508 MW), before dropping to 1,320 MW in FY19 – and increased again to 1407.94 MW in FY 20.[1] To meet the demand, the domestic installed capacity has also increased at a CAGR of 6% from FY10 to FY20. However, the continually expanding domestic generation capacity has not been sufficient to meet the ever-expanding domestic demand. Today, Nepal is experiencing a demand-supply gap, as illustrated in Figure 4. This gap is currently being managed, at least in part, by importing power from India. In FY 20, these imports have been in the range of 300 to 500 MW.[2]

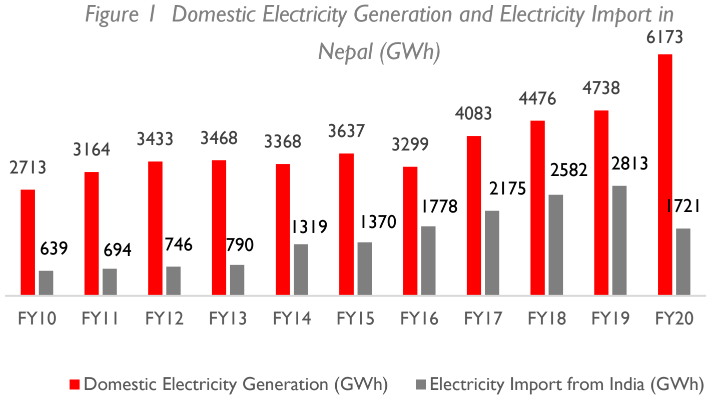
Despite being a net importer of electricity, Nepal conducts its own exporting of power to India during the wet season, when more water translates to more hydro generation. Nepal's peak generation period matches nicely with the peak demand season of India, and other South Asian countries. Nepal's peak exports were 29.57 GW, recorded between September and October of 2020.[3]

Figure 2 Domestic Installed Capacity and Peak Demand in Nepal (MW)



Source: NEA Annual Report, 2020

Figure 1 Domestic Electricity Generation and Electricity Import in Nepal (GWh)



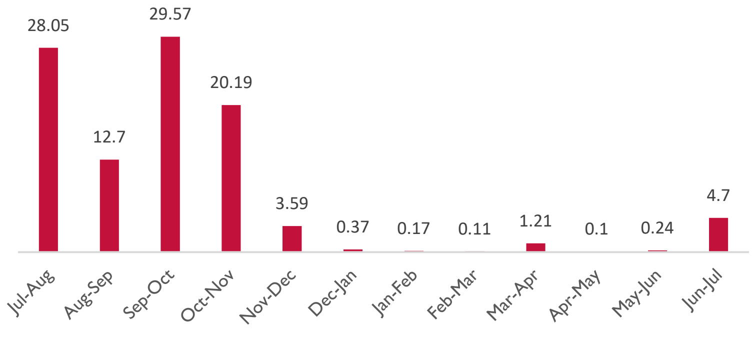
Source: NEA Annual Report, 2020

1 NEA. 2020. NEA Annual Report for FY 2020.
2 NEA. 2020. NEA Annual Report for FY 2020.
3 NEA. 2020. NEA Annual Report for FY 2020.

Nepal also exports during its off-peak hours in the wet and dry seasons. The time-zone gap of 15 minutes with India and the differences in the geographical and social characteristics of the two countries result in a time-slab advantage and different peak references from India.

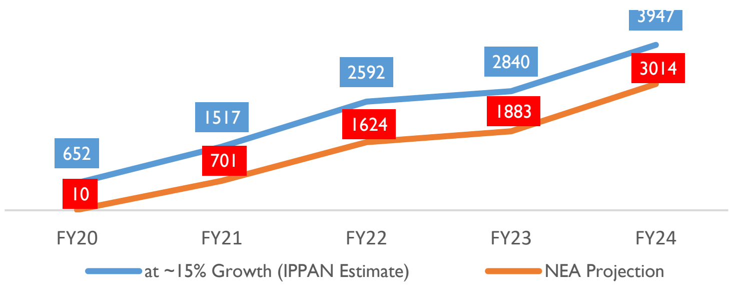
According to NEA's load forecast data the outlook of Surplus Generation Capacity, Nepal's peak power demand is projected to increase to approximately 3,703 MW by the end of FY24. NEA has also projected that Nepal will have a high surplus power in the near-term under all scenarios – winter peak load (dry peak), summer peak load (wet peak) and summer off-peak load (wet off-peak). According to NEA's estimates, Nepal is expected to have enough capacity to meet its domestic demand from FY 21 (amounting to approximately 700 MW) thereafter, and by FY24, the surplus is expected to reach 3,014 MW. According to another set of projections made by the Independent Power Producers Association of Nepal (IPPAN), surplus capacity is expected to reach 3,947 MW by FY 24.

Figure 3: Nepal's Power Export to India in FY 20 (GWh)



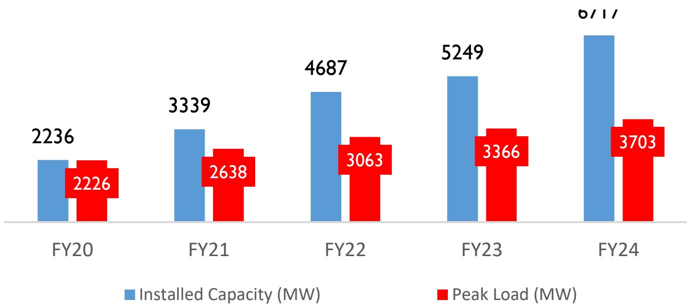
Source: NEA Annual Report, 2020

Figure 5: Surplus Capacities Projected by NEA and IPPAN (MW)



Source: NEA Annual Report 2019; IPPAN Presentation, Power Summit 2019

Figure 4: Projected Installed Capacity Vs Peak Load (MW)



Source: NEA Annual Report 2019, IPPAN Presentation, Power Summit 2019

This projection exceeds NEA's forecasts by nearly 25%. Whichever estimate is correct, it is clear that in the near-term Nepal's generation will exceed domestic demands, thereby providing an opportunity to export surplus hydropower to neighboring countries by FY 24. In line with the GoN's target to develop 15,000 MW[4] of generation capacity in the next 10 years, this will further increase the surplus capacity in the future, resulting in an even greater need for Nepal to export its power.

To summarize, today, Nepal's power generation is entirely dependent on run-off-river hydropower projects. Nevertheless, Nepal is still experiencing a power deficit and therefore remains a net importer of electricity. However, there are seasonal surpluses during the monsoon season, during which time

[4] The Kathmandu Post. 2018. Government Target to Increase Generation Capacity. Published on October 18, 2018.

Nepal exports power to India. Nepal is expected to have at least 3 GW of surplus power capacity by the end of 2024. Therefore, Nepal needs to do all that it can to expand the domestic demand and to source markets where it can sell all of its unused power in neighboring countries.

1.1.2. CURRENT POWER TRADING OPTIONS

The cooperation between two countries is the exchange of power in the contiguous border towns based on radial mode of supply system. Both parties already signed the power trade agreement and also set up a joint working group for the planning and identification of cross-border interconnections. Cross-border energy trade could lead to effective utilization of natural resources, increase in supply reliability, and make savings in capital and operating costs.

1.1.2.1. POWER EXCHANGE MECHANISMS

The Koshi and Gandak Agreements were concluded nearly seventy years ago, the first power exchange between Nepal and India only came into being in 1971, when the Koshi Agreement provided Koshi power to Biratnagar, Dharan, and Rajbiraj. Over time, cross-border electricity exchanges increased. By 1983, Nepal imported about 6 MW of electricity from India to supply border towns from power exchange points; Nepal also exported about 5 MW from the Birgunj-Raxual point.[5]

The tariff of such exchanged electricity across border is decided by Power Exchange Committee (PEC), formed with joint representation by Nepal and India. Further, NEA concluded a Power Sale Agreement with Power Trade Corporation of India for to import power from the Dhalkebar-Muzaffarpur (DM) 400kV cross-border transmission line. NEA and National Thermal Power Company (NTPC) limited, India's Largest Power Utility and Vidyut Vyapar Nigam Limited of India (NVVN) signed a Power Purchase Agreement (PPA) in 2016 to supply of Round the Clock (RTC) power. Pursuant to that agreement, Power supply commenced with the commissioning of Dhalkebar-Muzaffarpur (DM) line. Subsequently, NEA and NVVN signed a Composite PPA and Power Service Agreement (PSA) in July of 2020.

NEA also purchases High Voltage (132 k V) as a bulk consumer of Bihar State Power Holding Company Limited (BSPHCL) and pays the energy charge applicable to a 132 kV bulk consumer of BSPHCL in Bihar pursuant to an approval of the Bihar Electricity Regulatory Commission, but not the demand charge.

1.1.2.2. POWER TRADE MECHANISM

In addition, since 2009 NEA is importing electricity through power trading from India's short-term electricity market. Under this arrangement, NEA purchases power through PTC India Limited during the dry months of December through May each year. The price of electricity purchased under this arrangement is pursuant to the market driven price in India. When Nepal first explored this market in 2009, the price was close to IRs 6.00 per kWh. Last year, however, that price had dropped to IRs 3.50 at the seller's point – including open access charges, losses, and other charges the landed price was Indian Rupees (IRs.) 3.75/kWh.

[5] Pun, S.B. 2009. Power Trading. In: The Nepal-India Water Relationship: Challenges (eds. D.N. Dhungel and S.B. Pun); Springer Science and Business Media B.V.; pp. 153-196.

1.1.2.3. TRADE IN POWER EXCHANGE MARKET

NEA and Vidyut Vyapar Nigam Limited of India (NVVN) signed an agreement in April 2019 to trade power through the Indian Power Exchange. The Designated Authority of India (DA) issued procedure for approving and facilitating Import / Export (cross-border) of electricity in February 2021. NEA and NVVN had previously signed an agreement in April 2019 to trade power through and exchange. On this basis, NVVN submitted an application to the DA to participate in the Indian Power Exchange. NVVN received the approval of the DA to purchase power up to 350 MW for the supply of energy to NEA, through power exchange(s). Based on this approval, in April of 2021, NVVN began purchasing power from NEA from the Indian Energy Exchange (IEX). NVVN filed a separate application with the DA to sell NEA power through the Indian Power Exchange, but approval of this application has not yet been approved.

1.1.3. EXISTING REGULATORY AND POLICY FRAMEWORK

The concept of power trading is not new for Nepal, and there are a number of plans and policy documents already addressing multiple issues. Initially, the trade of electricity between Nepal and India were guided by the bilateral agreements of Kosi and Gandak, concluded in the 1950s. In SAARC Summit (2014), leaders signed SAARC Framework Agreement for Energy Cooperation. The framework provides non-discriminatory transmission access for cross-border electricity trading. Following this, Nepal and India signed an agreement on Electric Power Trade, Cross-border Transmission Interconnection and Grid Connectivity in 2014. Power Trade Agreement (PTA) signed between Nepal and India was much touted as the most significant achievement for power trade between Nepal and India. This agreement has been perceived as a major advance in not just addressing the increasing power demand in India and Nepal but also the regional balanced of power. The possibility of exporting surplus hydropower was first announced in 1992 in the Government of Nepal's Hydropower Development Policy. The following discussion addresses the prevailing national policies and plans related to hydropower and transmission line development as they relate to cross-border electricity trading.

1.1.3.1. ELECTRICITY ACT, 1992 (2049)

The Electricity Act 1992 provides for the import and export of electricity. If a licensee seeks to distribute electricity by importing power into Nepal, it may do so by obtaining the prior approval of GoN, under applicable law. A licensee seeking to export its own sourced electricity to a foreign country may do so by entering into an agreement with the GoN, subject to paying export duties to the GoN as prescribed by applicable law.

1.1.3.2. HYDROPOWER DEVELOPMENT POLICY, 2001

Nepal's Hydropower Development Policy, 2001, also applies to the cross-border trading of electricity. This policy envisages the development of hydropower for export, and has encouraged the export of electricity, taking into account Nepal's abundant hydropower potential. For such trade, this policy prescribes a strategy of bilateral or regional cooperation in the hydropower development sector.

1.1.3.3. WATER RESOURCES STRATEGY, 2002

Nepal's Water Resources Strategy (WRS) (2002) was the first Nepali document of Nepal to incorporate the principles of Integrated Water Resources management (IWRM). One of the specific objectives adopted by the WRS was to generate sufficient hydropower to satisfy the nation's energy requirements and to allow for the export of surplus energy.

1.1.3.4. NATIONAL ENERGY CRISIS MITIGATION AND ELECTRICITY DEVELOPMENT DECADE, 2016

A concept paper on the mitigation of national energy crisis and electricity development decade was presented by the then Ministry of Energy, Water Resources, and Irrigation (MoEWRI) in January, 2016. It planed to import up to 930MW of electricity from India for up to 2 years in order to fulfill Nepal's domestic demand of Nepal. By 2026, generation of 10,000 MW of electricity including 5,000 MW from storage projects is anticipated. After fulfilling the internal demand, the plan intends to export all excess generation capacity. To achieve this goal, the plan foresaw theneed to study and execute cross-border transmission lines of 400kV capacity, including multiple transansmission interconnection projects, including the New Butwal-Gorakhpur, Duhabi-Purniya, Kohalpur-Lucknow, Lamki-Bareli, Attaria-Bareli and Chilime Hub-Kerung.

1.1.3.5. TRANSMISSION SYSTEM DEVELOPMENT PLAN OF NEPAL, 2018

In 2018, the Rastriya Prasaran Grid Company Limited (RPGCL), a transmission company owned by the GoN, prepared its Transmission System Development Plan. That plan includes six Nepal-India cross-border connection points in the Terai Region and two Nepal-China cross-border connection points in the Himalayan Region. These cross-border lines, which will be capable of transmitting a total of 15,900MW of electricity, are much same as those proposed by the Electricity Development Decade, 2016.The Transmission Plan was prepared in accordance with the GoN latest target – to devleop 15,000MW in 10 years and approximately 40,000 MW by 2040. Similarly, the Joint Technical Team (JTT) of Nepal and India has developed an 'Integrated Master Plan for the Evacuation of Power from Nepal to India' through the year 2035.

1.1.3.6. ELECTRICITY REGULATORY ACT AND RULES 2019

Pursuant to the Electricity Regulatory Commission Act 2019, the Electricity Regulation Commission (ERC, or the Commission) was established to, among others, to regulate the trade of electricity. ERC is responsible to set prices for the purchase and sales, as well as the procedures to be empoloyed between a distribution licensee and generation licensee, trade licensee and body corporate established by the GoN pursuant to prevailing laws until the establishment of whole-sale electricity market in Nepal. ERC also prescribes terms and conditions for the conduct of electricity trade and monitors such transactions on a regular basis. The Commission is also mandated to provide necessary advice and suggestions related to policy reform to the GoN to make electricity trading reliable and effective.

1.1.4. EXISTING TECHNICAL FRAMEWORK

Existing Cross-Border Transmission Lines: The 400 kilo volt (kV) Dhalkebar-Muzzaffapur cross-border transmission line which links Nepal and India has been charged successfully at the 400 kV voltage level. Today the line already has a capacity of 1100 MW.[6] In addition, Nepal and India also have other transmission interconnections at 132 kV, at Ramnagar, Raxaul, Dhuhabi and some others at 33 kV.

[6] World Bank. 2020. Nepal-India Electricity Transmission and Trade Project (P115767).

Cross-Border Transmission Lines Under Development: Nepal and India have already planned the construction of the new Butwal-Gorakhpur 400 kV cross-border transmission line which is expected to have a total capacity of 2,500 MW.[7] NEA and PGCIL have now also signed the Joint Venture Agreement to construct and operate a cross-border transmission line between the Nepal-India Border and Gorakhpur. This Transmission Line will be 110 kilometers in length, with a capacity of 400 KV, and with the ability to carry electricity up to 3000 MW.

[7] RBGCL. 2018. Transmission system development plan of Nepal,

CHAPTER 2: ANALYSIS OF THE ELECTRICITY-DEMAND SUPPLY SCENARIO

2.1. ANALYSIS OF ELECTRICITY DEMAND-SUPPLY SCENARIO

NEA is expected to add approximately1,017 MW[8] of capacity to the grid during the coming fiscal year of 2021/22. Most of this energy (and energy procured till date) has been acquired by NEA from private sector producers on a '*take or pay*' contract, which means that NEA must pay for the energy regardless of whether or not it is used. However, Nepal's energy demand has not kept pace with the steep increase in supply. This has already resulted in spilled energy and lost revenue to NEA. In the immediate future NEA should put in place a process to plan for all electricity generated in Nepal, and to know how much can be taken up in country, and how much should be sold into the regional market.

With these issues in mind, we have analyzed the demand and supply scenario for the coming fiscal year[9] to identify the quantum of energy that NEA may be able to sell as surplus (also referred to as "spill energy" throughout section 2 of this report), the cost of such surplus for NEA, and the potential revenue that NEA can realize through export. As such, this analysis only focuses on identifying potential export of energy during the wet season when surplus is expected rather, than any imports that NEA may require to serve unmet demand during the analysis period.

The COVID-19 related lockdown measures imposed by the GoN has resulted in shifting demand patterns, making it difficult to use the current demand data to accurately forecast demand for multiple years in the future. Similarly, the flooding which has this year resulted from stronger than expected monsoons has postponed the commercial operation date (COD) for upcoming hydropower projects — thereby adding to the uncertainty of supply. For these reasons we have conducted this analysis only for the next fiscal year. We will update the analysis on a periodic basis, as and when we receive more visibility into the years beyond the next fiscal year.

2.2. FORECAST OF ELECTRICITY DEMAND FOR FISCAL YEAR 2021/22

2.2.1. DEMAND FORECAST METHODOLOGY AND ASSUMPTIONS

For the demand analysis, we have used the hourly demand data from the year 2019 (January to December) as the basis of the forecast. The reasons for using only a single year's data are two-fold – first, the years before 2019 were marred by intermittent load-shedding, which resulted in suppressed demand; and second, because more recent data from 2020 and 2021 have suffered from the sporadic lockdown measures caused by COVID-19. For all of these reasons we feel the demand data from 2019 provides us with the best, un-skewed reference point to begin our demand analysis.

To make the energy dispatch modeling easier, instead of forecasting hourly demand for the entire 365 days of FY21/22, we have assumed the average, maximum, or minimum demand obtained during a 24-hour period during each month in 2019 to be representative of the 24-hour period of the same month

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[8] NEA. 2019. Corporate Development Plan. p.85

9 Nepal's fiscal year 21/22 is from July 16, 2021, to July 15, 2022. For simplicity, the analysis period is taken as Aug 1, 2021, to July 31, 2022

in FY21/22. For example, when using the average profile, we have averaged the demand during all 1:00 a.m. periods during the 30-days of June 2019 as an input to forecast the 1:00 am demand for June 2022. Similarly, when using the maximum or minimum profile, we have instead used the maximum and minimum demand during the 1:00 am period, respectively.

To make the analysis method clearer, the steps and examples below show how we have calculated the demand for a typical 1:00 am period for the month of June 2022 using the average profile:

Step i. Determination of Monthly to Annual System Peak Ratio for 2019

Actual peak load in June 2019 =1,343 MW

Actual annual peak load for 2019 = 1,408 MW

Ratio (percentage) of monthly to annual system peak for 2019 = (1,343 / 1,408) 95%.

Step ii. Estimation of Monthly System Peak for FY21/22

Estimated system peak for FY21/22 = 1,763 MW (from NEA's load forecast for FY21/22)

Monthly to annual peak load ratio from step (i) = 95%

Peak load for the month of June 2022 = 1,763 MW x 95% = 1,682 MW

Step iii. Determination of Average Hourly Demand to Monthly System Peak

Average demand at 1:00 am in June 2019 = 942 MW

Actual peak load for June 2019 = 1,343 MW

Ratio of average 1:00 am demand to monthly peak load for June 2019 = 942 MW / 1,343 MW = 70%

Step iv. Estimation of Hourly Demand During June 2022

Average peak load for June 2022 from step (ii) = 1,682 MW

Ratio of average 1:00 am demand to monthly peak load for June 2019 from step (iii) = 70%

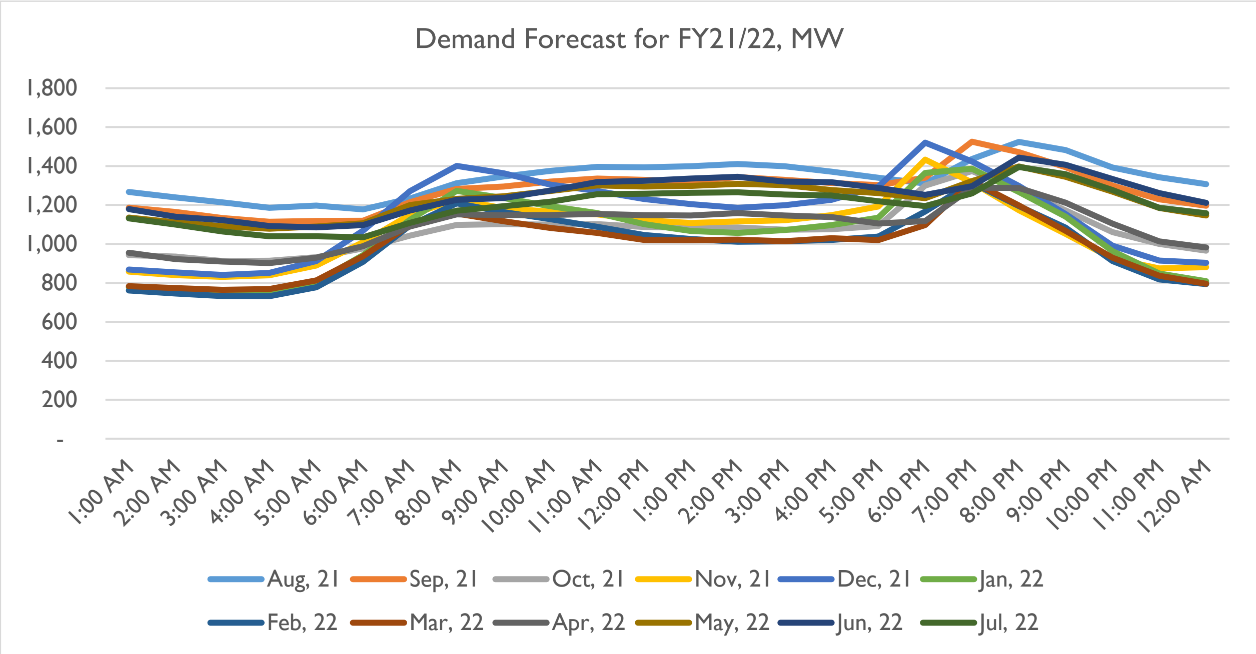
Average hourly demand during 1:00 am for June 2022 = 1,682 MW x 70% = 1,179 MW

As shown above, we have calculated the average hourly demand for each hour of an average day in June 2022 and have assumed that the resulting 24-hour demand pattern is true for each day of that month. We have made similar assumptions and calculations for the remaining 11 months of the fiscal year to forecast the hourly demand during the analysis period. As for the demand forecast using the maximum and minimum profile, the analysis has simply replaced the average 2019 demand used in step iii, with the maximum or minimum demand from 2019.

2.2.2. DEMAND FORECAST RESULTS

The figure below depicts the demand forecast results for FY21/22 using the average demand profile discussed above.

Figure 6. Demand Forecast Result for FY21/22 using the Average Demand Profile



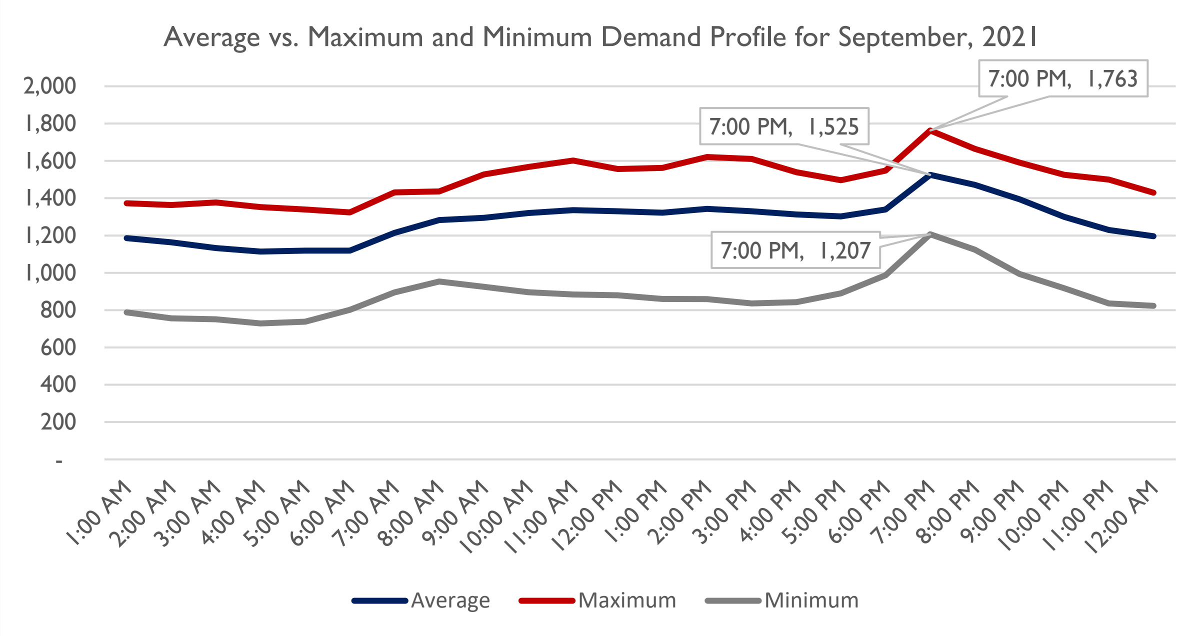
Since the forecast is completely dependent on the demand profile for 2019, it shows similar characteristics to those witnessed throughout that year. The results are consistent with the demand profile of Nepal, which peaks during the evening hours of 5:00 pm and 8:00 p.m. Also, demand during the afternoon is lower during the winter months, as compared to those of the summer months. Using the average profile, we obtain peak demand of 1,525 MW at 7:00 p.m. in September 2021 and the lowest demand of 732 MW at 3:00 am of February 2022.

Figure 7 below depicts the difference between forecasted demand when using the maximum and minimum demand profile, as opposed to the average one. For this illustration, we have used the estimated demand for the month of September 2021, because it is the month when we experience the peak demand for the FY21/22.

The middle line represents the demand profile obtained by using the average demand profile from 2019 (this is the profile shown in the Figure 6). The top and the bottom line represent the demand profile obtained using the maximum and minimum demand profile from the same year, respectively. As can be seen, we obtain a variation of around 250 MW between the three forecasts. Using the average method, we obtain a peak load of 1,525 MW at 7:00 PM, whereas the same peak load using the maximum and minimum method is 1,763 MW and 1,207 MW, respectively. We obtain the peak load of 1,763 MW as estimated by NEA for FY21/22, only when we use the maximum profile.

While using the average demand profile has helped us identify the average cost of surplus for NEA and the average quantum of energy it can export during the analysis period, using the minimum demand profile has helped us identify the maximum export potential that NEA could have over the analysis period and whether such surplus will put stress on its existing transmission system. Similarly, using the maximum demand profile has helped us recognize the minimum export potential for NEA so that it does not over-commit on the round the clock (RTC)[10] export agreements. However, since the purpose of this exercise is to identify the surplus energy and related costs and revenues on '*average*' and not system constraints or variations in export potential, we have only used results from the average demand profile in the sections that follow.

Figure 7. Variation in Demand Obtained When Using Average, Maximum, and Minimum Demand Profile



2.3. FORECAST OF ELECTRICITY SUPPLY FOR FISCAL YEAR 2021/22

2.3.1. REVIEW OF EXISTING ELECTRICITY SUPPLY SCENARIO

Nepal's energy supply is predominantly dependent on hydropower. Although there are a few hydropower plants available with storage capacity, most of the supply is based on 'R*un-of-River*' type hydropower plants, whose supply increases during the '*wet*' season of May to October. Supply from such power plants declines during the '*dry*' season when the monsoon recedes to reduce the water flow in the rivers. As such, NEA procures power from various types of hydropower plants, as given below:

i. Run-of-River (ROR) Hydropower Plants: Hydropower plants that produce energy based on the water flow in the river and do not have any storage capacity.

ii. Peaking ROR (PROR) Hydropower Plants: Hydropower plants with some storage or '*peaking'* capacity but largely dependent on the water flow in the river.

[10] Minimum spill energy throughout the day

iii. Storage Hydropower Plants: Hydropower plants with seasonal storage capacity – can store water during the wet season to supply energy during the dry season.

Since all the supply from ROR power plants and most of the supply for PROR power plants cannot be stored and must be used when available, they are exposed to the danger of energy spillage and are used to serve base load. On the other hand, energy from storage power plants is used only when needed to serve peak load. Apart from these sources, NEA also procures energy from some solar and thermal plants. However, the contribution from such power plants is not significant.

Through the end of July 2021, NEA's largest supply of power comes from the private sector – referred to as the Independent Power Producers (IPPs). NEA procures power from such IPPs by paying set tariff rates according to type of power (ROR, PROR, or Storage) through Power Purchase Agreements (PPAs). This is the most expensive source of power for NEA, together with imports from India. Since Although NEA is a vertically integrated utility – responsible for generation, transmission, and distribution functions, it nevertheless invests in its own generation plants.

Table 1. Total Power Capacity connected to the Grid as of July 31, 2021

Source (Project Type)	Capacity (MW)
IPP ROR	791
NEA ROR	152
IPP PROR	152
NEA PROR	313
Renewables (Solar and Cogeneration)	23
NEA Storage	106
Thermal (Multifuel and Diesel)	53
Total	**1,591**

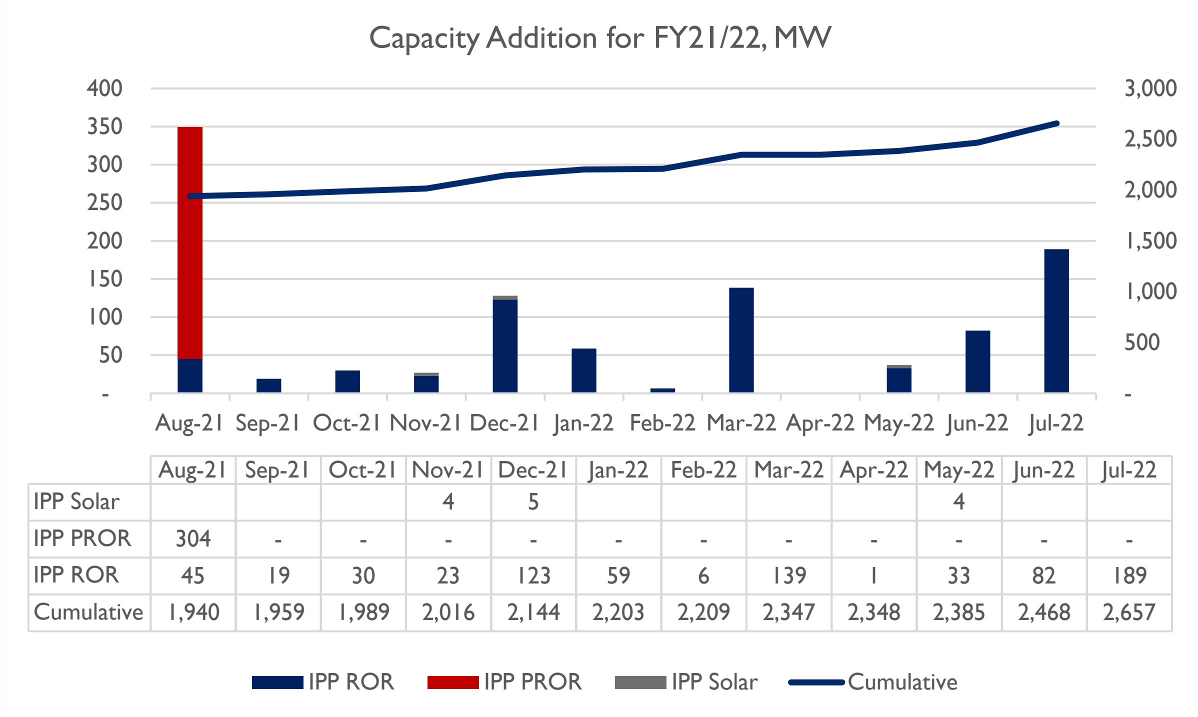
Source: NEA Power Trade Department

The Table 1 above summarizes the total capacity connected to the grid, segregated according to source of supply. As can be seen, a total of 1,591 MW has been connected to the grid as of July 31, 2021. The major source of the total supply has been the 791 MW Run of River (ROR), and 152 MW Peaking ROR projects developed by Independent Power Producers (IPPs). NEA's own ROR, Peaking ROR, and Storage power plants have added 152 MW, 313 MW, and 106 MW each to the grid. The balance of 53 MW and 23 MW has come from multifuel and renewable power plants, respectively.

2.3.2. CAPACITY ADDITIONS

At the time of this writing (August 2021), flooding across various parts of Nepal had delayed the commissioning of many power plants and NEA has been undertaking an exercise to adjust commissioning dates for such projects. Since this exercise was expected to take some time, after consultation with NEA, we have postponed the estimated Commercial Operation Date (COD) of such projects by 6 months. Using this assumption, NEA is expected to add about 1,066 MW of installed capacity to the grid by the end of FY21/22.

Figure 8. Capacity Additions Each Month for FY21/22



	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22
IPP Solar				4	5					4		
IPP PROR	304	-	-	-	-	-	-	-	-	-	-	-
IPP ROR	45	19	30	23	123	59	6	139	1	33	82	189
Cumulative	1,940	1,959	1,989	2,016	2,144	2,203	2,209	2,347	2,348	2,385	2,468	2,657

The figure above provides details regarding expected capacity additions during FY21/22. As can be seen, apart from 304 MW (4 units x 76 MW each) of Upper Tamakoshi – an IPP PROR project – all other capacity additions are through IPP ROR (749 MW) and solar (13 MW) projects. These additions will take the total installed capacity at the end of the analysis period to 2,657 MW.

2.3.3. ENERGY AVAILABILITY ASSUMPTIONS AND SUPPLY FORECAST RESULTS

To calculate the monthly energy available using the capacity shown in Figure 8, we have made following assumptions:

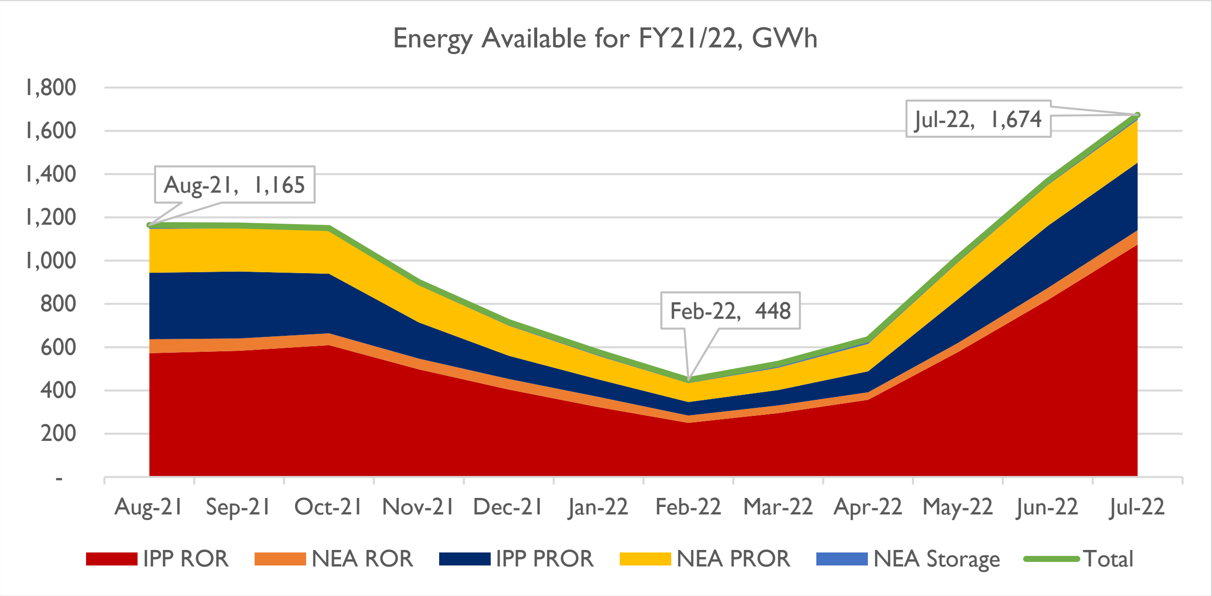
Table 2. Assumptions made to calculate energy available during FY21/22

Source of Energy (Power Plant Type)	Assumptions Made
IPP ROR, PROR, Renewables	90% and 100% of contract energy for dry and wet seasons, respectively
NEA owned ROR	Actual generation for FY20/21
NEA owned PROR and Storage	Average of last 5 years of generation (FY20/21 as the latest year)

For existing and upcoming IPP ROR, PROR, and Renewable Energy projects, we have used their contract energy[11] as their expected supply, owing to limited available information on their actual generation data. However, analyzing the recent past, we have found that the actual energy delivered by these IPP power plants does not precisely equal their contract energy. While the actual energy delivered during wet season can be approximately equal to the contract energy, those supplied during the dry season can be lower. Hence, we have used estimates of 90% and 100% of contract energy for dry and wet seasons, respectively, to calculate the energy that IPP ROR, PROR, and Renewable Energy projects will be able to supply to the grid.

For NEA-owned ROR projects, we have used the latest actual published generation data from NEA's annual report for FY20/21. However, for NEA's PROR and Storage power plants, we have used an average of their last 5 years' generation data because of significant variations in their energy production over those years.

Figure 9. Monthly energy available for FY21/22



Note: Since energy from renewable sources (solar and cogeneration) formed an insignificant portion of energy, we have merged them under IPP ROR

From the figure above, we can see that energy availability is higher during the wet season than the dry season, mainly because of the variations in energy supply from ROR and PROR projects. Also, as more projects come online over the course of the fiscal year, the energy supply during the wet months of 2022 surpass those of 2021. For the year 2021, the highest quantum of energy is expected to be available during the month of August – 1,165 GWh. As we move onto year 2022, it steadily decreases to its lowest quantum during the dry month of February – to reach 448 GWh. As the monsoon rains fill the river to increase the water flow, the supply of energy is expected progressively to increase to reach a peak of 1,674 GWh during the month of July 2022.

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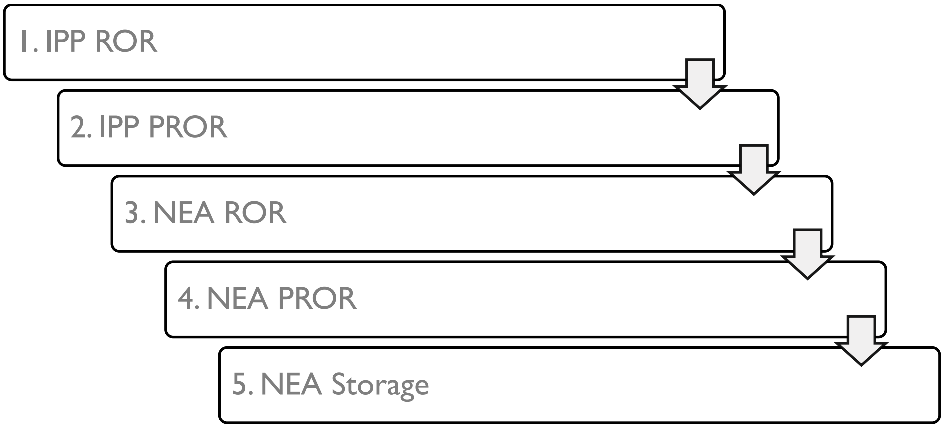
[11] Schedule of monthly energy that IPPs agree to supply NEA

2.3.4. MERIT ORDER DISPATCH ASSUMPTIONS

We should be aware that the manner in which NEA dispatches the power available from various power plants could alter tariffs to the domestic consumers, i.e., the cost of energy procured for domestic sale could be an important consideration in designing domestic tariffs. However, we feel this topic warrants a more comprehensive regulatory and political discussion and have not included it in the scope of this analysis. Instead, to model the energy dispatch, we have assumed that NEA's motivation will be to minimize the cost of surplus energy. As such, we have based the order or merit in which power from various types of power plants are dispatched on two factors – first, the cost of power to NEA and second, peaking and storage availability of the power plants. The figure below shows the merit order dispatch that NEA is expected to follow.

Figure 10. Dispatch Merit Order for NEA



Most of the power purchased from IPPs are in the form of *"take or pay"* contracts, which require NEA to pay for the power, regardless of whether it is used. Furthermore, the source of the take or pay power is also the most expensive, after imports for NEA.[12] Therefore, we have assumed that NEA would want to dispatch power purchased from IPPs first. Between the IPP-owned ROR[13] and PROR power plants, NEA will want to dispatch power from ROR power plants first, since the energy produced from these power plants cannot be stored and must be used as and when available.

NEA will use the power procured from its own power plants only after those procured from IPPs have been exhausted. Among its own power plants, it will use the ROR ones first to meet the base load, followed by its peaking ROR power plants to meet the remaining or balance demand. It will use its storage power plants only when demand cannot be met through the other generation facilities.

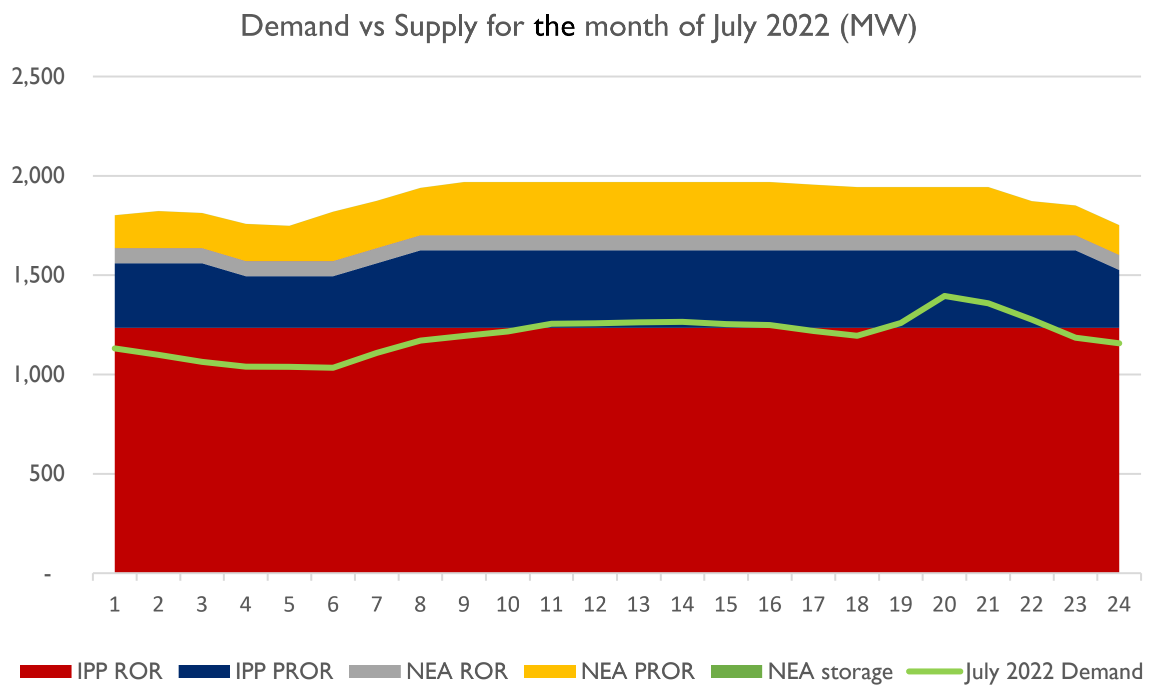
Figure 11provides an example of how demand for July 2022 is met through the model. The red line in the figure indicates the demand curve for the month and the various colored layers indicate the supply or dispatch made to meet that demand. To meet the base load, IPP ROR energy is dispatched first, followed by IPP PROR and NEA ROR. The final layer at the top depicts energy dispatched from NEA PROR plants. This figure does not show energy available from storage power plants since the energy

[12] Average cost of power purchase from IPPs and Imports are NPR 5.86 and 7.95, respectively according to NEA Annual Report for FY20/21

[13] Also includes IPP owned renewable power plants

supply from all other types of plants were sufficient to meet the demand during all the hours of this month. As such, the energy from storage power plants was stored to be used during the dry months to meet peak demand.

Figure 11. Demand and Supply Scenario for the month of July 2022



Similarly, we have modeled a demand and supply scenario for each of the months in the analysis period to identify months when NEA is expected to have surplus energy.

2.4. ASSESSMENT AND REVIEW OF SURPLUS ENERGY FOR FISCAL YEAR 2021/22

After superimposing the energy supply over the demand for all months during the analysis period, we found that the months of September and October of 2021, and June and July of 2022 are expected to have surplus energy. Since the analysis was limited to identifying the quantum of such surplus, along with its costs and potential revenue, we have presented the analysis results for the identified months only.

2.4.1. FORECAST OF ENERGY BALANCE, QUANTUM, AND COST OF SURPLUS ELECTRICITY

The table below presents the quantum of energy demand and supply, the source of energy surplus, and the costs associated with such surplus. While the first 3 rows highlight the quantum of energy demand, energy surplus, and energy balance, the remaining rows provide the source of energy surplus (by power plant type) to arrive at total potential export for FY21/22.

On aggregate, we expect NEA to have 1,014.8 GWh of surplus energy over the 4 months as shown above. The largest surplus of 582.2 GWh is expected in July 2022 with the least amount of surplus of 77.0 GWh expected during September 2021. We obtained these figures after adjusting the total energy supply available each month with NEA's expected average transmission and distribution (T&D) loss of 14.5%[14] for FY21/22.

Table 3. Energy Balance, Quantum, and Cost of Surplus Energy for FY21/22

	Units	Sep-21	Oct-21	Jun-22	Jul-22	Total Units, GWh
Energy Demand	GWh	920.4	796.8	902.2	889.3	3,508.7
Energy Supply	GWh	989.0	969.6	1,153.7	1,411.3	4,523.5
Surplus Energy/Balance	GWh	**68.5**	**172.7**	**251.5**	**522.0**	**1,014.8**
IPP ROR	GWh	-	-	-	49.7	49.7
IPP PROR	GWh	-	7.8	52.7	280.9	341.4
NEA ROR	GWh	-	19.8	48.8	63.1	131.7
NEA PROR	GWh	75.7	165.1	179.0	188.5	608.3
NEA Storage	GWh	1.2	-	-	-	1.2
Total Potential Export	GWh	**77.0**	**192.6**	**280.5**	**582.2**	**1,132.3**

During the same period, NEA can potentially export 1,132.3 GWh of energy. This figure is larger than the 1,014.8 GWh total surplus discussed above for two reasons. First, while NEA may not have surplus energy throughout the 24 hours of the day, it will still be able to export energy during those hours when it does have a surplus, causing the total daily surplus to be lower than the aggregate of hourly surpluses. Second, while the surplus has been calculated using the 14.5% T&D loss, we have assumed that exports will be subject to only 4.64% transmission loss[15]. Among the sources of surplus energy, PROR plants provide the largest at 608.3 GWh and storage plants provide the least at 1.2 GWh.

As discussed in section 2.2.1, NEAs source of power purchase are its own power plants, IPPs, and imports. Among these sources, the average cost of power purchase from imports are the most expensive at NPR 7.95/KWh. Those purchased from IPPs are slightly lower at NPR. 5.86/KWh[16]. Since NEA does not buy power from its own power plants, it is difficult to quantify the average cost of such power. Hence, we have used their operating expenses and generated energy to arrive at an average cost of power purchase at NPR. 2.07/KWh. Using all three sources, we get NEA's average cost of

[14] NEA expects FY21/22 T&D loss to be approximately 14.5%
[15] NEA. 2021. Annual Report for FY20/21. p.72
[16] NEA. 2021. Annual Report for FY20/21. p.217

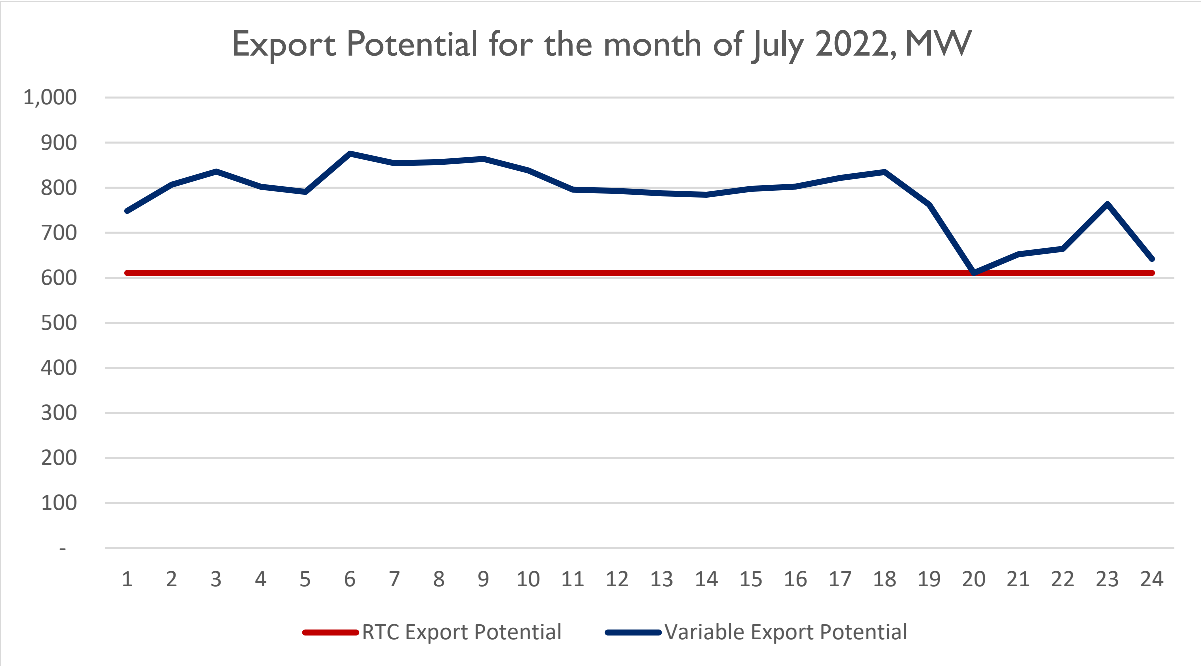
power purchase at NPR. 5.33/KWh. Now, to calculate the cost of surplus power, we adjusted this cost by removing the cost of imports and arrived at NPR. 4.10/KWh, which provided us with the total cost of surplus power of NPR. 4,640.3 million.

2.4.2. ESTIMATION OF REVENUE FROM POTENTIAL EXPORTS

To calculate the potential revenue from exports, we have assumed that all surplus energy will be sold in the Indian short-term power market using either short-term bilateral contracts with DISCOMS[17] and open access consumers or intra-day trading through power exchanges on the day-ahead market. Our motivation for such division was to capture the price differences in these two different types of markets.

As an example, the figure below illustrates how we have segregated potential exports for the month of July 2022. The horizontal line shows the average RTC export potential (minimum spill available throughout the day) and the line above it depicts average variable spill energy available during various hours of that day. For this example, RTC export potential is calculated at 611 MW, while variable export potential is anywhere between 31 MW to 265 MW. Similar segregation has been done for all the relevant months.

Figure 12.Export Potential (RTC and Variable Export) for the month of July 2022



We have assumed that the RTC potential can be sold through short-term bilateral contracts and the variable export potential can be sold through the day-ahead market. The result of the analysis is shown in the table below:

[17] Distribution Companies and Utilities.

Table 4. Revenue Potential from Surplus Energy for FY21/22

	Units	Sep-21	Oct-21	Jun-22	Jul-22	Total
RTC Export Potential	GWh	-	38.4	167.5	454.4	660.3
Bilateral RTC price[18]	INR/KWh	3.62	3.12	3.32	3.93	**3.66**
Bilateral RTC price	NPR/KWh	5.79	4.99	5.31	6.29	**5.86**
Revenue from RTC Export	NPR MM	-	**191.6**	**889.7**	**2,857.1**	**3,938.3**
Variable Export (above RTC)	GWh	77.0	154.3	113.0	127.9	**479.0**
Day-ahead weighted avg price[18]	INR/KWh	2.77	2.83	2.41	2.56	**2.61**
Day-ahead weighted avg price	NPR/KWh	4.43	4.53	3.86	4.10	**4.18**
Revenue from Variable Export	NPR MM	**341.2**	**698.5**	**435.8**	**523.8**	**1,999.2**
Total Revenue from Exports	NPR MM	**341.2**	**890.1**	**1,325.4**	**3,380.8**	**5,937.5**

The first and fifth row of the table highlight the segregation of the surplus or spill energy into RTC and variable export potential while the third and sixth row represent the price per unit such energy is expected to realize in their respective markets. The result for each type of energy and their total is presented in the final column. The results indicate that NEA may be able to realize NPR 3,938.3 million and NPR 1,999.2 million through the bilateral and day-ahead market respectively taking the total revenue potential of surplus energy for the FY21/22 to NPR 5,937.5 million.

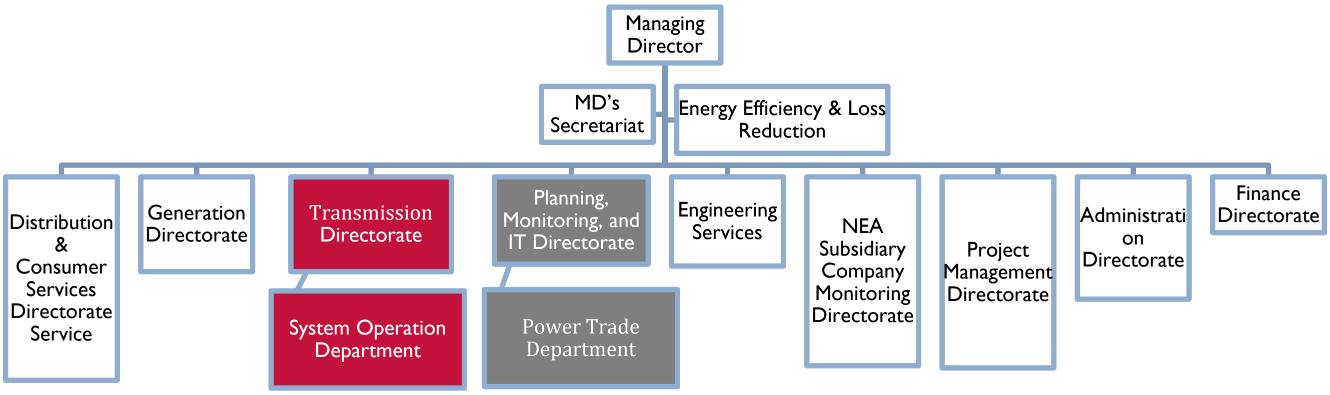
[18] CERC. 2020. Monthly Report on Short-term Transactions of Electricity in India (Market Monitoring 2020). Central Electricity Regulatory Commission, Government of India. Accessible at: https://cercind.gov.in/report_MM-2020.html

CHAPTER 3: REVIEW OF EXISTING INSTITUTIONAL FRAMEWORK OF NEA FOR CBET

3.1. REVIEW OF EXISTING INSITUTIONAL FRAMEWORK OF NEA FOR CBET

Nepal Electricity Authority (NEA) was established in August 1985, under the NEA Act 1984 which merged the Department of Electricity within the Ministry of Water Resources, Nepal Electricity Corporation, and other related Development Boards. The legislation authorized and obligated NEA to undertake Generation, Transmission, and Distribution (GTD) activities throughout the country, making it a vertically integrated, fully state-owned electric utility.

Figure 13 Organizational Structure of NEA



SOURCE: HTTPS://NEA.ORG.NP/ORGANIZATIONAL_STRUCTURE

As shown in Figure 13, NEA currently operates through nine directorates. Within NEA, there are two discrete departments holding obligations related to CBET – the Power Trade Department (PTD, highlight in grey) and the System Operation Department (SOD, highlighted in red). The former is responsible for signing contracts and agreements with foreign counterparts; the latter is responsible for the day-to-day buy-sell operations.

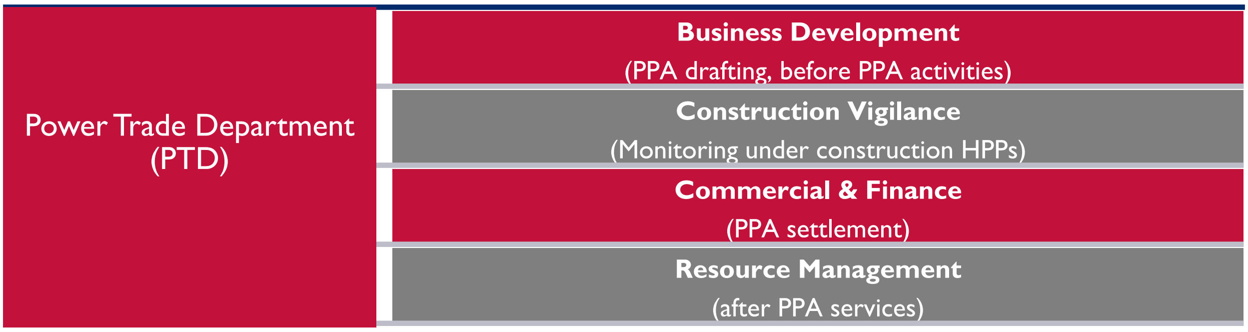
3.1.1. LEGAL FRAMEWORK OF NEA'S POWER TRADE DEPARTMENT

NEA is authorized to conduct CBET under Section 22 of the Electricity Act of 1992, which allows a distribution licensee to import or export electricity after obtaining prior approval from the GoN. The Electricity Rules of 1992 further clarify the approval process, stating that a GTD licensee can import electricity into Nepal after obtaining approval from GoN through the Department of Electricity Development (DoED). NEA's PTD, although established primarily to purchase power from the private sector Independent Power Producers (IPPs), is also authorized to conduct CBET activities. The PTD is under the Planning, Monitoring, and Information Technology Department (PMITD).

3.1.2. EXISTING STRUCTURE, OBJECTIVE AND FUNCTIONS

The PTD is responsible to sign contracts, both for short-term bilateral trading to import Round the Clock (RTC) power, and to conduct intra-day imports from power exchanges in India. However, its current structure does not comprise any specific department or division dedicated to CBET, as illustrated in Figure 14.

Figure 14 Organizational Structure of the Power Trade Department (PTD) within NEA



The PTD is divided into four sections dealing primarily with domestic PPAs between NEA and IPPs. The fact that CBET functions are bifurcated at NEA, there is not, as such a "Power Trade" or a "CBET" department to conduct international electricity trade. CBET agreements are signed by the head of the PTD, with the approval of the Managing Director (MD). Since the SOD has more visibility into the daily demand/supply patterns, it has been entrusted with daily operational activities, including fixing the quantum of import/export and communicating with traders in India. Like the PTD, the SOD does not have any specific departments or divisions to conduct such activities.

3.1.3. CHALLENGES WITH THE EXISTING FRAMEWORK

The current structure of the PTD indicates that its purpose is to manage domestic PPAs. Similarly, the SOD is primarily responsible for the smooth running of the grid – not CBET. Combining these two departments might enable the management of the current low volumes of import and export, it might not cope with the impending high-volume of CBET on the horizon.

Owing to this bifurcation of responsibilities, the current structure faces the following limitations and challenges:

I. **MANDATE OF THE UNITS**
Both PTD and SOD have been designed with a specific mandate – the former for domestic PPAs; the latter for system operation. Neither specifically manages CBET. For that reason, the incentives and performance appraisals of the employees within those departments is probably not directly linked to CBET either.

II. **JOB ROTATION AND EMPLOYEE TRANSFERS**
Since both the PTD and SOD teams are under NEA's Human Resource (HR) planning, they are subject to job rotation and transfers, which may make it difficult to build a dedicated team with skills related to CBET.

III. **CAPACITY BUILDING**
Related to point ii, capacity building of employees on CBET may be challenging if they are rotated within various departments. There is also a challenge of skill attrition if those who have already been trained on CBET are transferred to other job functions or departments.

IV. **LOCATION OF THE UNITS**
PTD is housed within the head-office of NEA; SOD is housed elsewhere. Their only means of communication is through telephone and emails, and this may prove to be an impediment for quick decision making and the kind of co-ordination often required for intra-day trading.

As this report will show, CBET has the potential to become a substantial revenue generating activity for NEA and Nepal. As Nepal's surplus energy increases over the years, a better, more efficient organizational arrangement will be required to effectively manage both the contractual and operational functions.

CHAPTER 4: INTERNATIONAL EXPERIENCE: SELECT CASE STUDIES

In order to effectively plan for the evolution of the trading entity and to prepare the transition roadmap to strengthen the institutional structure, it is helpful to understand similar trading entities (including CBET) in other countries. Three international examples – two in India and one in Europe, have been selected for this purpose. The Indian examples illustrate the key drivers required to establish a trading entity in this South Asian region and also shows how these evolved to undertake domestic and cross-border electricity trading. The European example gives an insight into the best practices, followed by a trading entity in a mature electricity market operating in a region characterized by high level of regional cooperation for cross-border electricity trading. Key drivers or success factors – whether in terms of institutional setup, operating model, or through strategic initiatives, have been highlighted for each of the examples. Following that review, the learnings from NEA's perspective and in the context of this report have been derived.

4.1. PTC INDIA LIMITED

PTC India Limited (PTC) was established by the Government of India (GoI) in 1999 as a Public-Private Partnership (PPP-shareholders included other government-owned companies, including NHPC, PGCIL, NTPC, PFC,[19] as well as private investors including banks and financial institutions). Then, an institution was needed that could provide credit risk mitigation to private power project developers. At the time, there was lack of interest among private players to venture into developing power generation projects. Therefore, GoI established PTC.

It is notable that PTC was established as an entity for the purpose of electricity trading, including CBET. Initially, cross-border trade from Bhutan to six Indian states was being handled by the Power Grid Corporation of India (PGCIL), even though its core business was power transmission. The GoI wanted a dedicated trading company to take over CBET. In 2002, PTC took over the electricity trade between Bhutan and India. The concept of a trading license was introduced in the Electricity Act of 2003; however, PTC undertook trading activities, including CBET, without a license from 1999 until the law changed. The Central Electricity Regulatory Commission, (CERC) was required to provide a transitional mechanism to cover the tie between notification of Electricity Act, 2003 and notification of regulations for trading licensees which would outline the governing qualification criteria and other procedures. CERC did so, using an order published in July 2003 which authorized PTC to continue its trading activity through December 2003 (later extended to May 2004). Once the final Regulations for trading licensees were notified, PTC was granted a license under the new Regulations after completion of all procedures and conditions specified under the Regulations.[20]

PTC's mandates are:

- To optimally utilize the existing resources to develop a full-fledged, efficient, and competitive electricity market
- To attract private investment in the Indian electricity sector
- To encourage trade of electricity with neighboring countries

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[19] *NHPC- formerly known as National Hydroelectric Power Corporation. PGCIL-Power Grid Corporation of India, NTPC- formerly known as National Thermal Power Corporation, PFC-Power Finance Corporation.*

[20] *Model Framework for Trading License Regime and Guidelines for grant of trading license to facilitate Cross Border Electricity Trade in South Asia Region, SARIEI (IRADE). 2017. https://irade.org/SARI-EI-IRADe-Report-on-Model-Framework-for-Trading-Licence-Regime-and-Guidelines-for-grant-of-trading-licence-to-facilitate-Cross-Border-Electricity-Trade-in-South-Asia-Region.pdf*

PTC was one of the pioneers that started an electricity market in India. Today it conducts trading activities including long-term trades of electricity generated by large power projects and short-term trading to address demand-supply mismatches in various regions of the country. It has a client base covering all the country's state utilities, and some power utilities in neighboring countries. PTC holds a Category I license from Central Electricity Regulatory Commission (CERC) (the highest category), with permission to trade unlimited volumes of electricity. A Category I trading licensee is required to maintain a minimum net worth of approximately USD 6.7 million and trade above 7 TWh in a financial year. If the trading volume exceeds 10 TWh, the licensee is required to have a minimum net worth of approximately USD 10 million.[21]

PTC had the largest market share, electricity traded by trading licensees on the short-term market in FY2019-20 (April 2019 – March 2020), with approximately33 percent[22] and PTC registered its highest trading volume of approximately 66 TWh in the same year. In the business mix, short-term trades contributed approximately 44 percent, whereas long- and medium-term trades contributed approximately 56 percent in the total traded volume. CBET was approximately 10.41 percent of the total traded volume.[23]

Within India, PTC offers the following services to among others, state utilities:

- Long- and Medium-Term Sales
- Short-Term Sales
- Power Banking Arrangements

PTC trades with three countries in the region – Bangladesh, Bhutan, and Nepal. It is currently engaged in cross-border electricity trading in the following ways.[23,24]

Table 5: PTC's cross border electricity trade

Bangladesh
• Supplying 250 MW power to Bangladesh from West Bengal (WBSEDCL) since 2013. The power is being supplied after successful participation of PTC in the International Competitive Bidding Process conducted by the Bangladeshi entity. • Has also been awarded LOI for supply of additional 40 MW power to Bangladesh on medium basis.
Bhutan
• In line with the allocation determined by GoI, the eastern and northern states in India are importing electricity from Bhutan through PTC. Bhutan is supplying electricity from three projects (approximately 1,416 MW). • PTC is the nodal agency for Import of power from the 720 MW Mangdechhu hydropower plant, commissioned in FY 2019-20. The PPA is for 35 years. Assam, Bihar, Odisha, and West Bengal are the beneficiaries.

[21] CERC. 2020. Procedure, Terms and Conditions for grant of trading license and other related matters Regulations, 2020. Central Electricity Regulatory Commission (CERC)>

[22] CERC. 2020. Report on Short-term Power Market in India: 2019-20, Central Electricity Regulatory Commission (CERC). Accessible at: https://cercind.gov.in/2020/market_monitoring/Annual%20Report%202019-20.pdf

[23] PTC. 2020. Annual Report of PTC India Limited for FY2019-20. Accessible at: https://www.ptcindia.com/annual-report/

[24] PTC. 2020. Accessible at: https://www.ptcindia.com/cross-border-power-trade/

- PTC has signed a PPA with Tangsibji Hydro Energy Limited (THyE), wholly owned by the Royal Government of Bhutan through the Druk Green Power Corporation Limited (DGPCL), for purchase of electricity from a 118 MW hydro power plant. Electricity is be supplied to Assam Power Distribution Company Limited (APDCL) to meet its power demand in the state on long-term basis.

Nepal

- PTC has been consistently supplying 20 to 35 MW of electricity to NEA since 2008 during dry season through 132 kV Tanakpur – Mahendranagar Transmission line to meet Nepal's electricity deficit.
- PTC has signed PPA with NEA for supply of 150 MW for 25 years, facilitating the financial closure of Dhalkebar-Muzaffarpur line in 2011.

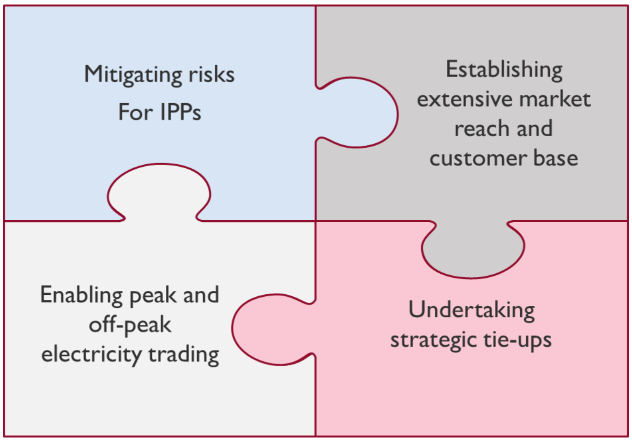
PTC intends to establish a power exchange, which will be India's third. Pranurja Solutions Limited (PSL) was incorporated in 2018 as a consortium of PTC and BSE (formerly, Bombay Stock Exchange) and ICICI Bank. In May 2021, the Central Electricity Regulatory Commission (CERC) granted PSL the right to establish and operate a power exchange. PSL's power exchange will operate for 25 years from the date of commencement of operation.[25]

PTC also owns power generation assets in India through its subsidiary company, PTC Energy Ltd., (PEL), established in 2008. This subsidiary holds wind power assets, with long-term PPAs with state utilities. However, it will be selling these assets to the government owned hydropower developer SJVN.[26]

Key Features and Success Factors

PTC's operating model and strategic tie-ups are the key reasons for its success as an electricity trading company and the fact that it established itself as the leader in power market development in India.

Figure 15: Key drivers for PTC's success as an electricity trading company (domestic and CBET)



[25] *Mercom India. 2020. News article, May 2021/. Accessible at: https://mercomindia.com/cerc-approves-indias-third-power-exchange/*
[26] Livermint. 2021. *News article, March 2021. Accessible at: https://www.livemint.com/companies/news/sjvn-wins-bid-to-buy-ptc-s-wind-assets-for-2-000-cr-11615402484840.html*

PTC's operating model:

- Mitigates risks for IPPs: During the 1990s, even though privately financed and operated, IPPs were authorized to operate and contract directly with the then existing state electricity boards, with a guarantee from the state governments. In some cases, counter-guarantees were provided by GoI. Investment decisions related to electricity generation and transmission infrastructures were not being undertaken in a coordinated manner, and this resulted in inefficiencies. Also, there was limited inter-state and almost no inter-region electricity trading. PTC was developed because GoI was not willing to sign anymore sovereign and state-level guarantees for IPPs. Another objective was to enable more efficient electricity trading, which would ultimately de-link power purchases from direct fiscal impact. PTC acts as an intermediary PPA off-taker for IPPs, allowing for transparent and standardized negotiation and contracting practices, while also selling power to the state power utilities under PPAs. As such, PTC directly addresses IPP's concerns regarding creditworthiness by limiting exposure to specific utilities and payment securities. It can also arrange for alternative buyers in the event of default. There has been no unaddressed default in its more than twenty years of operating history.[27]
- Enables peak and off-peak electricity trading: PTC also trades electricity from regions/utilities with a surplus to regions/utilities with electricity deficit on a short-term basis. PTC was a pioneer in the Indian electricity market for differentiated peak and off-peak trading. It introduced the 'Day Ahead Market'.
- Has extensive market reach and customer base: In addition to power utilities, PTC deals with more than 700 industrial/bulk consumers directly. It is a dominant market leader among the electricity traders in India, with a share of 46 percent (considering short, medium- and long-term transactions).[28]

Strategic tie-ups:

- PTC has opted for strategic-tie ups to enable investment and enhance technical competence. At the time of its incorporation in 1999, PTC was primarily held by government entities (53 percent). Over the years, this shareholding has decreased to around16 percent, while FIIs (Foreign Institutional Investors) and banks/financial institutions hold approximately 35 percent and 20 percent respectively.[29] These investors have provided additional funding and assisted in the expansion of PTC's business.

Key Learnings for NEA

NEA should strive to eventually create an entity which will be perceived as creditworthy and capable of reducing risks for the power developers to encourage them to participate in electricity trading. Like PTC, the NEA's entity should satisfy the following conditions:

- Have a sufficient net worth to collateralize PPA obligations
- Ensure alternative buyers in the case of default by the actual off takers
- Ensure timely payment by the off taker/buyer
- Create higher market profile and access to markets in other countries

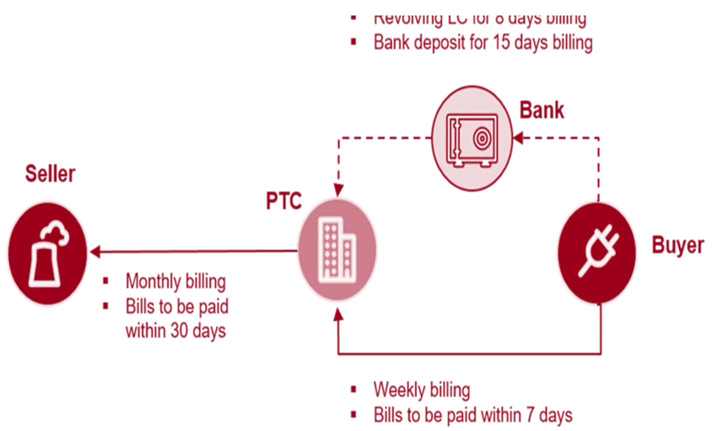
[27] *PTC. 2020. Corporate Presentation: Power Market Development and PTC's Role. Accessible at: https://www.ptcindia.com/wp-content/uploads/2021/01/PTC-Corporate-Presentation_06Aug2020.pdf*

[28] *PTC. 2020. Corporate Presentation: Power Market Development and PTC's Role. Accessible at: https://www.ptcindia.com/wp-content/uploads/2021/01/PTC-Corporate-Presentation_06Aug2020.pdf*

[29] PTC. 2020. *Shareholding patten as on 31st March 2020. Accessible at: https://www.ptcindia.com/about-us/shareholders/*

Using its capital base, PTC has been able to act as a creditworthy PPA counterparty. As planned, the PTC's involvement as an 'offtaker' since 2004 has resulted in a shift from government guarantees. It has been highly successful in developing both the Indian and regional cross-border electricity markets by increasing investor confidence in supporting IPPs, and by demonstrating the viability of cross-border electricity trading.

Figure 16: Illustration of payment risk mitigation by electricity trading companies



The following mechanism, which is similar to that of PTC, may be employed to mitigate payment delay risks. During the initial years of the trading license regime, the sale of energy through traders provided more comfort, in terms of credit risk and payment delays, owing to the services provided by traders, including weekly billing and payment and payment security mechanisms. PTC had a weekly payment system, together with payment security agreed with the buyers, and a monthly payment system with the sellers. As PTC received payments from buyers on weekly basis, with an option to divert the power, encashment of LC and deposit etc., it was able to make the payments to the sellers on time.

Like PTC, NEA can consider strategic tie-ups for the trading entity to attract investment and also to bring in more technical expertise. PTC has been successful in unlocking a substantial amount of private investment. Investments by banks can assist in leveraging access to working capital financing and capital financing. Business investors, through synergies, can also deliver local and technical expertise in managing the business. Other potential partners could be regional electricity trading entities or power exchanges for cross-border trading. This will provide better access to customers in those countries enhance technical competence of the entity.

4.2. NTPC VIDYUT VYAPAR NIGAM LIMITED (NVVN, INDIA)

NTPC Vidyut Vyapar Nigam Ltd. (NVVN) was formed by NTPC Ltd. (India's largest power utility owned by GoI) in 2002, as its wholly owned subsidiary, to tap the potential of electricity trading in the country. NVVN holds a highest Category 'I' power trading license, pursuant to the latest CERC regulation. NVVN's main function is to carry out electricity trading domestically, as well as with other countries. However, it is also looking to increase its asset base by developing RE projects (particularly solar) and providing is also providing solutions for the electric vehicle sector.

NVVN has established itself as a leading electricity trading company in India and offers a variety of short-, medium-, and long-term options as follows:

- Bilateral/Swap Power
- Solar Bundled Power
- Power Banking
- Power Exchange
    - DAM (Day Ahead Market)
    - TAM (Term Ahead Market)
    - RTM (Real Time Market)
    - G-TAM (Green-Term Ahead Market)
    - REC (Renewable Energy Certificates)/ESCerts (Energy Saving Certificates)

Among the traders in India, NVVN plays a major role in cross-border electricity trade. It has been designated as the Nodal Agency for cross-border trading with Bangladesh, Bhutan, and Nepal. It also trades with Myanmar. Presently NVVN is exporting 710 MW power to Bangladesh, which is approximately 61% of total power exports to Bangladesh. NVVN is also supplying up to 350 MW of power to Nepal.[30]

Key Features and Success Factors

NVVN is a good example of how a dedicated electricity trading company could be formed from a major power utility. One of the competitive advantages it enjoys is the backing it received from a strong promoter (NTPC Limited), a leader in electricity generation in India, with an excellent track record of developing energy infrastructure. These qualities provide the following advantages:

- NTPC provides strong managerial, technical, and financial support
- NVVN leverages NTPC's existing strong network with the existing utilities, which assists in establishing credibility with the potential buyers and sellers
- NVVN has access to skilled manpower since its employees have been drawn from the highly experienced manpower pool of NTPC, who have been dealing with various commercial and commercial issues at NTPC
- NTPC provides asset-back up to NVVN, which facilitates NVVN's trading business

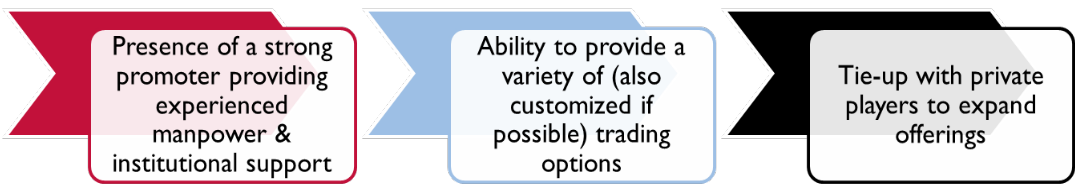
Another strength of NVVN is that it has introduced multiple options for electricity trading meeting short-, medium- and long-term requirements of its clients as mentioned above, which encourages potential customers, both in the domestic market and in other countries.

NVVN is also designated as Nodal Agency and Settlement Nodal Agency by GoI for cross-border electricity trading, because it can provide reliable electricity at best possible price to cross-border entities. GoI in 2019, pursuant to the 'Guidelines for Import/Export (Cross-Border) of Electricity 2018, nominated NVVN as 'Settlement Nodal Agency' (SNA) for settlement of grid operation related charges with neighboring countries – Bangladesh, Bhutan, Nepal, and Myanmar.

Key learnings for NEA

Learnings that can be adopted in the Nepal context are illustrated below:

Figure 17: Key takeaways for Nepal



[30] http://nvvn.co.in/why-nvvn/

- Having a strong promoter with experienced manpower and a robust network are elements that the trading entity can leverage to great benefit. Additionally, capacity building (technical, institutional, regulatory and policy) will be required to gradually enable the entity to deal with a variety of trading options or products.

- Among the options introduced by NVVN in its trading portfolio, of particular interest is the solar-bundled power strategy. To incentivize the setting up of a large number of solar plants, while minimizing the impact on tariffs, various alternatives were explored. One of the options was to bundle solar power together with power from the cheaper unallocated quota of central thermal stations and to sell this bundled power to state distribution utilities at the CERC regulated price. For the purpose of bundling, power had to be purchased by an entity and re-sold to the state power distribution utilities. Under the existing statutory provisions, this could only be done only by a trading company/distribution utility. NVVN was designated as nodal agency by the Ministry of Power (MoP) for concluding PPAs with solar power developers to purchase solar power fed to 33 KV and above grid, in accordance with the tariff and PPA duration as fixed by CERC. The MoP allocated to NVVN equivalent capacity (in MW) from the central unallocated quota of NTPC power stations, at the rate notified by the CERC for bundling with solar power. NVVN undertook the sale of the bundled power to state utilities at CERC-determined rates. The state utilities were also entitled to use the solar part of the bundled power for meeting their Renewable Purchase Obligations (RPO) under the Electricity Act, 2003. From Nepal's perspective, a similar strategy of bundling solar with hydropower could be contemplated.

  NVVN also buys power from solar park developers and under NSM, collaborated with Solar Energy Corporation of India (SECI) to implement electricity trading from utility scale solar plants under the VGF (Viability Gap Funding) scheme under Batch-1 Phase-II of JNNSM. This promoted the growth of the renewable energy sector.

- In addition, leveraging the existing networks of its parent company, NTPC, NVVN has sought to expand its offerings through tie-ups with private players. For example, NVVN has signed a memorandum of understanding with Greenko Energies Private Limited (Indian renewable energy developer) in August 2020, to explore the possibility of entering into an arrangement for trading and partnership in Integrated Renewable Energy Storage Projects set up by Greenko to offer Round the Clock (RTC) renewable energy power to potential customers in India. This will enable NVVN to establish itself strongly in various segments of RTC bundled renewable power. NEA's trading entity can learn from these leading practices to develop its strategies and portfolio.

4.3. VATTENFALL (SWEDEN)

Vattenfall is a leading European energy company operating in the following segments: generation, distribution, supply, trading, and energy services. Its electricity distribution operations are regulated by the Swedish Electricity Act and the German Energy Industry Act and are unbundled from Vattenfall's other operations. Vattenfall's parent company, Vattenfall AB, is 100% owned by the Swedish Government. Its headquarters is in Solna, Sweden.

In addition to Sweden, Vattenfall has offices in seven other countries: Denmark, Finland, France, Germany, the Netherlands, Poland, and the United Kingdom. It sells the electricity output of Vattenfall's power plants and buys electricity for its customers on the European electricity wholesale market. It is also involved with sales and origination. Vattenfall trades in the Nordic countries, in

Continental, Central Eastern, and Southern Eastern Europe, and the United Kingdom. The realized trading result in 2020 was USD 320 million.[31]

Key features and Success Factors

Market access and skilled manpower are the key drivers in Vattenfall's success in becoming a major player in energy (including electricity) trading in Europe. Vattenfall has established itself as leading player in commodity trading and in the market for power purchase agreements (PPAs) in northwest Europe. It trades on Nord Pool and the European Energy Exchanges (EEX).

Vattenfall operates from 7 countries in the Europe and the UK, enabling it to stay close to its markets and business partners. In each of these countries, it has established an office. For example, Vattenfall Energy Trading GmbH is located in Hamburg, Germany, as a subsidiary and has adequate manpower with the required skillsets (336 employees) to undertake all the activities. Overall, Vattenfall's energy trading and asset optimization function has a highly skilled team of over 670 people.

Vattenfall's primary trading activities include:

- Optimizing and hedging Vattenfall's generation plants and customer portfolios
- Managing the trading of physical and financial energy commodities
- Offering transactions and contracts tailored to its business partners' specific requirements

Providing market access is core to Vattenfall's trading business. It offers products (including electricity) with the best possible bid/ask spreads. This is ensured with a multitude of different trading partners, with whom business relationships are established and maintained. For example, as a wholly owned subsidiary of Vattenfall Energy Trading GmbH, Vattenfall Europe Power Management GmbH benefits from the infrastructure of one of Europe's leading energy trading companies. Customers receive market access to all the key trading centers for energy. Experienced portfolio managers are active on the markets and, advise and support in buying and selling. All transactions are executed at the market price and a commission is charged as brokerage fee.

Vattenfall expands its market by building business relationships. For example, it is expanding its UK operations by collaborating with Good Energy, a leading UK supplier of renewable energy to homes and businesses throughout the UK. It will provide Good Energy with access to the long-term and short-term wholesale electricity market through its Energy Trader platform. The agreement will also allow Good Energy to efficiently balance its extensive renewable portfolio. Good Energy often has excess wind and solar power to sell back to the grid. Energy Trader is a fully-fledged trading platform for utilities, suppliers, industrial companies, and energy traders for long- and short-term wholesale electricity and gas trading.

Within the energy trading function, Vattenfall has a specialized sales and origination team. This team offers innovative products across all energy commodities to Vattenfall's business partners in the Nordic countries, Belgium, the Netherlands, Luxembourg, UK, and Germany.

[31] *Vattenfall. 2020. Vattenfall Year-End Report 2020. Accessible at : https://group.vattenfall.com/siteassets/corporate/investors/interim_reports/2020/q4_report_2020.pdf*

Considering the case of Vattenfall, electricity trading can be undertaken in various development stages, differing primarily by purpose, volume, type of trading activities, and acceptable risk exposure. Based on this, several business models are possible:[32]

- ‘Buying and selling model’ - ensures utility’s energy balance by selling surplus electricity and buying electricity to meet deficit
- ‘Brokerage model’ - trades on behalf of external customers who pay a service fee to the trader
- ‘Portfolio and risk manager’ model - aims at optimizing the structure of the utility’s generation, trading
- and sales portfolio to maximize the profit across the entire value chain
- ‘Proprietary trading model’ - ensures profits by pure trading without any consideration to the utilities’ own generation facilities or retail market
- ‘Sales and origination model’ - creates more complex and tailored products for customers

Key Learnings for NEA

Most European utilities have adopted the ‘Portfolio and risk manager’ model because it aims at maximizing profit across the value chain. Companies that are more experienced and have developed their risk management capabilities, extend their trading activities to “Proprietary trading” – which provides opportunities for additional profit, but also increases risk. Vattenfall is an example of an extremely developed trading company which covers several of the activities of the models mentioned above.

Given that electricity trading is still at its earliest stages in Nepal, in the short-term it can adopt the ‘Buying and selling model’ and gradually also adopt the ‘Brokerage model’ later (next five years).

The key takeaway for NEA is that, like Vattenfall, the trading entity can:

- Establish its presence in potential markets for cross-border electricity trade (for example, India, Bangladesh), either through trading desks, subsidiary companies, or joint ventures, depending on the rules and regulations in the other countries. This will enable better market access.
- Recruit staff with the required skills sets (understanding of the regional electricity market, trading options, rules, and regulations) is also necessary for engaging in trading with other countries in South Asia. This calls for undertaking adequate capacity building activities.

4.4. SUMMARY OF KEY LEARNINGS FOR NEA

It is clear from the examples cited above that power utilities need to strengthen electricity trading capabilities (including cross-border) in order to balance demand and supply, optimize electricity portfolios, and eventually to undertake other transactions to establish a sustainable trading department/company. To develop a strategy and roadmap for NEA’s trading entity, it will be useful to summarize the key factors which have emerged from the review of the selected international examples. Depending on the overall institutional strengthening and trading strategy of the proposed entity (which will be covered in the subsequent sections), all or a combination of the following factors will play important role in establishing and developing the entity.

[32] *Research Reports ‘Electricity Trading beyond “Buy and Sell”’ and ‘Next-generation energy trading’*

Table 6: Key factors for consideration for developing a sustainable electricity trading business (including CBET)

Key drivers/factors	Details
Market access and establishing strong network	Presence of the entity (through tie-ups/JVs or subsidiary companies) in potential markets can assist in better market access and reaching out to the potential buyers.
Skilled manpower	A proper mix of recruitment and capacity building initiatives (for the existing employees) might be required to build a technically sound team with the adequate skillsets to undertake the various activities pertaining to trading in general and CBET.
Creditworthiness and mitigating risk of developers	The trading entity can fulfil the role of an intermediary PPA off-taker for IPPs, thus enabling transparent and standardized negotiation and contracting practices, while also selling power to the power utility(ies) under PPAs. From CBET perspective too, it will address IPP's concerns about creditworthiness by limiting exposure to buyers and payment securities. Also, if the entity has better market access, it can arrange for alternative buyers if there is a default.
Strategic tie-ups	Gradually, the entity can start initiating tie-ups with investors for additional funding to grow the business. Technical knowhow can also be enhanced through tie-ups with possible partners such as regional power trading entities/exchanges to enhance technical knowledge and CBET experience.
Introduction of customer-oriented options in trading/variety of options	To develop trading as a sustainable business for the entity, various options may be explored in addition to the existing G-to-G arrangements or bilateral contracts. Market access and tie-ups can play important role in achieving this.
Dedicated entity for electricity trading	As seen in the Indian examples, a separate entity (can be a subsidiary of NEA) primarily for trading purpose can be eventually established. This will provide impetus to Nepal's electricity trading business. *However, it must be taken into account that until the new Draft Electricity Bill is approved – which has proposed unbundling of NEA (generation, transmission, and distribution functions), the creation of such of a separate entity will not be possible.*

In the next steps, it will be essential to evaluate options and suggest the entity's trading strategy, understand the appropriate business model, and design a roadmap involving distinct phases. Requirements and institutional arrangements for strengthening the organizational setup of the entity, according to best practices, while also considering the regional conditions will be another key area to be addressed. In addition, it will be required to understand the capacity building initiatives and, the policy and regulatory enablers that must be in place for the sustainable and efficient operations of such an entity. Subsequent sections cover these aspects.

CHAPTER 5: STRATEGIC OPTIONS FOR ELECTRICITY EXPORT FOR NEA

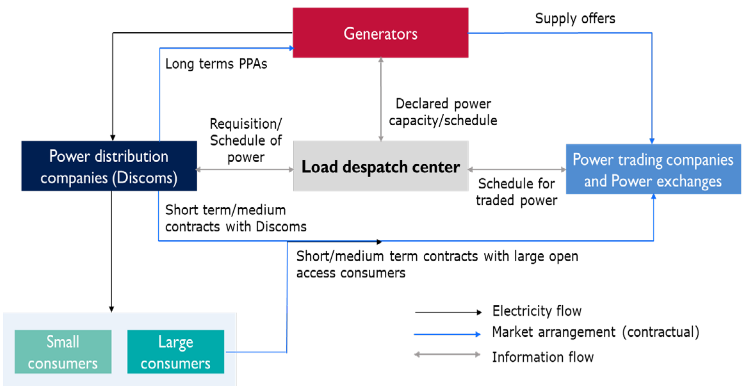
5.1. EXPORT TO INDIA

5.1.1. REVIEW OF POWER MARKETS IN INDIA

The power market has wholesale competition, enabled through power traders, power exchanges, competitive bidding, and open access. Participants in the power market include generators, power traders, power exchanges, power distribution companies/utilities and large (C&I) consumers buying power through traders, and power exchanges, as depicted and explained below.

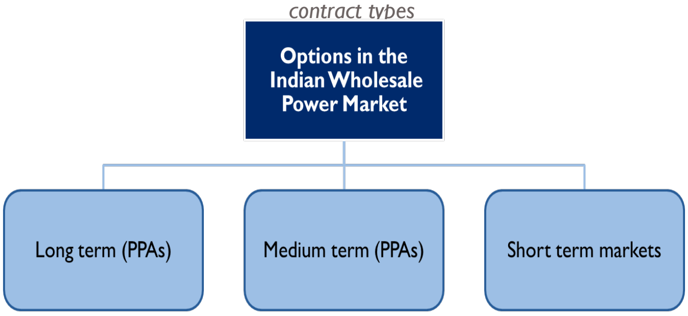
- Generators, who trade and sell electricity from their power plants, either to trading companies/power-exchanges or directly to distribution companies.
- Power traders and exchanges that trade and source electricity in order to sell to distribution companies or end users through open access
- Distribution companies – (DISCOMs) that buy power, either directly from generators or from power traders and exchanges and sell it to their retail consumers.
- Load dispatch centers, which maintain equilibrium by meeting the supply with demand and vice- versa. They do this by coordinating with various stakeholders in real time.

Figure 18: Wholesale power market structure in India



According to the types of options and related contracts, the wholesale power market can be divided into long-term, medium-term, and short-term, as shown below. The types of contracts are:

Figure 19: Categorization of wholesale power market based on options & contract types



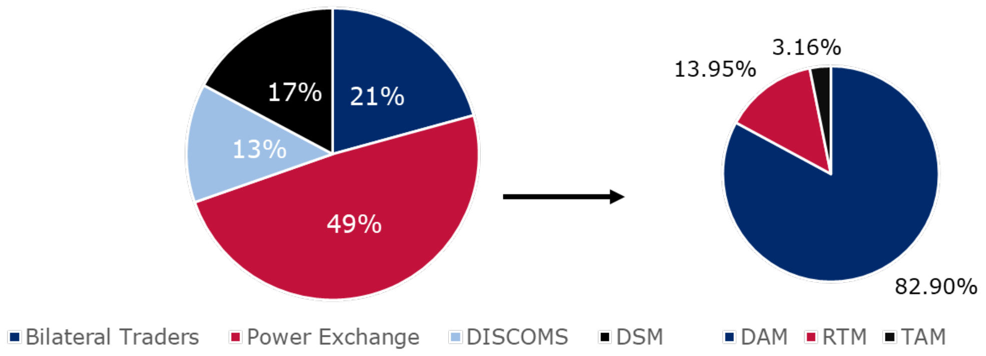
- Long-term: Contract/PPA duration is more than 7 years. A power generator may conclude a PPA with a DISCOM or state government to sell power for a fixed term pursuant to the tariff determined by the regulator (cost plus basis) or discovered through competitive bidding. For CBET, this can be done through a power trader in India.
- Medium-term: Contracts are generally between 1 to 7 years.[33] DISCOMs buy power for a medium-term based on competitive bidding through 'DEEP', a marketplace portal. Additionally, generators can sell power through power traders to large open access consumers (for example, railways).

[33] *According to open access definition in India, medium term access is between 3 months to 7 years*

- Short-term: Contracts are up to 1 year. In line with the Ministry of Power's Guidelines, the procurement of power for the short-term (more than 1 day to 1 year) by Discoms shall be through tariff-based bidding process. In general, contracts between a buyer and a seller may be bilateral in nature and can be executed either through mutual negotiations or competitive bidding through power trader, or via power exchanges like India Energy Exchange (IEX) and Power Exchange India Limited (PXIL).

The short-term wholesale power markets comprise the bilateral power traders, power exchanges, DISCOMs, and DSM (Deviation Settlement Mechanism), as shown below[34].

Figure 20: Short term wholesale power markets (transactions)



Power exchanges provide different products, including -

- DAM (Day Ahead Market)
- RTM (Real Time Market)
- TAM (Term Ahead Market)
- G –TAM (Green Term Ahead Market)

The volume of power sold in India through Power Exchange and Traders is on the higher side during June, July (highest) and August, owing to high demand *(Apr'19-Mar'20)*. During the June to November period, maximum prices for sale of power on the Power Exchange and Traders were respectively NPR 5.73 and 7.79 per unit *(Apr'19-Mar'20, IEX for power exchange).*[35] Volume and price trends in the short-term market are favorable for NEA's surplus power. As per CBET Guidelines / Regulation / Procedure issued by respective authorities of India, the cross-border entity only can participate in DAM market of the power exchanges.

5.1.2. MAPPING OF OPTIONS AND POTENTIAL BUYERS FOR NEA

Currently the primary mode of trading with India is through bilateral G-to-G arrangements and short-term transactions through power traders in India, to import power. There is a very small quantum of power exported from Nepal to India (for example, highest monthly export was 28.05 MU in the month of Shrawan – July/August[36]). Except for G-to-G power trade agreements, all other cross-border power

[34] CERC. 2020. Reports on Short-term Power Market.
[35] CERC. 2020. Monthly Monitoring Reports (2020).
[36] NEA. 2020. Annual report for FY 2020/21.

trading with any Indian entity or power exchange (LT, MT, or ST[37]) must be routed through a power trader in India.

The top 5 (total of 22) trading licensees – PTC, NVVN, Adani Enterprises, Tata Power Trading Company and GMR Energy Trading accounted for approximately 76 percent of the total volume transacted by traders in the short-term market in the month of March 2021.[38] NEA has existing arrangements with NVVN and PTC for importing power through short-term bilateral contracts. After the issuance of CBET procedure by the Designated Authority (DA), NVVN submitted an application with the DA for approval of NEA for participation in power exchange in India. This is based on the Power Trading Agreement signed between NVVN and NEA in April 2019. NVVN submitted a Day Ahead power purchase bid for the first time for NEA on 17 April 2021 on IEX, after receiving approval from the DA. Cross-border trading started in April 2021 and actual supply commenced in May 2021, thus heralding a new era in CBET in the South Asian region. As mentioned in section 4, NVVN has been designated as nodal agency and settlement nodal agency by Government of India for CBET with three neighboring countries including Nepal.

The various options, potential buyers, and key elements for executing the transactions are discussed below.

Long-term options

Option 1	Long-term contracts in the form of Government to Government (G-to-G) arrangements
Description	Generally, political, and diplomatic goals drive G-to-G arrangements. Nepal and India concluded a power trade agreement (PTA) in 2014, allowing the exchange of electricity and opening up opportunities for cooperation in the hydropower sector. Government-to-government agreements may involve government-financed infrastructure. Each agreement is guided by a unique set of government objectives. There exist such long-term contracts where the duration varies between 25 to 15 years. The contracts are either with GoI or with a state government in India (for example Bihar Government).[39]
Risk/challenge	Transactions based on G-to-G arrangements do not necessarily follow fundamental power sector economics of supply, demand, and price formation. As such, it might not provide a competitive tariff for export. In certain cases, for hydropower, government objectives might be driven by other important issues but outside power sector economics like irrigation and flood control.

[37] LT-long term, MT-medium term, ST-short term

[38] CERC. 2020. Latest data available is for March 2021: Monthly Report on Short-term Transactions of Electricity in India.

[39] Market intelligence

Option 2	Long-term bilateral contracts under commercial arrangements (through a power trader)
Description	Long-term contracts can be executed as bilateral transactions between Nepal and India though an Indian power trader. For example, Arun III Hydro Power Project in Nepal is being developed as an export-centric project, which has a capacity of 900 MW. The project developer, Sutluj Jal Vidyut Nigam (SJVN) was selected through international competitive bidding. After Arun III is commissioned, the power will be then exported to India via the 140 Km long, 400 kV Dhalkebar-Muzzafarpur transmission line. The power will be sold to various states in India. The PPAs will be signed with the project SPV and the off taker(s).
Risk/challenge	In the case of the Arun III Project, the tariff for power exported to India will be determined by CERC and not based on competitive bidding. In addition to power for export, pursuant to Arun III's Project Development Agreement (PDA), Nepal will receive 21.9 percent of free power during the entire concession period of 25 years. This can also be exported and may be tied up under medium term or long-term arrangements either in India or Bangladesh. The risk here is that of obtaining DA approval on time for selling in India. If NEA participates in this tender and becomes the L1 (lowest) bidder, it will receive the Letter of Intent (LoI). However, if timely DA approval is not obtained, it will result in forfeiture of EMD.

Medium term options

Option 1	Medium-term bilateral contracts with open access consumers including Railways and Metro rails/mass rapid transit systems
Description	Railways can be a buyer since they have been accorded deemed licensee status (CERC order 2015). They can take NOC from the respective State Electricity Regulatory Commissions (SERC) for open access. They issue tenders for power purchase and generally conclude medium-term (up to 5 years) bilateral contracts.[40] Indian railways, in order to reduce cost of operations, has embarked upon direct procurement if power as deemed licensee instead of consumer. For example, in 2019, Railways procured approximately 1,400 MW (70 percent of power) under open access, through competitive bidding, as deemed licensees in 11 states.[41] Some of these states are Maharashtra, Gujarat, M.P, Jharkhand, Rajasthan, Haryana and Karnataka and Punjab.[42] Generally, Railway Energy Management Company Limited, an arm of Indian Railways, issues open tenders for power procurement.

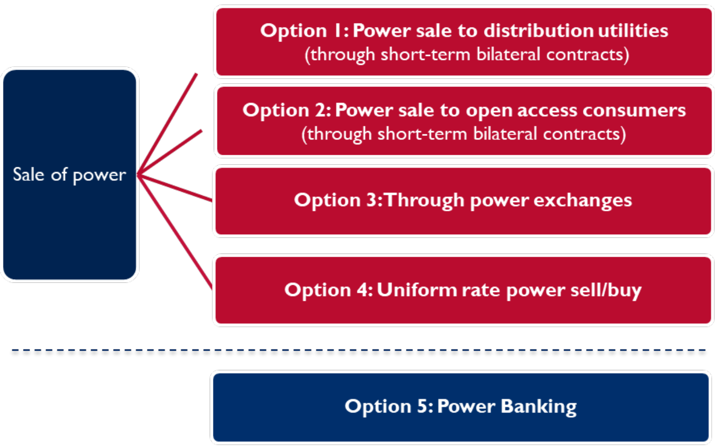
[40] Market intelligence
[41] Business Standard. 2019. News article, November 2019.
[42] GoI. 2017. News Article, November 2017. GoI Press Information Bureau – Ministry of Railways

	Even though Metro rail/mass rapid transit systems still have not been accorded the deemed licensee status in India, they can still procure power through open access and be potential buyers.
Risk	• NEA has surplus power available for only 6 months during the year, so this might prevent from taking power since the requirement will be year-round • The tendering process is involved, which makes the process complicated, and the contract has penalty clauses for failure to supply power

Short-term options

Options available for exporting short-term surplus power by NEA in India are as depicted below.

Figure 21: Potential options to sell short-term surplus power



Electricity sale options are defined as sales to through short-term bilateral contracts to Discoms in different states and open access consumers and, on power exchanges in India. For each short-term bilateral transaction, a separate contract is required. It is suggested that NEA sign an 'umbrella MoU' with the power trader, followed by separate contracts for sale through bilateral contracts and a power exchange. NEA is currently importing power from distribution utilities in India through short-term bilateral contracts route through PTC and NVVN. Similarly, other traders, that is, private power traders, can also be engaged for selling NEA's surplus power in India to other possible markets (consumers) including industrial consumers, airports, and railways. NEA also has the option to engage multiple traders. In line with CERC's Regulation for the grant of trading license (2020), for CBET, the trading margin would be mutually decided by the trader and the seller. Additionally, the banking of power can also be explored. However, it will take at least 2 years to begin banking power between Nepal and India – until the mechanisms are finalized. Therefore, another short-term option is the uniform rate power buy/sell as explained below.

Option 1	Power sale to DISCOMs under short-term bilateral contracts
Description	The procedure for power trading is as follows: • The trader finds the tender issued by the Indian DISCOMs and submits the online bid in DEEP portal after taking consent from seller. A per unit tariff is quoted at delivery point as per requirement of the tenderer. • Reverse bidding is undertaken and the bidder quoting the lowest tariff is selected. • Thereafter, LOI is issued by the DISCOMs. • Based on LOI received from DISCOMs, the trader takes approval from the Designated Authority (DA) in India (CEA Member – Power Systems). • On receipt of DA approval, the trader applies for Open Access and then actual power supply takes place. Terms and conditions, requirement of power depends on the demand of the utility (buyer). In the tender, the utility includes information about – (1) power requirement; (2) type of requirement i.e., RTC/evening peak/time block; (3) months during which power will be required; (4) billing & payment terms. Typically, utilities in North India (Punjab, Delhi Uttar Pradesh, and Haryana) issue short-term tenders for power to meet demand in the wet season. The advantage is that RTC power can be sold to the DISCOMs, thereby providing certainty.
Risk	• The tendering process is involved, which makes the process complicated, and the contract has penalty clauses for failure to deliver (BG may be required) • Long lead times are involved and application to the Designated Authority (DA) in India who provides such approvals, must be submitted 3-4 months in advance by the power trader. • If LOI is received and subsequently DA is not granted, then EMD may be forfeited.

Option 2	Power sale to Open Access (OA) consumers under short-term bilateral contracts
Description	Multiple power traders, including private traders, may be used to gain access to a wider network of consumers such as industrial consumers, and airports. The procedure for power trading is as follows: • The trader takes approval from the Designated Authority in India (CEA Member – Power Systems) • The trader also seeks approval for open access from LDC • Once all the approvals are in place, trader sells NEA's surplus power to its OA consumer The process is easier, as tendering is not involved. Tariff negotiation will be undertaken by the power trader. Compensation clause/penalty, which is there in contracts with Discoms is not applicable.
Risk	NEA has surplus power available for only 6 months during the year, so this might prevent from taking power since the requirement will be year-round.

Option 3	Power sale through power exchanges
Description	In April of 2021 Nepal began to purchase buying power on IEX. Short-term surplus power can be sold on power exchanges in India - Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL). IEX trades approximately 99 percent of the volume of power traded on the Day-Ahead Market (DAM).[43] The procedure for power trading is as follows: • The trader takes approval from the Designated Authority in India (CEA Member – Power Systems) on behalf of NEA • The DA processes the application within 60 days and sends it to the Ministry of Power (MoP) (no time limit for MoP to provide approval) • Post-approval, the trader registers NEA on the power exchange as its client (submission of a 2-page KYC document required) and starts transacting to sell NEA's surplus power Volume sold on DAM during the wet season (June-Nov. 2019) was between 3,389-4,801 MU, the highest being in July. The average price discovered during the same period is between NPR 4.58 (INR 2.87)/unit-NPR 5.73 (INR 3.59)/unit, with the month of July recording the highest price.[44] Cross-border electricity trading can be done only on DAM on Indian power markets. ○ The bid is placed on D-1 and payout to the trader takes place on D+1 ○ Depending on the terms, agreed by NEA and the trader, NEA can obtain payment from the trader on D+1 or in the ordinary course of business (+7) [45] The advantage in this option is that power trader has to file for a one-time approval from the DA. Therefore, the procedure is less time consuming (no tendering process is involved).
Risk	There is uncertainty of discovered/market clearing price about the power being sold during the wet season.

Option 4	Uniform rate power sell/buy
Description	CBET Regulations and Guidelines do not recognize power banking arrangement yet. Therefore, a mechanism has to be developed to undertake a similar kind of transaction/arrangement which is not prohibited according the CBET Regulations. Therefore, same rate buys, or sell can be thought of. In this arrangement, whichever entity draws power first will pay energy charge at a pre-agreed rate plus transmission charges and losses and, the entity who draws power later will pay energy charge (same tariff) which the first entity paid in addition to transmission charges and losses. This can be facilitated through a power trader in India. This arrangement can take advantage of the seasonal variations in the in surplus and deficit situations in Nepal and India.
Risk	Generally, a premium is involved in banking of power and this aspect might also be required to be included in the arrangement.

[43] *CERC reports*
[44] *CERC reports*
[45] *Market intelligence*

Option 5	Banking of power *(an option which can be exercised after 2 years or so once the mechanism is finalized)*
Description	During the 8th India-Nepal Joint Steering Committee meeting in December 2020, the development of an energy banking mechanism was discussed. Power banking is usually on the basis of a G-to-G agreement, although some power traders indicate that they can also be involved in this. Power banking usually involves a premium: for example – if Nepal supplies 100 MW during wet season to a state in India, then say, during winter it will get back 102 MW at a premium of 2% from that state. The commercial terms i.e., the premium and penalty (on failure to return the contractual quantum) are decided on a case-by-case basis. It has been observed that states in Northern India require power during the wet season and can send back the power during winter.[46]
Risk	The tendering process is involved and there is penalty clause.

5.2. EXPORT TO BANGLADESH

5.2.1. REVIEW OF POWER MARKETS IN BANGLADESH

Bangladesh Power Development Board (BPDB) is a partially integrated power utility which is involved with generation as well as the purchase and sale of power as a single buyer. BPDB purchases power from both government-owned generators and IPPs and, sells it to urban distribution companies and the Bangladesh Rural Electrification Board (BREB) cooperatives.

A shortage of power and unreliable supply has hampered the nation's economic growth. Bangladesh has been facing difficulties in meeting peak electricity demand. Peak demand had touched 14,796 MW on May 29, 2019, against generation of 12,893 MW.[47] As such, this can be a good market for Nepal to export power. For Bangladesh, expanding CBET mechanisms could expand access to hydropower from Nepal and other resources that could supplement the country's diminishing natural gas reserves cost-effectively.[48]

Bangladesh has been negotiating for CBET and working to develop the interconnection of transmission lines between them across India, pursuant to the Guidelines for Import/Export (Cross- Border) of Electricity-2018 of India. Apart from bilateral trades, Bangladesh has signed with an Indian company to import electricity from Nepal. Bangladesh has concluded an LOI to import 500 MW of power from the 900 MW Upper Karnali hydropower project in Nepal. NEA will receive 108 MW (12 percent of the total capacity) free power from this project, pursuant to the PDA signed between NEA and GMR. Considering the involvement of Indian developer, the rest of the power may be considered to be off-taken in India. Bangladesh's Power System Master Plan (PSMP) envisages new import of 1,496 MW in 2022, and additional 4,500 MW of import between 2023 and 2035, and another 4,500 MW of import between 2036 and 2041. For bulk power purchases from IPPs, there are guidelines for tariff structure. It also covers the interconnection of the IPP to the national transmission grid.

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[46] *Market intelligence, existing CERC regulations and CEA guidelines*
[47] *Equity research report, September 2020; research reports of 2020*
[48] NREL. 2021. Regulatory Foundations for Cross-Border Electricity Trading; Bangladesh.

It has been agreed to use the transmission line passing through the Siliguri corridor in India, connecting Nepal and Bangladesh for trade power in the near-term. According to the Memorandum of Understanding signed by Nepal and Bangladesh on 'Cooperation in the Field of Power Sector' in 2018, the authorities have also decided to study the prospect of building dedicated power lines in the long-term.

Nepal and Bangladesh have pledged to make their best efforts to develop a trilateral trading arrangement. Authorities from both countries also plan to study and invest in 20 major hydropower proposed projects. The proposed projects include four storage and other major hydropower plants such as Upper Arun, Dudhkoshi, Sunkoshi 2, Sunkoshi 3, West Seti and Phukot Karnali.[49]

5.2.2. MAPPING OF OPTIONS AND POTENTIAL BUYERS

Even though the Indian power market offers various options and buyers providing a potential market to export surplus power from Nepal's hydropower plants, it also has to compete with the abundant cheaper and clean energy being generated in India. Therefore, in this perspective, Bangladesh seems to be a more promising market given its power deficit scenario.

Trading between Nepal and Bangladesh will be in the form of trilateral CBET because power will also flow through the Indian transmission network. Given Bangladesh's power market, export of NEA's surplus power can be done through long term G-to-G agreements, long-term agreements with export-oriented projects in Nepal, or on a year-on-year basis between NEA and BPDB on commercial basis.

Option 1	Long-term contracts in the form of Government to Government (G-to-G) arrangements or contracts with export-oriented hydro projects
Description	The Upper Karnali hydropower project is an example, which can guide trading between Nepal and Bangladesh, under a trilateral arrangement. In February 2020, Bangladesh issued letter of intent (LoI) to purchase 500 MW from the 900 MW Upper Karnali hydropower project. The LoI was issued by the buyer, Bangladesh Power Development Board (BPDB). The buying entity will conclude a PPA for a period of 25 years.[50] In addition to power for export, NEA will receive 12 percent of free power from this project. Hence NEA can enter into an arrangement with BPDB to supply this power under commercial arrangement. This will be the first trilateral trade in the region. Bangladesh has signed a Memorandum of Understanding with India's NVVN to import electricity from the Upper Karnali project via India.
Risk/challenge	In the absence of a proper regulatory and other frameworks for trilateral trade, there will be ambiguity regarding several issues, including transmission pricing, use of transit grid infrastructure, etc.

[49] *Kathmandu Post article, June 2019*
[50] *Kathmandu Post news articles*

Option 2	Bundling of hydro and solar Power
Description	NEA can explore the possibility of bundling of hydropower from Nepal with solar power in India and supply this bundled power to BPDB on a long-term basis. This arrangement can be through a power trader in India. It can be discussed with Bangladesh whether to carry it out through a G-to-G arrangement or commercial basis. The commercial terms and conditions can be separately prepared if it is agreed in principle. This arrangement has provided double benefit – better utilization of inter-country transmission line and economical tariff of bundled rate.
Risk	Proper forecasting of hydro power availability to comply commercial conditions of this arrangement.

Option 3	Uniform rate power sell/buy
Description	Bangladesh's has the highest power demand from February through October. NEA can supply power to BPDB from June to October and import power during the dry season at the same rate. This is not exactly power banking, but a similar arrangement (payment is involved and not exchange of power). Whichever entity draws power first will pay energy charge at a pre-agreed rate plus transmission charges and losses and, the entity who draws power later will pay energy charge (same tariff) which the first entity paid in addition to transmission charges and losses. This can be discussed with Bangladesh and accordingly initiated from June 2022 onwards.
Risk	Generally, a premium is involved in banking of power and this aspect might be required to be included in this arrangement too.

CHAPTER 6: ROADMAP FOR CROSS BORDER ELECTRICITY TRADE FOR NEA

6.1. MARKET TRANSITION ROADMAP FOR CBET

Nepal's power sector is driven by a vertically-integrated state-owned enterprise, NEA, with private sector involvement only in power generation. A portion of the power generation and the entire transmission, and distribution of electricity is undertaken by NEA. NEA also acts as the single buyer for all PPAs. As mentioned previously, currently, there are two departments within NEA dealing with all the power trading related activities in Nepal including CBET - the Power Trade Department (PTD) and the System Operation Department (SOD). A dedicated entity – the Nepal Power Trading Company Limited (NPTC) was incorporated in March 2017, with NEA as the major shareholder (51 percent). However, it is still not operational, due to the lack of licensing provisions. Currently, NEA is involved in CBET primarily through G-to-G and short-term bilateral transactions (only for import of power), while purchasing power from the Indian power exchange has recently started.

The objective is to operationalize the independent NPTC. which will enable the transition from cross-border bilateral to trilateral trade and gradually to multilateral trade by creating the required environment, institutional and regulatory frameworks, and undertaking capacity building. However, developing a roadmap for the market transition first requires an understanding of the current situation, highlighting the bottlenecks as well as the areas of opportunity. The following presents an analysis of the strengths, weaknesses, opportunities. and threats (SWOT) which will assist NEA in decision-making given the present situation.

Table 7: SWOT analysis for Nepal's transition to trilateral and multilateral power trade

Strengths	**Weaknesses**
• Strong level of cooperation with India on energy trade. • Have already identified various new cross border lines with India and China, as part of the Transmission System Master Plan. Nepal and India have recently signed another investment agreement, this time for the construction of the second Butwal-Gorakhpur 400 kV dedicated CBET line which will enable approximately2,000 MW of power trade.[51] • Have started participation in undertaking CBET through India's power exchange / DEEP portal	• There are ambiguities in institutional framework for CBET and licensing. • The grid code is prepared by NEA, though not separately reviewed and approved by regulator yet. • No dedicated entity for power trading including CBET.
Opportunities	**Threats**

[51] *News article, September 2021*

• Trilateral arrangements with Bangladesh and India can set the foundation for future trilateral and multilateral trades in the region. • ERC Act has enabling provisions for open access and wholesale market. • Proposed draft of Electricity Act has provisions for trading licensees and approval of CBET transactions. • Possibility of power banking with India in the future, as India also keen to formalize the terms related to the power banking between Nepal and India.	• There are concerns on cost competitiveness of hydropower from Nepal, especially if concessional financing or grants are not available for projects. • Surplus power from the hydropower plants will be seasonal and round-the-year. • These exists a challenge regarding compliance with Indian CBET Guidelines / Regulation / Procedure for trading with or via India.

Considering the current situation of the power market, the regulatory and institutional framework in Nepal, and also the potential trading countries/partners of Nepal, the roadmap for market transition is as below.

Table 8: Roadmap for market transition for Exporting surplus and power trading in general

	Focus areas and recommended transactions
Short term (i.e., starting FY 2021-22)	Immediate focus will be to develop arrangements to execute the options/transactions (among the ones mentioned in the previous Section) to sell the surplus estimated for FY2021/21 and future years that will be there during the wet season. • Undertake short-term bilateral contracts to sell power to DISCOM by participation in tenders (through DEEP portal) issued time to time and open access consumers in India through bilateral negotiation. • Sell short-term power on IEX and PXIL. NVVN is facilitating purchase of power on IEX in the Day Ahead Market for Nepal. Once approval to sell power is obtained, export can be initiated. PXIL has not opened up yet to CBET, however in 2020 it unveiled a technology-based trading platform, PRATYAY, which is compatible to handle CBET. • Undertake medium-term bilateral contracts to sell power in India to open access consumers like the railways. This also must be channeled through a power trader. • Execute long-term G-to-G arrangements and contracts under commercial arrangements from export-centric hydropower projects for selling power to India. • Sell bundled power (hydropower from Nepal and solar power from India) to Bangladesh through a power trader in India. It can be undertaken on commercial basis between NEA and BPDB. NEA has been involved in transactions with NVVN and PTC and, already has contracts with them. Therefore, in the short-term, it is advisable to continue trading through these power traders in India. It can gradually connect with the other private traders in India, who have international experience of import and export of power.

	Focus areas and recommended transactions
Medium term (i.e., starting FY 2024-25)	Long-term trilateral trade with Bangladesh can be initiated in this phase, focusing on trilateral trade along with the existing bilateral transactions. • Undertake long-term PPAs with Bangladesh for selling power from export-oriented projects. The Upper Karnali project will be the first such hydropower plant to sell power to Bangladesh and is expected to be commissioned during this time. PPA of 25 years will be signed. In the recent Nepal-Bangladesh Joint Working Group (JWG) meeting held in September 2021, Bangladesh has expressed a willingness to import a total of approximately 9 GW of electricity from Nepal by 2040. The two countries would be jointly developing either the Sunkoshi III project or Khimti Shivalaya project.[52] However, any trade with Bangladesh will require the use of the Indian transmission network, hence a proper mechanism must be developed. Therefore, both parties have agreed to talk with India to proceed with a triparty agreement and build dedicated line from Nepal to Bangladesh. NEA may supply power to Bangladesh on commercial basis by using the Indian transmission network. Currently, no transmission capacity is available between India and Bangladesh. Arun III hydropower project is expected to be commissioned in 2024. Therefore, discussion may be initiated to tie up the 21.9 percent free power available from the project and supply to Bangladesh, so that as and when India – Bangladesh transmission link is established, NEA may commence supply within the shortest possible time. • Banking of power can also be initiated once the mechanism has been finalized by India and Nepal.
Long term (i.e., FY2030-31 onwards)	Shifting to multilateral trade by establishing a power exchange in Nepal can be considered a longer-term goal. Twenty IPPs came together in 2019 to establish 'Nepal Power Exchange Limited,' the aim being to supply power generated by private developers in Nepal and to export electricity to neighboring countries including India and Bangladesh through the power trading company. However, this has not yet materialized because enabling regulations are required. There will be future developments in the power markets of other countries too in the South Asian region and enhanced cooperation for CBET. Deliberations have been ongoing to eventually enable multilateral trade in the region. As such, the creation of a power exchange will not only make the domestic market competitive but also provide more options for short term CBET. The generators /power trader of Nepal can sell power on the exchange to other countries, similar to the way that IEX in India is selling power to Nepal.

[52] *News articles, 14 September 2021*

6.2. INSTITUTONAL ARRANGEMENTS

Together with the regulatory and policy enablers, a robust institutional framework should be in place to focus on power trading, including CBET. This sub-section considers whether a separate entity should be created to be the custodian of power trade and handle all the operations – or in the alternative, the current two departments of NEA should continue to carry out the functions and consider potential tie-ups to increase market access.

Option 1: NPTC as the trading entity in the future

The following options are available to institutionalize a separate power trading company in Nepal:

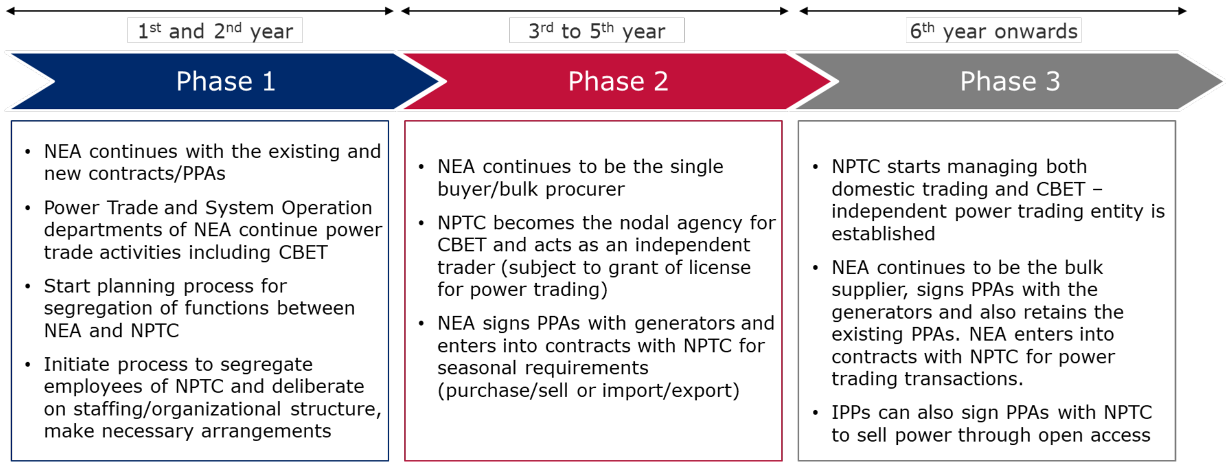
- Independent government owned entity: It could be formed with ownership of the GoN and executive representation from Ministry of Energy and Ministry of Finance. In addition, public sector banks or financial institutions such as HIDCL might also be included in the ownership structure. However, the trading company could also be hindered by slow decision making and from competition from other government departments. Lastly, the independent character of the government owned company might not be obvious to outside developers.
- Subsidiary of NEA: NEA would have an important role to play in the initial establishment and operationalizing of the trader function, as it is the only entity with some experience in CBET.
- Independently privately-owned entity: A privately-owned PTC could also be considered. A variation on this approach might be to establish a company that has a private entity as the majority shareholder and with government or foreign entities holding the minority positions. However, the power market in Nepal is still in its earliest stages. It will take time to develop. The quantum of power available for trading during the initial phase might not be sufficient for private sector participants. Considering the added uncertainty of Nepal's fledgling regulatory framework, most would probably consider this a risky venture at this stage.

Nepal Power Trading Company Limited (NPTC), a subsidiary of NEA, has already been established. NPTC had been established with the objective of carrying out both domestic power trade and CBET. NPTC was incorporated on March 9, 2017, pursuant to the prevailing Company Act of Nepal. NEA is the major shareholder of NPTC with 51 percent shareholding. The other shareholders are Vidyut Utpadan Company Ltd. (17 percent), Rastriya Prasaran Grid Company Ltd. (17 percent) and Hydroelectricity Investment and Development Company Limited (15 percent). The current status is that the business plan for its operation has approved by the Company's Board. However, issuing it a license for power trading is under consideration. NEA would prefer NPTC to start its operations at the earliest.[53] Therefore, the most likely option is to operationalize NPTC as the power trading entity.

[53] NEA. 2021. Annual report FY 2021-21.

Figure 22 illustrates the roadmap/transition required for NPTC to evolve as a separate entity for power trading.

Figure 22: Transition of NPTC to an operational power trading company



A gradual transition has been suggested for NPTC to become a fully functional power trading company. In Phase 1, the current status – in terms of power trade, continues and planning for NPTC begins. NEA continues to be the bulk procurer and signs all new PPAs, as well as retains the existing ones. In the next Phase, partial responsibility is given to NPTC, wherein NPTC becomes for sourcing surplus seasonal electricity from NEA and selling it through CBET. NPTC will negotiate with international power traders and sellers for procurement of power, as well as to export surplus power. NEA can sign back-to-back contracts with NPTC for import/export of power i.e., NPTC acts as a power trader for Nepal for cross-border transactions. Scheduling and dispatch will continue to be managed by NEA's Load Dispatch Centre, while NPTC will finally assume the position of the Nodal Agency for GoN, settling all commercial issues with the Nodal Agency of India. NPTC will be responsible for coordination and monitoring of power flow for CBET. NEA remains to be the bulk procurer and signs new PPAs with IPPs and NEA's subsidiaries and, retains the existing PPAs. In Phase 3, NEA's retains its function as the bulk procurer, also supplying to its retail consumers (as a DISCOM). NPTC continues with CBET as its core business and includes domestic power trading business when it is enabled. NPTC can also undertake power sale to open access consumers if introduced in Nepal. NEA continues to be the bulk procurer considering that a minimum amount of the net worth or standing will be required to sign the PPAs with the developers and avoid issues of bankability of PPAs. NPTC will be a new entity and will operate purely as a trading company, hence it might not have sufficient funds or net worth to get into contracts with the developers unless there is in place a mechanism like a Government guarantee to back the PPAs.

NPTC will begin operations as a subsidiary of NEA and with other GoN-owned entities as shareholders. Later on, the option to include participation from foreign investors or power traders from other countries as strategic tie-ups can be considered — for example power traders in India like PTC, NVVN or private Indian power traders (depending on the value proposition and interest). Strategic tie-ups can occur at the NEA level to leverage additional value. For example, NEA can tie-up with NTPC India, thus leveraging NTPC's manpower for the operations of NPTC. This is what PTC had done gradually and can be adopted for NPTC too. As mentioned in Section 4, PTC opted for strategic-tie ups to enable investment and enhance technical competence. At the time of incorporation in 1999, PTC was primarily held by government entities, however, over the years Foreign Institutional Investors, private investors and banks have also become shareholders, These investors have contributed by providing additional funding and assisted in the expansion of PTC's business. Up to 49 percent of the shareholding of NPTC could be by overseas investors or overseas power trading companies from neighboring countries. The external participation from other countries and international power trading companies would provide the necessary expertise and skill sets in the power trading function as well as quick access to the power markets in the neighboring countries like India. This structure would be most suitable for the role of investment facilitator and PPA aggregator for Nepal's hydropower development. GoN will still exercise some management control through its majority shareholding. As a precaution, private parties would have to be selected through a transparent process.

The pros and cons of this option (separate power trading company) are set out below.

Pros
• A dedicated power trading company will have its own clear vision, mandate, delegation of power (DOP) and own set of staff to undertake the related activities. This will enable better focus on CBET too and unlike in the present structure where there is rotation of staff, NPTC will have its permanent staff which will be experienced in this field through and bring in more focus. • Since most of the hydropower development will be driven by way of private sector participation, an independent institutional framework that can support and facilitate power trading in Nepal would be a positive step toward the realization of a region-wide power market. In the long-term, the role of a power trading entity could also include being an aggregator and facilitator of PPAs for private hydropower developers in Nepal. • The current institutional framework for Nepal's power sector lacks a market participant that can facilitate the development of a sound power market by identifying and mitigating risks currently associated with cross-border trading. PTC India was established to address the requirement to have an entity that could support private power developers by providing a way to mitigate credit risks. Similarly, among its other tasks, NPTC can carry out two essential roles: (i) representing Nepal's interests in the development of the regional framework, and (ii) being the nodal agency to coordinate with other entities, both within and outside of Nepal and seek ways to mitigate risks. This way it can attract more private investment in the Nepal's hydropower sector. • The capacities that are inherent in trading companies do not yet fully exist in the current power trading setup in Nepal. They can more easily be developed and institutionalized in a new and independent organizational structure. • The separation of trading function into a new company would not only cater to CBET needs but will also manage the power trading requirements within the country. This would support the overall reform agenda of unbundling and moving towards more competitive market structure.
Cons

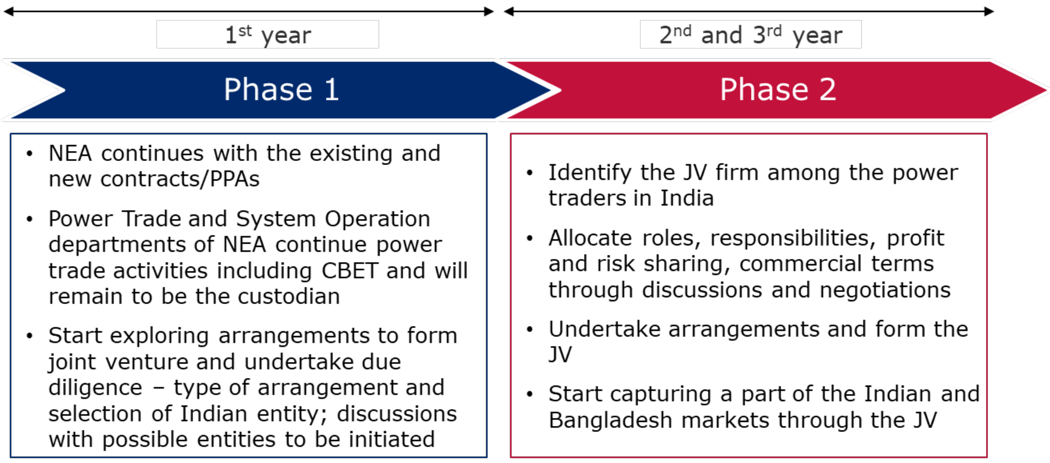
• The operationalization of NPTC (or any separate power trading company) in Nepal is subject to certain developments in the regulatory framework, which might take some time. NPTC commence operations once the new Draft Bill for an Electricity Act, currently before. parliament is approved. That bill includes language to unbundle NEA's generation, transmission, and distribution functions. In the absence of new legislation, the creation of such of a separate entity will not be possible.
• The following enabling framework will also be required:
    o Enabling provision for open access in transmission
    o Clear provision and procedure for a Grant of license to power trading companies (or in the absence of it, DoED grants the license to NPTC)
    o Policy aspects – clear export-import policy/guidelines, restructuring of power sector.
    o Regulatory changes i.e., tariff regulation, regulation related to transmission charges and losses
    o Electricity Grid Code i.e., scheduling, dispatch and energy accounting, demand and supply tool, independent system operator
• In order to function in Phase 2 as the nodal agency for CBET on behalf of NEA, NPTC will require consent from GoN through a notification.

Option 2: Joint Venture (JV) between NEA and an Indian entity

If the option of continuing with the existing set up (NEA continues to conduct power trade including CBET) is also explored, opportunities of potential tie-ups or strategic investments can be considered. The presence of the entity (through tie-ups/JVs or separate companies) in potential markets can assist in better market access and reaching out to the potential buyers. The most probable option for a JV partner will be Indian power traders including PTC or NVVN, or even and private power traders in India. This will provide access to not only the Indian market, but also the Bangladesh market, where these traders have contacts and have been undertaking transactions.

Figure 23 illustrates the roadmap for forming a JV for NEA.

Figure 23: Roadmap for forming a JV between NEA and an Indian entity to enhance CBET



There are various options/arrangements for a foreign company to enter the Indian market. To establish business operations in India, a foreign company can adopt the following routes:

I. As an Indian company - by incorporating a company under the Companies Act,1956 through:

A. Joint Ventures with Indian partners - the company can forge strategic alliances with Indian partners

B. Wholly-Owned Subsidiary company – a foreign company can also to set up wholly-owned subsidiary in sectors where 100% foreign direct investment (FDI) is permitted under the FDI policy. FDI, up to 100 percent, under the automatic route, is permitted in the power sector (except atomic energy). This includes generation, transmission, and distribution of electricity, as well as power trading, subject to the provisions of the Electricity Act, 2003.

II. As a Foreign company i.e., Liaison office/Project office/Branch office

To establish strategic tie-ups with an Indian power company/power trader and leverage their position in the market, entry into the Indian market as an Indian company seems to be a more suitable option. However, setting up a wholly-owned subsidiary company of NEA will require quite a substantial investment and the purpose of forming an alliance/tie-up with a strategic partner gets defeated. Therefore, JV formation seems to be the most suitable option, wherein NEA can get into a suitable arrangement with the identified partner/power company/power trader and also utilize its knowledge and connects in the Indian and Bangladesh power markets.

The pros and cons of this option are set out below.

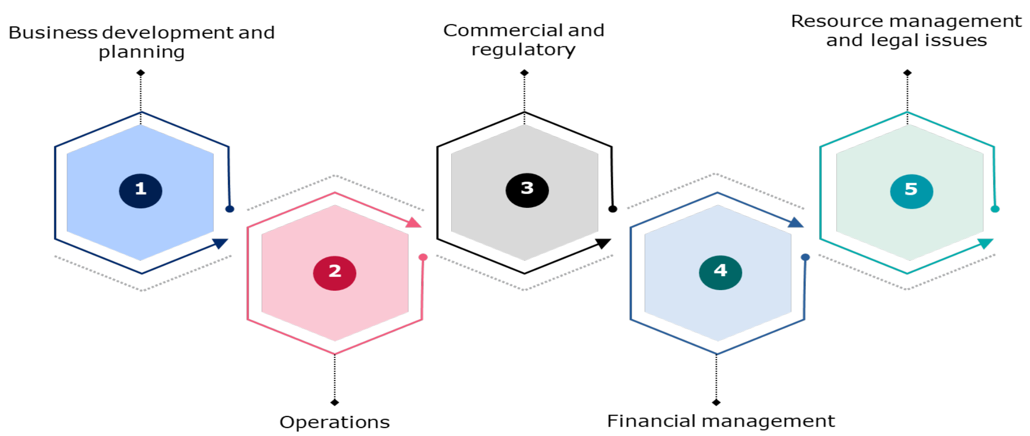
Pros
• Given the situation where there is delay in approval of the new Bill for an Electricity Act, NEA can continue with its current functions related to power trade. In this circumstance, the possible option will be to form a JV with an Indian power trading company to increase market access for selling its surplus power and benefit from the technical expertise that the firm will bring.
Cons
• Currently, there is rotation among the staff of NEA including the two departments which is involved in power trade, which brings in an element of ambiguity and lack of not so experienced personnel owing to regular change in staff. A permanent power trading company will be better able to address this challenge. • In order to undertake enhanced trade including CBET, capacity building of the current staff will be required in terms of educating them about the markets and trading options available in the potential trading partner countries. In the event of forming a JV with an Indian power trader, proper planning has to be undertaken to select personnel to operate in that set up or recruit staff from India, which might result in increase in operating expenses. • The primary challenge is to find a potential partner to form the JV. The power trading company should see some merit in forming a JV with NEA because the power trader might already have access to Nepal's power market through the existing mechanism (like NVVN and PTC are already undertaking transactions with NEA). Also, the cost of Nepal's surplus power should either be at par, if not lower than the power generated in India (thermal or renewable energy).

Taking into account all of the possible options that NEA can employ to increase power trade and CBET in terms of building a robust institutional framework, it appears that operationalizing NPTC seems toa be the best option. If this is the case, the required regulatory approvals, and the development of a sound policy/regulatory framework for CBET is needed immediately. This process must be expedited and is a key enabler for CBET.

6.3. OPERATIONAL CAPABILITY OF THE TRADING ENTITY/DEPARTMENT

Whether NEA continues with trading, or a separate entity is entrusted with this function, the following are the key competency areas required for any successful trading company/department to operate.

Figure 24: Key operational capabilities of the trading entity



The core functions specific to a trading entity will be the first three (as displayed in the figure)-business development, operations, and commercial expertise to meet the objectives of power trading as well as CBET. In addition to this, other support functions as illustrated will be required.

- Business development and planning:
  - Coordinate with potential buyers and sellers. Identify duration of buy and sell
  - Participate in various tenders on behalf of buyers and sellers
  - Formulate the overall sales and purchase strategy, carry out due diligence and analysis on projects, liaise with generation companies and other consumers, gather market intelligence on power trade specifically CBET, participate in tenders
  - Plan and develop CBET options and strategies (ST, MT, and LT), identify potential markets and buyers
  - Prepare demand-supply forecasts on a periodic basis, Analyze future purchase requirement
  - Preparing annual business plans including projections of power trading volumes and market prices

- Operations:
  - Arrange open access, scheduling / rescheduling of power, energy accounting, reconciliation.
  - Coordinate with the load dispatch centers in Nepal and other relevant cross border entities for scheduling & dispatch of power and monitor, liaise with the power distribution utilities and IPPs to process the consent required for open access.
  - Undertake competitor monitoring (as applicable) and, data analysis for proper forecasting of demand and supply.
  - Conduct daily power trading including CBET (ST, MT, and LT), especially on the power exchange in India where regular monitoring is required and utilize possible opportunities to sell surplus power.
  - Address seasonal variations in electricity requirement in Nepal (to meet both deficit and sell surplus).
  - Coordinate with regional counterparts and market participants to develop the South Asian regional power market.
  - Track events and regulations that could impact the power trading business.
  - Eventually develop a robust market mechanism for power trading.
  - Prepare Delegation of Power (DOP) for various activities / functions.

- Commercial and regulatory:
  - Finalize commercial arrangements including Power Purchase Agreements (PPAs), Power Sale Agreements (PSAs) and other related contractual documents.
  - Act as PPA aggregator. NPTC can take over the existing PPAs and act as bulk supplier for NEA and its successor entities.
  - Facilitate investment by signing new PPAs also for the future generation projects where the domestic demand is already fulfilled. It could tie up partial capacities from under construction or future projects on a long-term basis and make markets for the power in neighboring countries. This would facilitate the export of surplus seasonal capacity and also drive the financial closure of projects which could not otherwise find off-takers for full capacity during the surplus scenario. This will mitigate some risk for the developers and investors. However, bankability of future PPAs entered into with NPTC would be a challenge unless backed by Government Guarantees or NPTC has a credible net worth or there is an assured revenue stream.
  - Prepare, negotiate, and award tender documents for short (ST), medium (MT) or long term (LT) power purchase
  - Track of commercial transactions and settlements and follow up on payments

- Financial management:
  - Prepare and maintain of financial and accounting policies & procedures related to trade.
  - Prepare financial statements (if a separate company is formed) and maintain accounting books / statements.
  - Verify, and pass the bills raised by external parties towards the trading company/department.

- Be accountable for payments to sellers and receipts from buyers.

- Resource management and legal issues:
  - Handle matters related all the power trading staff, formulate, and implement Human Resource related policies.
  - Undertake capacity building and training of the staff.
  - Carry out legal vetting of documents, contracts such as PPAs.
  - Provide advice on legal matters, represent in court of law.

6.4. POLICY, REGULATORY, AND TECHNICAL ENABLERS

Enabling policy, regulatory and technical framework will be required for the transition roadmap charted out to execute the various options for power trade and CBET in specific and, also to develop the desired institutional arrangements. Regulatory, market mechanism, and technical changes that are needed have been mentioned throughout this Chapter, wherever relevant. In this section, the key enablers have been highlighted and summarized. First, the gaps in the present framework are evaluated, showing the level of preparedness, and clearly highlighting the near-term gaps.

Table 9: Current gaps in the policy and regulatory framework vis-s-vis the required enablers

Requirement for CBET	Availability	Comments
Strategic, policy and legal framework	Partially Available	• Agreements exist with India and Bangladesh for power trade / cooperation in power sector • Electricity Act has provisions relating to approval of import and export of electricity • Hydropower Development Policy promotes export-oriented projects • However, detailed guidelines/rules relating to CBET are not available yet
Regulatory framework	Not Available	• No dedicated regulation for CBET • No supporting regulatory provisions on aspects such as transmission pricing, open access and trading licensees
Transmission line development methodology	Partially Available	• Transmission System Development Plan of Nepal, 2018 has identified the new lines required for CBET • However, financing modalities, cost recovery mechanisms etc. are decided on a case by case basis for cross border lines. Also, trilateral trade mechanism has not been mentioned.
Transmission pricing and loss accounting	Not Available	• Owing to bundled nature of NEA, only retail tariff is being determined by regulator. There is lack of clarity about import and export tariff.
Open access / wheeling of power	Not Available	• Open access for wheeling of power is not yet operationalized. NEA continues as the single buyer.
Deviation settlement	Partially Available	• No proper deviation settlement mechanism • However, to promote responsibility in scheduling, there is a penalty mechanism for hydropower generators with monthly and weekly schedule declarations

✓ *Available* *Partially Available* ✗ *Not Available*

To summarize the following are the key requirements in the policy, legal, regulatory, and technical framework.

- Trading must be recognized in law as being a separate, licensed activity (as G, T, and D)

- Guidelines/rules related to CBET identifying the approving authority, types of approval required, trading eligibility, approval and application procedure, trilateral trade mechanism, etc.

- Regulations related to open access, transmission pricing mechanism including CBET lines and import/export tariffs, transmission loss

- Electricity grid code including scheduling, dispatch and energy accounting, demand, and supply tool. Establishment of an independent system operator.

- Robust technical framework providing a mechanism for transmission infrastructure planning and implementation which will cover aspects such as
  - identification and development of new transmission lines
  - implementation of lines identified in the Transmission System Development Plan of Nepal, 2018
  - financing procedures and cost recovery mechanisms for cross border lines
  - cyber security in transmission network
  - integrated system planning including maintaining information systems to record and maintain monthly cross border energy transfers and network constraints
  - communication protocols including communication equipment and minimum standards to be adopted for protection

- The power trading company and the trading function must be subject to the regulatory jurisdiction of the Electricity Regulatory Commission, since it is an independent economic regulator

- The regulator will, by way of its license and Act, regulate the trading margin; specify the technical requirements, capital adequacy requirement, and credit worthiness of the power trading licensee; monitor the performance of the power trader; report to the government annually and settle disputes as they arise.

About USAID's Urja Nepal Program:

USAID's Urja Nepal Program supports the efforts of the Government of Nepal in establishing effective policy, regulatory and operational changes to create a financially viable electricity sector, thereby enabling it to provide affordable, reliable, and secure electricity while encouraging private sector investment into Nepalese energy market. The Urja Nepal Program is supported by the American people through the United States Agency for International Development (USAID) and is implemented by Deloitte Consulting LLP.

USAID's URJA NEPAL PROGRAM

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