

A Glimpse of NEA Transmission System

Presented By:

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Nepal Electricity Authority*

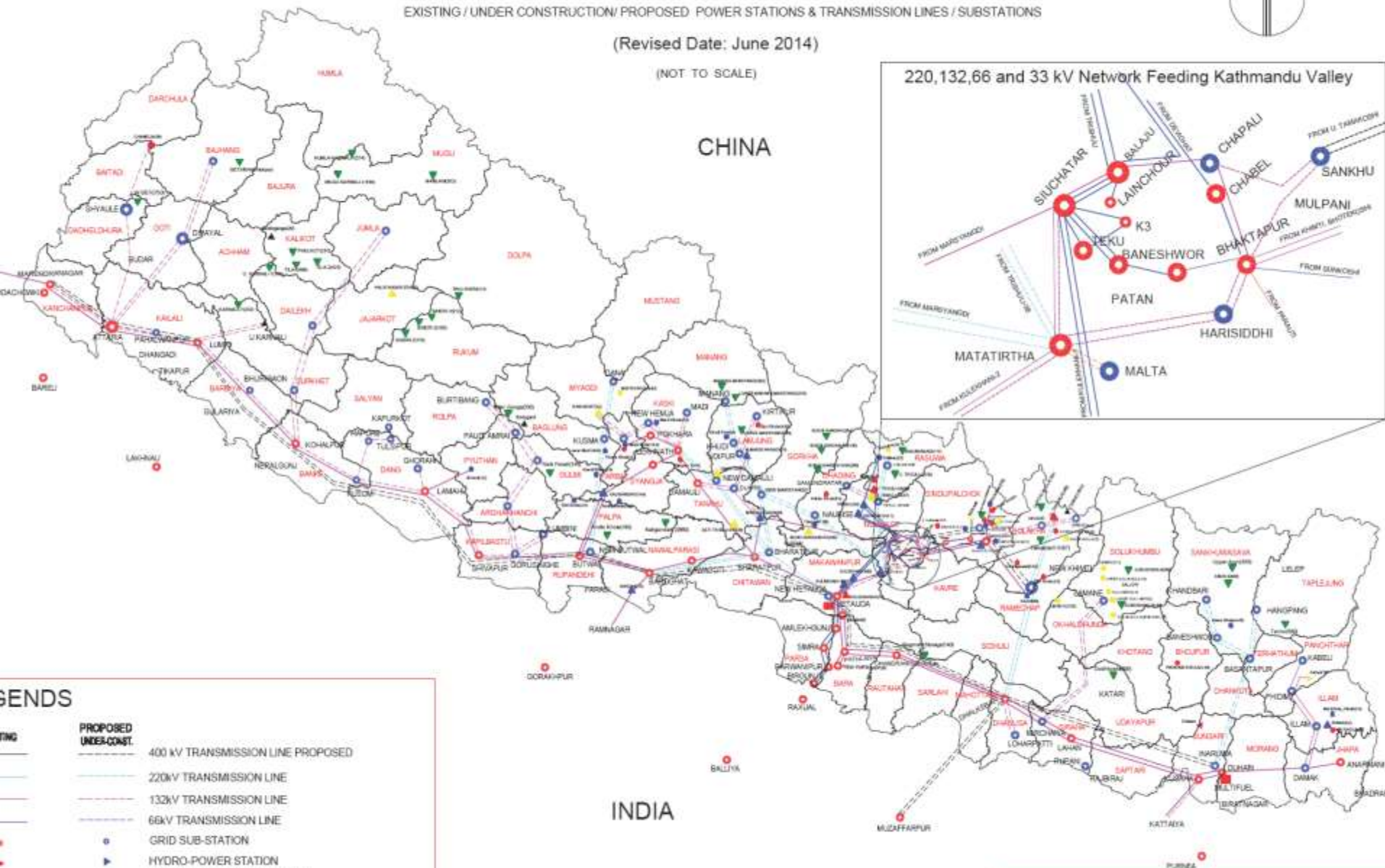
POWER DEVELOPMENT MAP OF NEPAL



EXISTING / UNDER CONSTRUCTION/ PROPOSED POWER STATIONS & TRANSMISSION LINES / SUBSTATIONS

(Revised Date: June 2014)

(NOT TO SCALE)

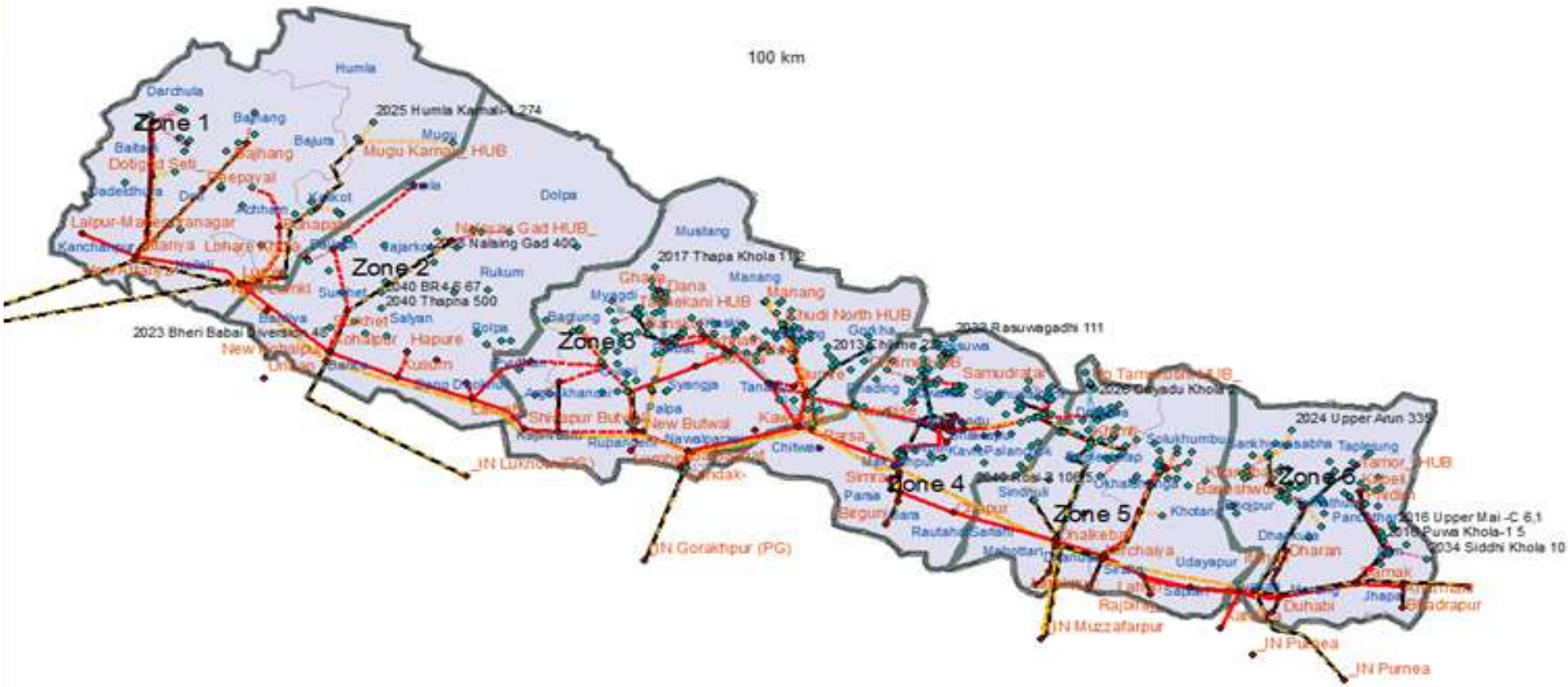


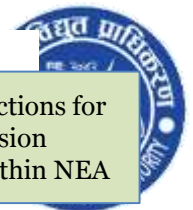
LEGENDS

- | | |
|--|-----------------------------------|
| | PROPOSED 400 kV TRANSMISSION LINE |
| | 220kV TRANSMISSION LINE |
| | 132kV TRANSMISSION LINE |
| | 66kV TRANSMISSION LINE |
| | GRID SUB-STATION |
| | HYDRO-POWER STATION |
| | IPP's HYDRO-POWER STATION |
| | DIESEL/M-F POWER STATION |
| | NEA HYDRO-POWER STATION |
| | IPP HYDRO-POWER STATION |
| | MAJOR HYDRO-POWER STATION > 100MW |

NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
TRANSMISSION LINE & SUBSTATION CONSTRUCTION DIVISION

Transmission Master Plan - 2015





Structure for transmission functions in Nepal

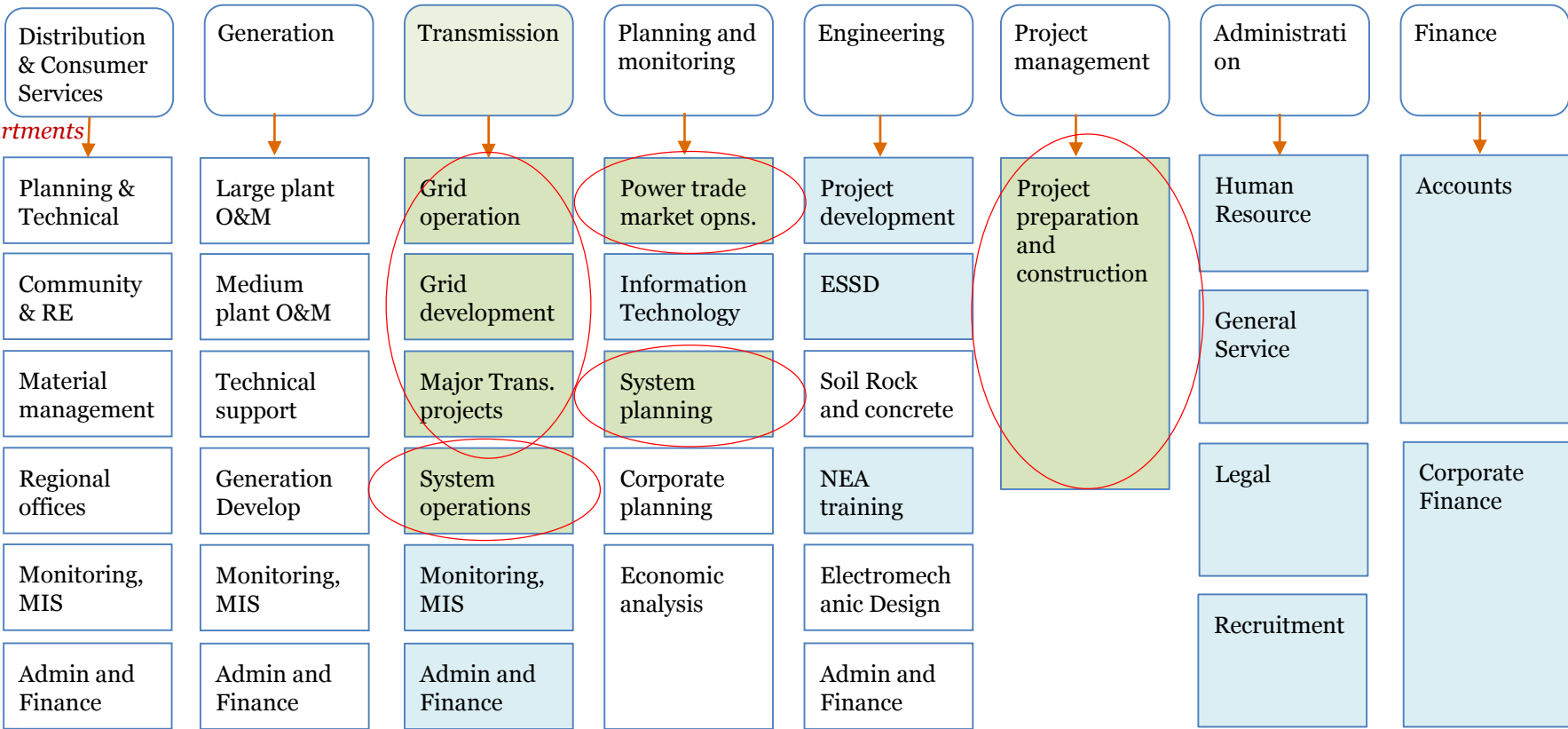
Core functions for transmission sector within NEA

Shared functions for transmission sector within NEA

NEA Board & Managing Director

Directorates

Departments



SYSTEM AT A GLANCE



Installed Capacity: 950 MW

In Grid 945MW

Off Grid 5 MW

Hydro 892 MW

Thermal +Solar 53 MW

ROR 800 MW

Storage 92.0 MW

IPP 414 MW

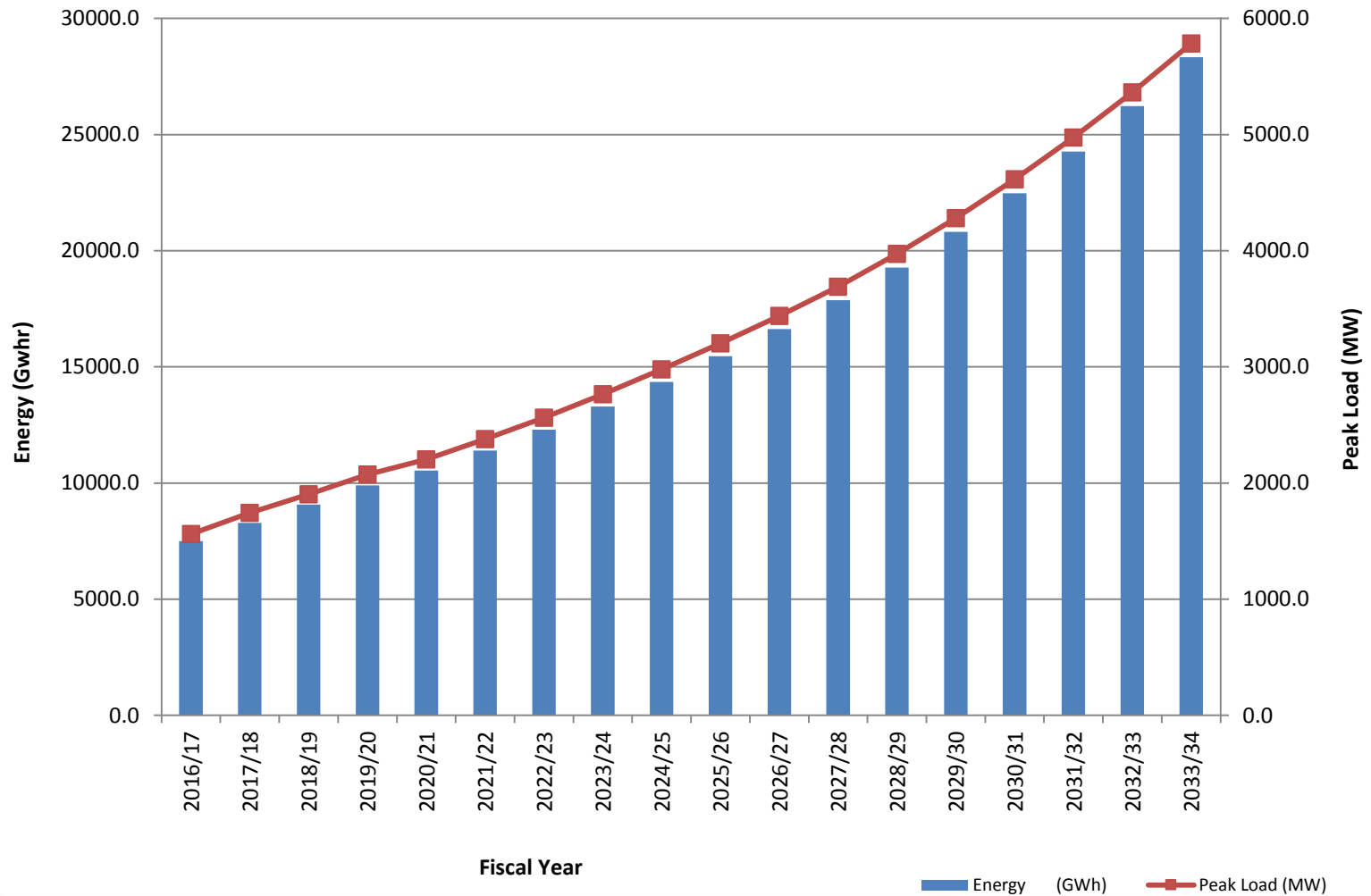
NEA 478 MW



NEA Load Forecast

Fiscal Years	Energy (GWh)	Peak Load (MW)
2016/17	7491.1	1559.7
2017/18	8287.0	1742.2
2018/19	9070.2	1903.3
2019/20	9889.9	2071.5
2020/21	10540.6	2203.8
2021/22	11398.9	2378.9
2022/23	12299.4	2562.1
2023/24	13295.1	2764.5
2024/25	14349.2	2978.3
2025/26	15460.0	3203.0
2026/27	16631.6	3439.5
2027/28	17869.0	3688.7
2028/29	19275.0	3971.7
2029/30	20811.8	4280.7
2030/31	22474.7	4614.4
2031/32	24274.3	4974.9
2032/33	26221.9	5364.5
2033/34	28329.9	5785.3

NEA Load Forecast





SYSTEM AT A GLANCE –

Recorded peak - 2073 Falgun 30	MW	Time (hrs)
NEA	308.25	
Internal Purchase	127.85	
Import from India	373.51	
Power Shedded	405.00	
Power Interruption		
Calculated' Evening Peak	1214.61	19:05
Calculated' Peak of this day, last year	1312.58	18:40
Energy (MWh):	072/11/26/4	073/11/26
Generation (National Grid only)	5676.62	7344.07
Total Supply (with Import)	12093.36	16104.11
Calculated Demand (Including L/S)	20093.36	18504.11

NEA TOTAL
4463.11 MWH
308.25 MW

IPP TOTAL
2880.96 MWH
127.85 MW

IMP. TOTAL
8760.04 MWH
373.51 MW

High Voltage Transmission Lines & Substations



Transmission Lines	Existing (Circuit km)	Under Construction (Circuit km)	Planned (Circuit km)
66kV Voltage Level	511.16	-	
132kV Voltage Level	2337.7	1010.0	1320.0
220kV Voltage Level	-	659.0	949.8
400kV Voltage Level	-	648.0	6495.6
Total	<u>2848.86</u>	<u>2317.0</u>	<u>8765.4</u>

Substations	Existing (Numbers/Capacity)	Under Construction (Numbers/Capacity)	Planned (Numbers/Capacity)
66kV Voltage Level	13/509.15MVA	-	
132/66kV Voltage Level	28/1622.4MVA	10/506.5MVA	21/917MVA
220kV Voltage Level	-	-(*)	18/3876MVA
400kV Voltage Level	-	-	5/2025MVA



Transmission Line Projects

Total Transmission Line Projects **66**

Projects Under Construction **47**

•GoN Funded Project **19**

•Projects for Cement Industries **4**

•ADB Funded Projects **7**

•World Bank Funded Project **5**

•Government of India & GoN Funded Project **4**

•German Development Bank, European Investment Bank **2**

•Project Management Directorate **6**

Projects in different Development Phase **19**

Transmission System Master Plan (TSMP)



- “Objective - Transmission System Master Plan (TSMP) covering 2015 to 2035 that optimizes projected load flows within Nepal and between Nepal and India in a manner that is safe, respects agreed reliability criteria, is technically efficient and least cost to Nepal”
 - Prepared by Consultant EdF with WB financial aid in 2015
 - Generation scenario in consultation with DOED and NEA Engineering/PTD
 - Load Scenario – System Planning department
 - Transmission line development divided into four tranches –

2015-2020	2020-2025	2025-2030	2030-2035
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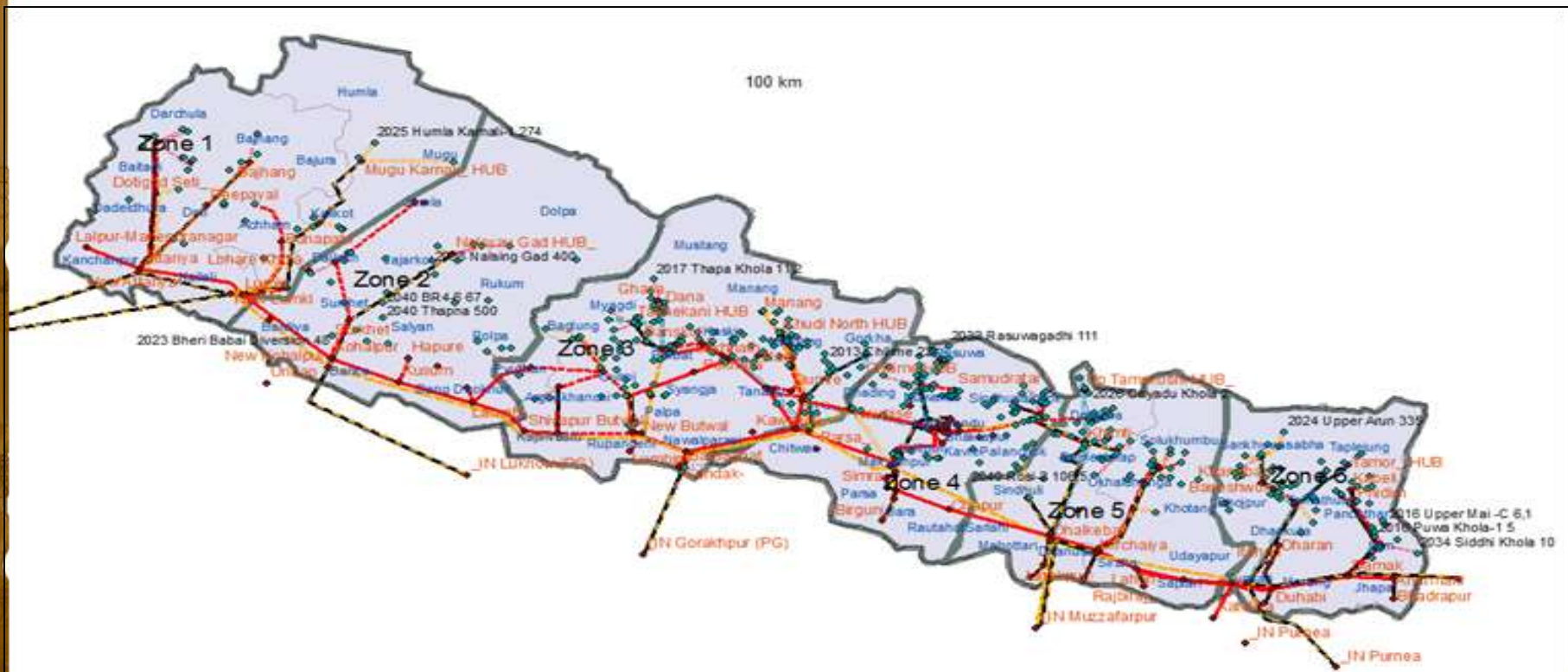
Transmission Master Plan



Nepal is divided into 6 zones (grid-zones) (for inter-areas or interconnections flows) –

For each zone, the design of the network was based on the following information:

- The location and the nominal power of future hydro power plant
- The existing network or committed network where any in the zone
- The criteria for selecting line types from the power transfer



Cross-Border Inter Connection Master Plan (by PGCIL for NEA)

- Cross-border Interconnection plan for export of energy to India
 - Projects proposed by GoN and NEA – identified projects of different stages – survey, design, PPA, under construction etc..
 - By 2021-22 = 8031 MW
 - By 2025 - + 5099 MW = 13130 MW
 - By 2035 - + 12855 MW = 25,985 MW
- Excluding Pancheswor (2800MW), Karnali Chisapani (10,800MW) and Saptakoshi (3400MW)
- **Six CB Interconnection Corridors / 11 Tx lines** planned/ proposed

Future Transmission Line Projects Year 2015 to 2035 (MUS\$)

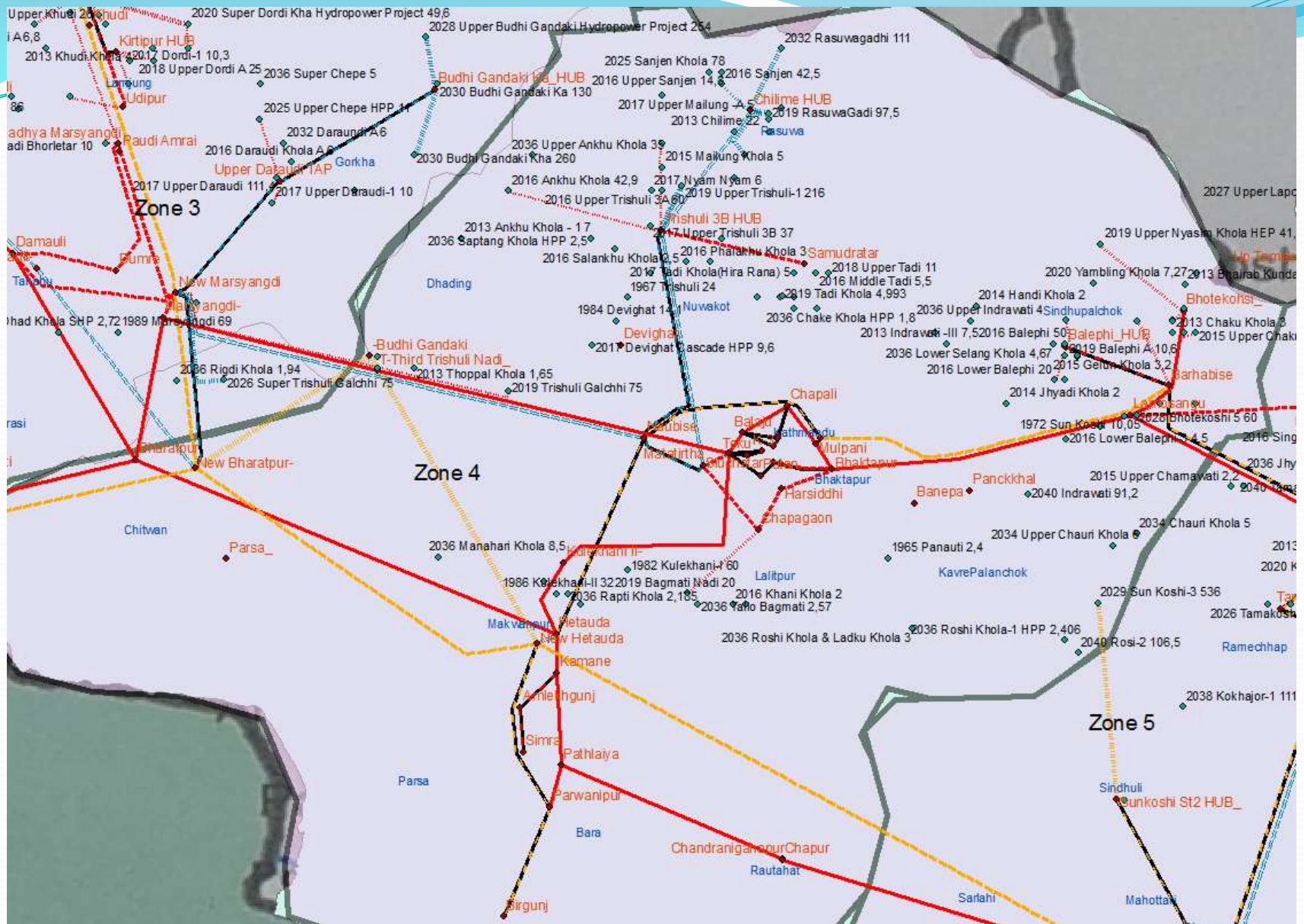


Zone	Major TL	TL Investment	SS Investment	Total Investment
Zone-1	<ul style="list-style-type: none"> ➤ 400kV Western West Seti-Karnali Corridor <i>(West Seti, Chainpur Projects, Upper Karnali Projects)</i> ➤ 400kV Eastern Corridor <i>(Mugu Karnali-Phulkot Projects)</i> ➤ 132kV West Corridors <i>(Chameliya, Bajhang, Deepayel, Budhiganga Projects)</i> 	233.7	144.6	378.3
Zone-2	<ul style="list-style-type: none"> ➤ 400kV Nalsyaugad Corridor ➤ Central 132kV Corridor <i>(Dailekh, Surkhet Projects)</i> 	366.8	124.5	491.3
Zone-3	<ul style="list-style-type: none"> ➤ 400kV Kaligandaki-New Butwal Corridor <i>(Uttar Ganga, Badigad, KG-2, Ridi Projects)</i> ➤ 400kV Kusma-New Butwal Corridor <i>(Dana, Tadhekuna, Beni, Upper Modi, Kusma Projects)</i> ➤ 400kV Khudi North HUB <i>(Manang, Khudi North, Kirtipur, Udipur, Khudi North Projects)</i> ➤ 220kV Upper Budhigandaki-N Marsyangdi Corridor <i>(Upper Daraudi, Bhdhigandaki Projects)</i> ➤ 220kV Tanahu Project ➤ 132kV Western Basin (Lamahi, Jhimruk, Gulmi, Butwal Loop) ➤ 132kV Lekhnath 	466.2	453.2	919.4

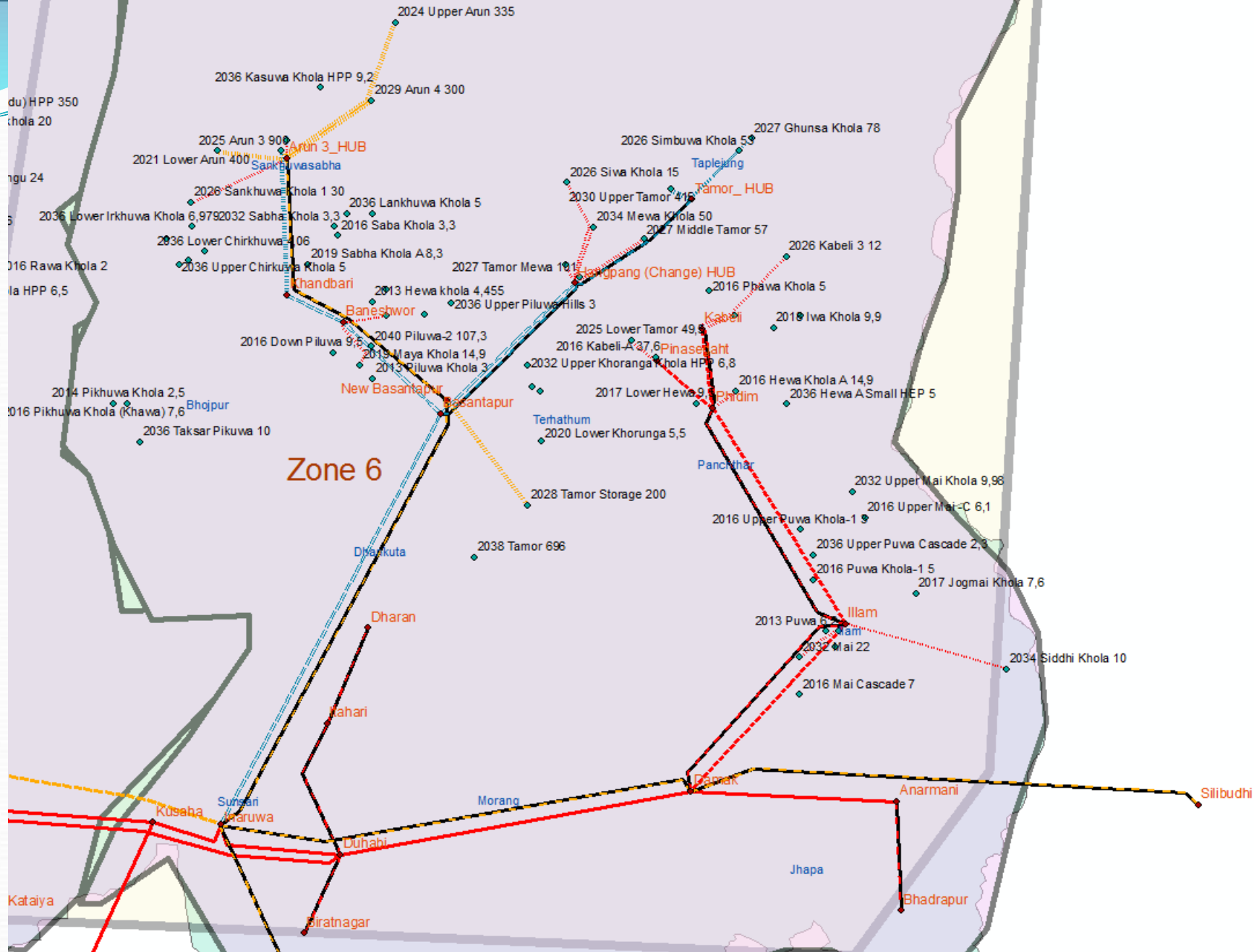


Future Transmission Line Projects Year 2015 to 2035 (MUS\$)

Zone	Major TL	TL Investment	SS Investment	Total Investment
Zone-4	<ul style="list-style-type: none"> ➤ 220kV Trishuli 3B-Chilime HUB <i>(Chilime HUB, Trishuli 3B HUB, Samundratar HUB Projects)</i> ➤ 400kV Barhabise Northern Section <i>(Lamosangu, Bhotekoshi, Balefi, Barhabise HUB Projects)</i> 	328.5	397.4	725.9
Zone-5	<ul style="list-style-type: none"> ➤ 400kV Dhalkebar Corridor <i>(Dudhkoshi, Tamakoshi-Sunkoshi Projects)</i> ➤ 400kV Likhu, New Khimti, Barhabise Corridor <i>(Likhu, New Khimti Projects)</i> ➤ 220kV Upper Tamakoshi ➤ 132kV Corridors <i>(Singati, Tingla Projects)</i> 	244.2	309.8	554.0
Zone-6	<ul style="list-style-type: none"> ➤ 400kV Arun Corridor <i>(Arun-3, Tamor Storage Projects)</i> ➤ 220kV Koshi Corridor <i>(Arunn-Khandbari, Hangpang, Basantapur Projects)</i> ➤ 132kV Kabeli Corridor 	261.1	326.1	587.2



Transmission System Master Plan Snap shot - Central Region



Transmission System Master Plan Snap shot - Central Region

Investment on Transmission



The core of the transmission network is to be commissioned during the next 10 years. The total investment cost planned for the whole 2015-2035 period amounts to 5.15 billion USD and is mainly concentrated in first ten years, i.e. between 2015 and 2025:

Label		2015	2020	2025	2030	2035	
All Zones	Commissioning from to year	2015	2020	2025	2030	2035	Total
		2019	2024	2029	2034		
		MUSD	MUSD	MUSD	MUSD	MUSD	MUSD
Lines	Comm.	412.8	621.1	214.2	0.0	0.0	1248.1
Lines	Planned	138.1	332.6	181.7	0.0	0.0	652.3
Lines	All	550.9	953.7	395.9	0.0	0.0	1900.5
S/S	Existing	123.0	60.2	13.2	34.5	26.1	257.1
S/S	Comm.	410.0	231.3	82.7	81.5	0.0	805.4
S/S	Planned	47.4	358.0	215.2	67.1	5.3	693.1
S/S	All	580.5	649.5	311.1	183.0	31.4	1755.6
Total	Existing	123.0	60.2	13.2	34.5	26.1	257.1
Total	Comm.	822.8	852.4	296.9	81.5	0.0	2053.6
Total	Planned	185.5	690.6	396.9	67.1	5.3	1345.4
Total	All	1131.4	1603.2	707.0	183.0	31.4	3656.0
Connection	Lines	142.6	584.2	420.4	76.8	4.1	1228.1
Connection	Bays	38.5	83.6	118.4	25.4	6.5	272.4
Grand Total		1312.5	2270.9	1245.9	285.2	42.0	5156.5

Transmission Planning Review



A Review is in process due to significant updates

- **Cross-border Integrated Master Plan is prepared together with PGCIL and submitted 2016 January**
- **Generation scenario has changed – some new projects identified/ dates**
- **Load scenario changed**
- **Transmission Lines configurations (committed) are changed**

The Review will study requirement and feasibility of

- **East –West transmission highway (back-bone) of 400kV and 765 kV**
- **Mid-hill transmission corridors of 400 and 220kV**
- **North-South corridors of 220 and 400 kV**

Nepal-India Cross Border Lines



- **Six corridors and 11 Lines – Pooling stations are Inaruwa, Dhalkebar, Butwal, Kohalpur, Ataria, Lamki**
- **Dhalkebar-Muzzaffarpur 400kV Transmission Line.**
 - ✓ Currently is in operation and importing 80MW of power from Muzzaffarpur in 132kV voltage level.
 - ✓ Second Tx lines 400kV DC in future as flow increases.
- **New Butwal-Gorakhpur 400kV Transmission Line**
 - ✓ Construction of New Butwal 220 kV Substation is in process .
 - ✓ New-Butwal-Gorakhpur Transmission Line study report (DPR) is submitted .
- **Future Cross Boarder Projects**
 - Attariya-Bareli 400kV Transmission Line (Now proposed as 765 kV DC Hexa)
 - Lamki-Bareli 400kV Transmission Line
 - Kohalpur (Chhinchu) -Lucknow 400kV Transmission Line
 - Inaruwa (Duhabi)-Purniya 400kV Transmission Line

Nepal-China Cross Border Line



Chilime-Rasuwagadhi-Kerung 400kV Transmission Line

- ❑ A study team from China has visited Nepal and contacted NEA for data for studying the feasibility and routes
- ❑ Possible alignment is Kerung (Jilong) S/S- Rasuwagadhi – Chilime hub S/S – Galchhi hub S/S 400kV DC line with B2B DC at Jilong

- ❑ Distance from Chilime hub to Galchhi hub is approximately 75 km
- ❑ Distance between Chilime hub to the nearest border Rasuwagadhi is about 20km & from Rasuwagadhi to Kerung is another 20km only.

- ❑ Preliminary proposal at present

Recently completed projects

- हेतुडर कडरने १३२/३३ के.डुी.सवसुटेशन (सलडडु सलडेनुट)
- डुटवल-कुहलडुर १३२ के.डुी. दुसुडु सरुकरुट डुरसरण लरुडन
- हेतुडर कूलखरनी २ सुडुकररु १३२ के.डुी. दुसुडु सरुकरुट डुरसरण लरुडन
- डलरुडर कडररी १३२ के.डुी डुरसरण लरुडन (शुडरुड सलडेनुट)
- ठलुकेवर-डुडडुरडुर ॡ०० के.डुी. करुसडुुडर डुर.लरु. (नेडरल खणुड.)
- डुरीड सुधुनरुठलकरण
- डुलडुले-डुधुड डुशुडरुडुडुी १३२ के.डुी. डुरसरण लरुडन

नेपाल सरकार तथा ने.वि.प्रा को संयुक्त लगानीका निर्माणधिन आयोजनाहरु



- थानकोट चापागांड भक्तपुर १३२ के.भी. प्रसारण लाईन
- सिंगटी लामोसांघु कोरीडोर १३२ के.भी. प्रसारण लाईन
- स्याउले १३२ के.भि. सवस्टेशन
- रुपनी १३२ के.भि. सवस्टेशन
- कुश्मा-तल्लो मोदी १३२ के.भि. प्रसारण लाईन
- हेटौडा-विरगञ्ज प्रसारण लाईन क्षमता अभिवृद्धि
- रामेछाप-गर्ज्याङ्ग १३२ के.भि. प्रसारण लाईन
- कुशाहा विराटनगर १३२ के.भी. प्र.ला
- बुटवल (गारुशिङ्गे)-लुम्बीनी १३२ के.भी. प्र.ला.
- दोर्दी कोरीडोर १३२ के.भी. प्र.ला.
- पुर्वि चितवन १३२ के.भी. सवस्टेशन
- बलेफी-वाह्रविसे १३२ के.भी. प्र.ला. (नयाँ आयोजना)
- गुल्मी (पैडी अमराई)-अर्भाखाँची-गोरुसिंघे १३२ के.भि. प्रसारण लाईन
- लेखनाथ-दमौली २२० के.भी. प्र.ला.

नेपाल सरकार, उर्जा संकट कार्यक्रम अन्तर्गत अध्ययन मा रहेका आयोजनाहरू

- डाँडाखेत (म्याग्दी) राहुघाट १३२ के.भी. प्रसारण लाईन
- सुर्खेत दैलेख कालीकोट जुम्ला १३२ के.भी. प्रसारण लाईन
- घोराही खुम्दी माडीचौर १३२ के.भि. प्रसारण लाईन
- ढल्केवार लोहारपट्टी १३२ के.भि. प्रसारण लाईन
- नवलपुर (लालवन्दी) १३२ के.भि. सबस्टेशन
- भक्तपुर वानेश्वर पाटन ६६ के.भि. प्रसारण लाईन क्षमता अभिवृद्धि
- नयाँ हेटौडा ढल्केवर ४०० के.भी. सबस्टेशन विस्तार
- चिलिमे हव केरुङ्ग ४०० के.भी. अन्तर्देशिय प्रसारण लाईन
- भेरी कोरिडोर ४०० के.भी. प्रसारण लाईन
- रुपल गाढ पश्चिम सेती पहलमानपुर ४०० के.भी. प्रसारण लाईन
- त्रिशुली ३वी भर्लाङ्ग मलेखु २२० के.भी. प्रसारण लाईन

नेपाल सरकार उद्योग मन्त्रालयको लगानिका आयोजनाहरू



- कुसुम हापुरे १३२ के.भी. प्रसारण लाईन आयोजना (दाङ्ग सिमेन्ट)
- लमही घोराही १३२ के.भी प्रसारण लाईन (घोराही सिमेन्ट)
- वर्दघाट सरदी १३२ के.भी प्रसारण लाईन (होडसी-सिभिम् सिमेन्ट)
- सुनवल १३२ सबस्टेशन (पाल्पा सिमेन्ट)

नेपाल सरकार तथा विश्व बैंकको संयुक्त लगानिका आयोजनाहरु



World Bank projects

- खिम्ती-ढल्केबार २२० के.भी. प्रसारण लाईन
- हेटौडा-भरतपुर २२० के.भी. प्रसारण लाईन
- भरतपुर -बर्दघाट २२० के.भी. प्रसारण लाईन
- कावेली कोरिडोर १३२ के.भी. प्रसारण लाईन आयोजना
- नेपाल भारत बिद्युत प्रशारण तथा ब्यापार हेटौडा-ढल्केबार- दुहवी ४०० के.भी. प्रसारण लाईन

नेपाल सरकार तथा एसियाली विकास बैंकको संयुक्त लगानिका आयोजनाहरु



ADB projects

- मध्य मसुर्याङ्गदी डुम्रे दमौली १३२ के.भी. प्रसारण लाईन
- चपली १३२ के.भी. सबस्टेशन
- कोहलपुर -महेन्द्रनगर १३२ के.भी. दोस्रो सर्किट प्र. ला. आयोजना
- चपली अगस्रेण्टेशन (चपली १३२ के.भी. सबस्टेशन बिस्तार)
- तामाकोशी-काठमाण्डौं २२०/४०० के.भी प्रसारण लाईन

ADB projects by PM Directorate

- मस्र्याङ्गदी-काठमाण्डौ २२० के.भी प्रसारण लाईन आयोजना
- कालिगण्डकी कोरिडोर २२० के. भी. प्रसारण लाईन आयोजना
- मस्र्याङ्गदी कोरिडोर २२० के. भी. प्रसारण लाईन आयोजना
- समुन्द्रटार-त्रिशुली ३वि १३२ के. भी. प्रसारण लाईन आयोजना
- ग्रीड सुध्दिठिकरण
- वर्दघाट गोरखपुर दोश्रो अन्तर्देशीय ४०० के.भी. प्रसारण लाईन आयोजना
- कोहलपुर सुर्खेत ४०० के.भी. प्रसारण लाईन आयोजना
- सुर्खेत माथिल्लो कर्णली ४०० के.भी. प्रसारण लाईन आयोजना

नेपाल सरकार तथा भारत सरकारको अनुदान तथा
एक्जीम बैंक इण्डियाको लगानीका आयोजनाहरु

- रक्सौल परवानिपुर १३२ के.भी प्रसारण लाईन
- कुशाहा कटैया १३२ के.भी प्रसारण लाईन
- कोशी करिडोर २२० के.भी प्रसारण लाईन
- सोलु करिडोर १३२ के.भी प्रसारण लाईन
- मोदी-लेखनाथ १३२ के.भी.प्रसारण लाईन



नेपाल सरकार तथा जर्मन विकास बैंक (kfw)

यूरोपियन ईनभेस्टमेण्ट बैंक (EIB) को

संयुक्त लगानिका आयोजनाहरु

- चिलिमे त्रिशुली २२० के. भी. प्रसारण लाईन
- त्रिशुली ३“बी” २२० के. भी. सबस्टेशन हब

Transmission Lines proposed with MCC (US Government)

For East-West 400 kV Back-bone

- Hetauda -Naubise 41 km
- Naubise –Lapsipheddi 48 km
- Naubise - NewDamauli 98 km
- New Damauli - NewButwal 89 km

(400kV Double Circuit Quad Moose Tx line)

- a. 280 km of 400 kV - Practical Capacity – ~ 2000 MW each side

Transmission Lines Overview



- ✓ Significant improvements in Planning
- ✓ Massive Investments in Transmission Lines
- ✓ Noticeable improvement in Implementation

When completed, they are expected to unlock the Constraints posed to Generation project development

- But Problems / Issues do persist against Early completion
 - ROW issues are persistent
 - Delays due to contract management, forest clearance also need to be expedited

But Momentum is gaining – Things will be Better !!!



Thank
You