

Presentation
on
Nepal Power System
With
Challenges and Opportunity
Task Force-2
16 Feb 2023, Kathmandu
USAID, SAREP

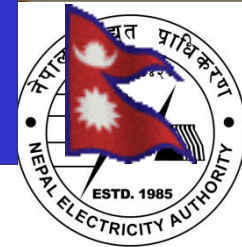
Presented by

Laxmi Jha, Senior Divisional Engineer, MOEWRI

Durga Nanda Bariyait, Director, NEA

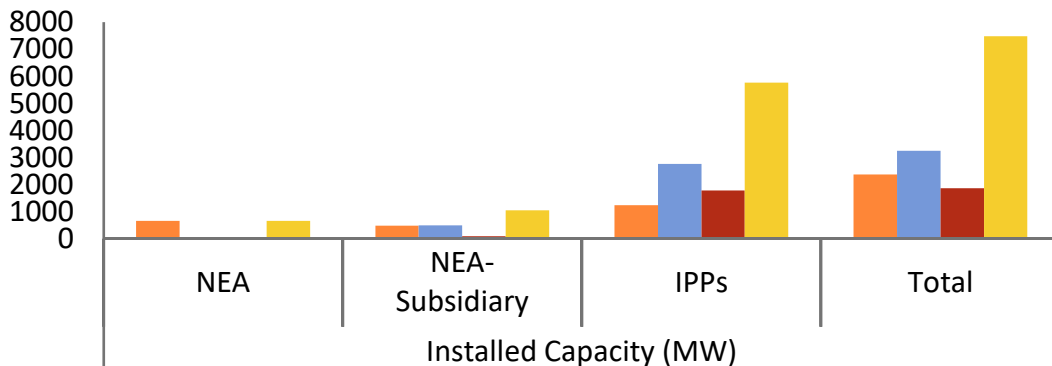


PRESENTATION OUTLINE

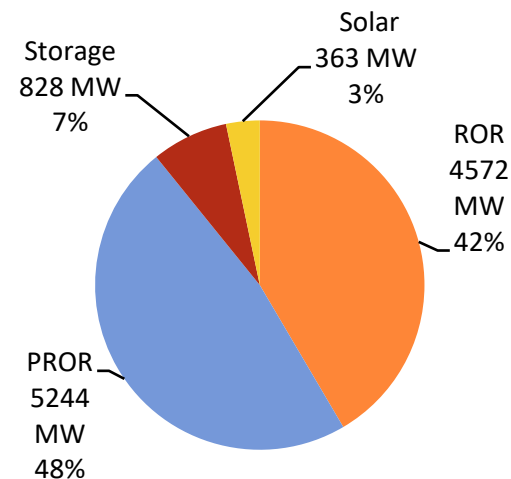


- **Nepal Power System (Present)**
- **Nepal Power System (Future)**
- **Challenges and Opportunity**
- **Way Forward/Conclusion**

POWER PROJECTS IN DIFFERENT STAGES OF DEVELOPMENT



	NEA	NEA-Subsidiary	IPPs	Total
Operation	661	478	1231	2370
Under Construction	0	487	2761	3248
Different Stages	0	86	1776	1862
Total	661	1051	5768	7481

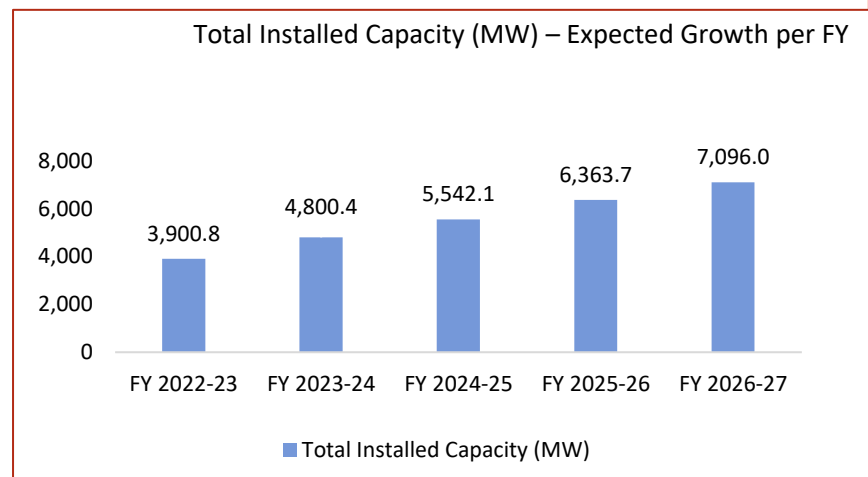


Total PPA Processing: 11007 MW

- Total PPAs Signed for IPPs' Power Projects : 369 (6,820 MW)
- Total Installed Capacity of Nepal (Grid Connected): 2,365 MW
- Installed Capacity of Nepal (Off-grid): 86.536 MW (NEA-4.536 MW, AEPC-82 MW)

Hydro Power Under Study/Development by NEA and its Subsidiary Companies

Projects	Type	Capacity (MW)	Current Status
Upper Arun	PROR	1,061	Access Road/Land Acq.
Dudhkoshi Storage	Storage	635	DED/Land Acq.
Tamakoshi V	PROR	99.8	Camp/Bidding
Upper Modi & Upper Modi A	RoR	60.2	Camp/Bidding
Chainpur Seti	PROR	210	DPR/Land Acq.
Arun 4 HEP	PROR	490	FS/EIA
Total		2,556	



Power status of Nepal - Present Scenario

- **Peak Demand: 1830 MW (February 08, 2023)**
- **Total Energy demand FY 2021/22: 10,686.17 GWh**
- **Total Energy Import FY 2021/22: 1,543.28 GWh**
- **Total Energy Export FY 2021/22: 493.60 GWh**
- **Per Capita Electricity Consumption: 235 kWh**
- **Access to Electricity: 92.51% (Grid)**
- **System Loss FY 2021/22 : 15.38%**
- **Kathmandu Valley Peak Load (January 28, 2023): 497 MW**

EXISTING TRANSMISSION LINE LENGTH

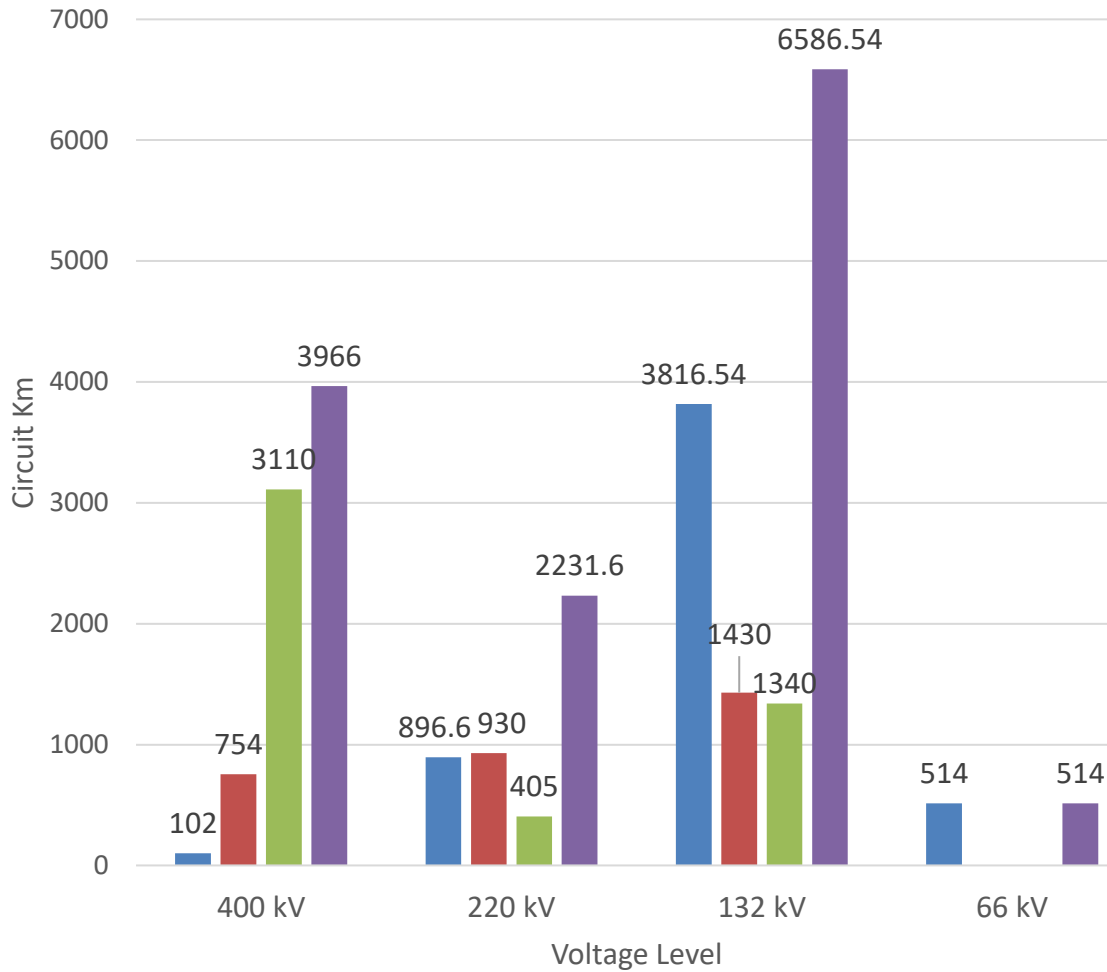
S.N.	FY	Circuit km				Total	Total Increment (ckt. Km)
		66 kV	132 kV	220 kV	400 kV		
1	2071/072	494	2130			2624	
2	2072/073	494	2417			2911	287
3	2073/074	494	2596	75	78	3243	332
4	2074/075	514	2717	75	78	3384	141
5	2075/076	514	3142.5	255	78	3989.50	606
6	2076/077	514	3240	437	78	4269	279.50
7	2077/078	514	3540.54	741.20	78	4874	604.74
8	2078/079	514	3816.54	896.60	102.00	5329	455.40
Total Increment in Eight Years							2705.44



EXISTING SUBSTATION CAPACITY

S.No	Voltage Rating (kV)	Total Capacity FY 077-78 (MVA)	Total Capacity FY 078-79 (MVA)	Total Increment (MVA)
1	400/220	945	945	0
2	220/132	1150	1350	200
3	132/66	635.40	610.40	-25
4	132/33	2082.00	2487.00	405
5	132/11	462.50	470.00	7.5
6	66/33	42.50	52.50	10
7	66/11	596.50	608.50	12
8	33/11	520.0	625.2	105.2
	Total	6433.90	7148.60	714.7

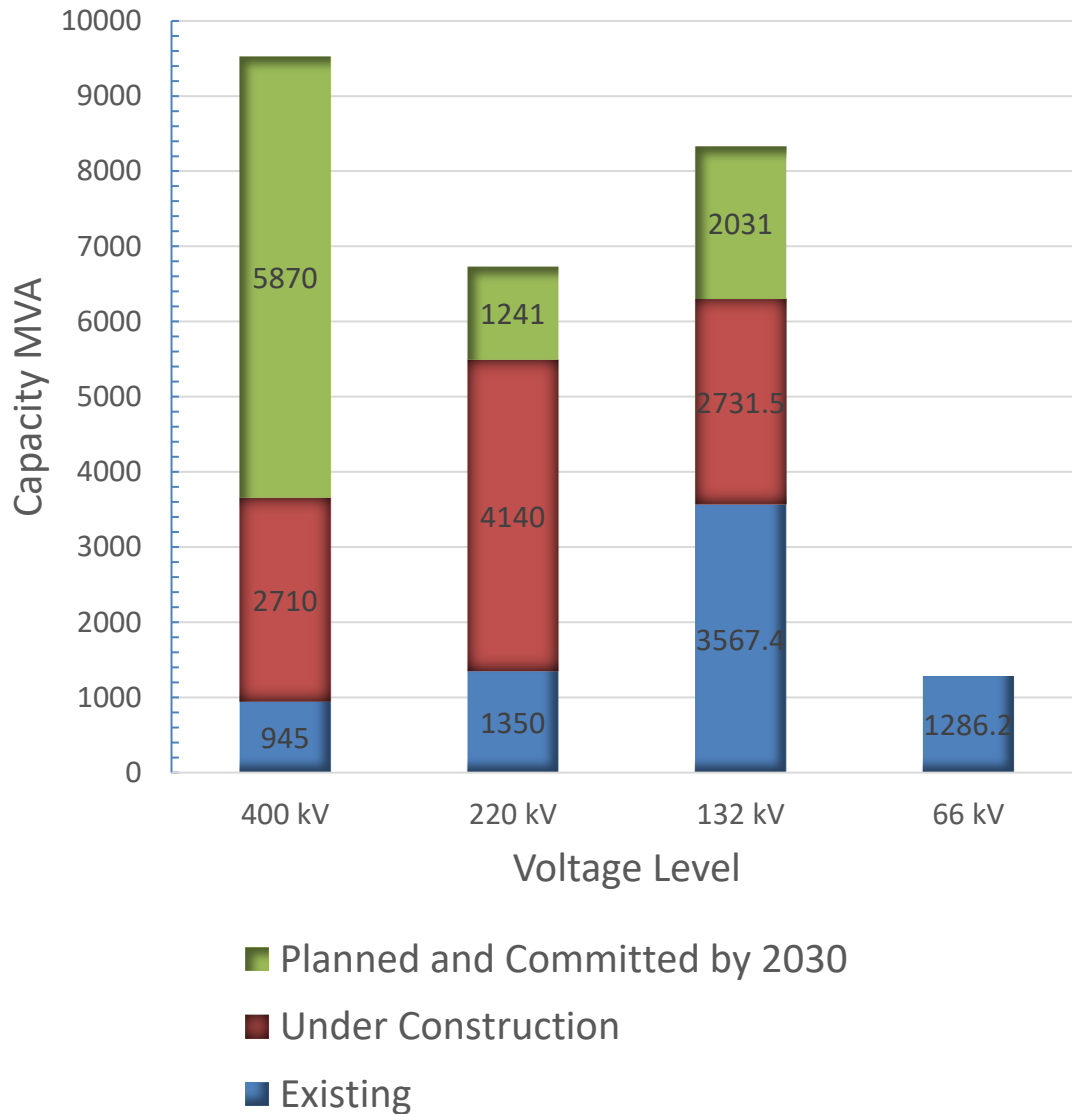
Transmission Line Expansion Plan



S.N.	Description	Voltage Level (kV)				Total (Ckt. km)
		400	220	132	66	
1	Existing	102	896.6	3816.54	514	5329
2	Under Construction	754	930	1430		3114
3	Planned and Committed by 2030	3110	405	1340		4855
Total		3966	2231.6	6586.54	514	13298

■ Existing
 ■ Under Construction
 ■ Planned and Committed by 2030
 ■ Total

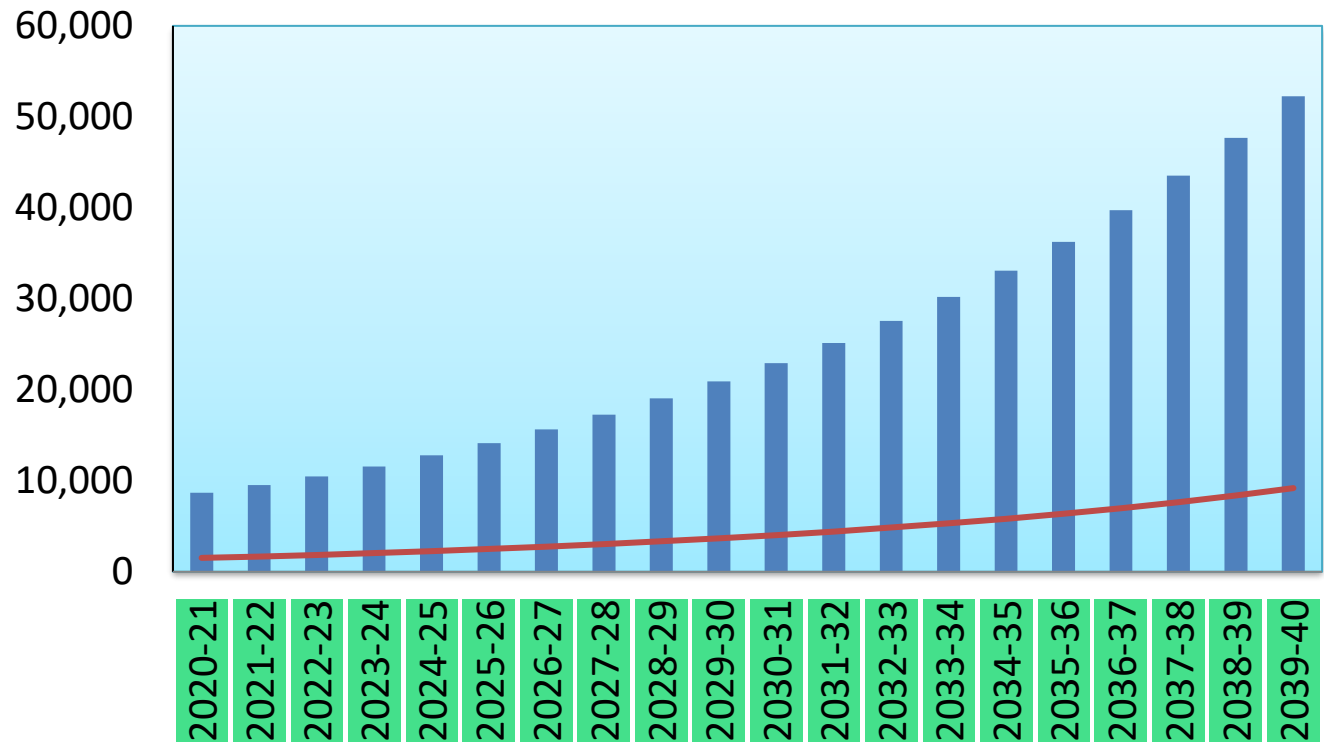
Substation Expansion Plan



S. N.	Description	Voltage Level (kV)				Total (MVA)
		400	220	132	66	
1	Existing	945	1350	3567.4	1286.2	7148.6
2	Under Construction	2710	4140	2731.5		9581.5
3	Planned and Committed by 2030	5870	1241	2031		9142
Total		9525	6731	8329.9	1286.2	25872.1

NEA'S LOAD FORECAST

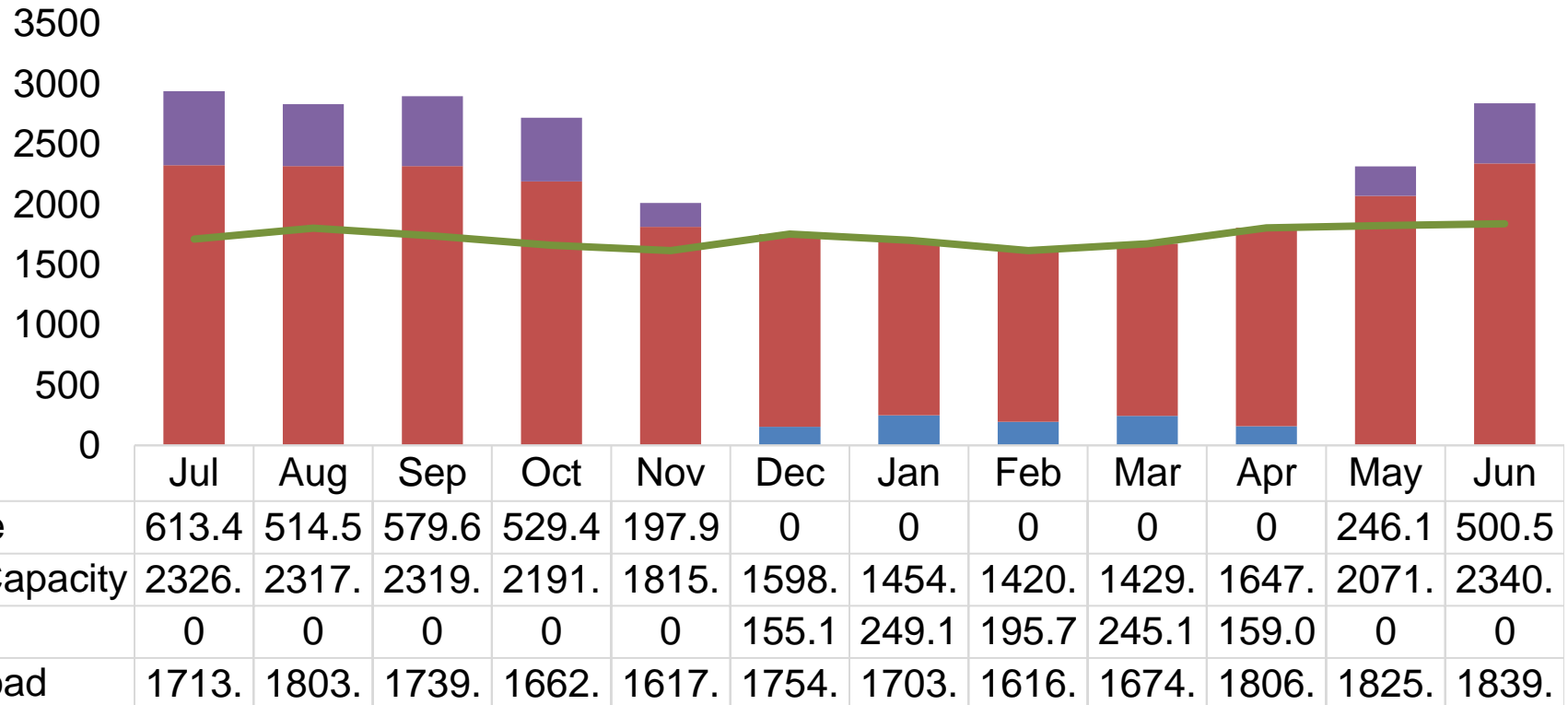
Fiscal Years	Total Generation Requirement (GWh)	System Peak Load (MW)
2020-21	8,678.2	1,524.1
2021-22	9,514.4	1,671.0
2022-23	10,476.5	1,839.9
2023-24	11,568.6	2,031.7
2024-25	12,802.2	2,248.4
2025-26	14,132.7	2,482.0
2026-27	15,625.2	2,744.2
2027-28	17,265.4	3,032.2
2028-29	19,070.5	3,349.2
2029-30	20,914.1	3,673.0
2030-31	22,931.6	4,027.3
2031-32	25,139.6	4,415.1
2032-33	27,556.4	4,839.5
2033-34	30,201.7	5,304.1
2034-35	33,097.5	5,812.7
2035-36	36,267.6	6,369.5
2036-37	39,738.4	6,979.0
2037-38	43,538.5	7,646.4
2038-39	47,699.4	8,377.1
2039-40	52,255.8	9,177.4



■ Total Generation Requirement (GWh) — System Peak Load (MW)

Energy/Capacity Simulation - FY 2022/23

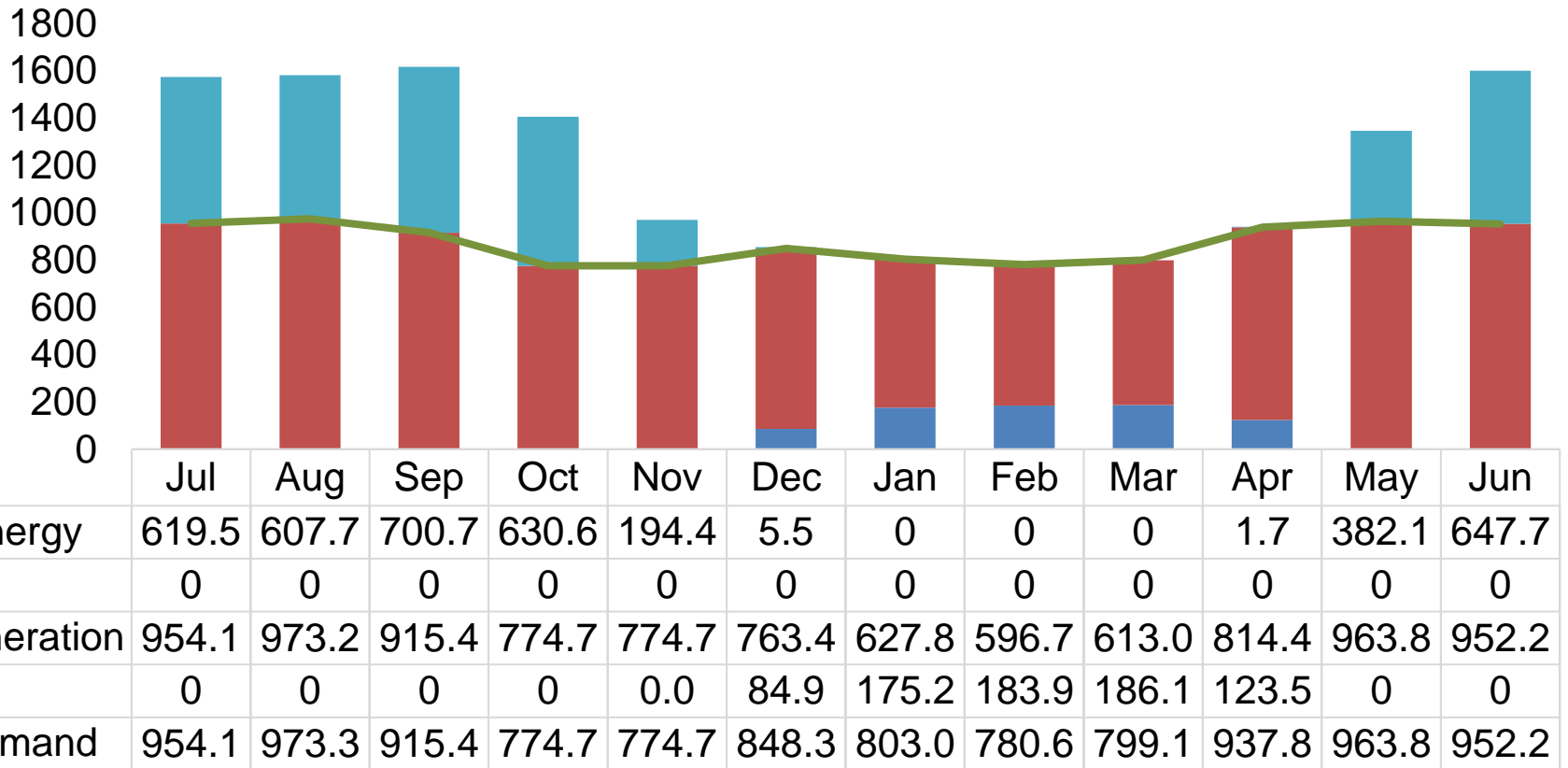
Capacity (MW)



Maximum Import Quantity (MW)	249.1
Maximum Peak Load (MW)	1839.9

Energy/Capacity Simulation - FY 2022/23

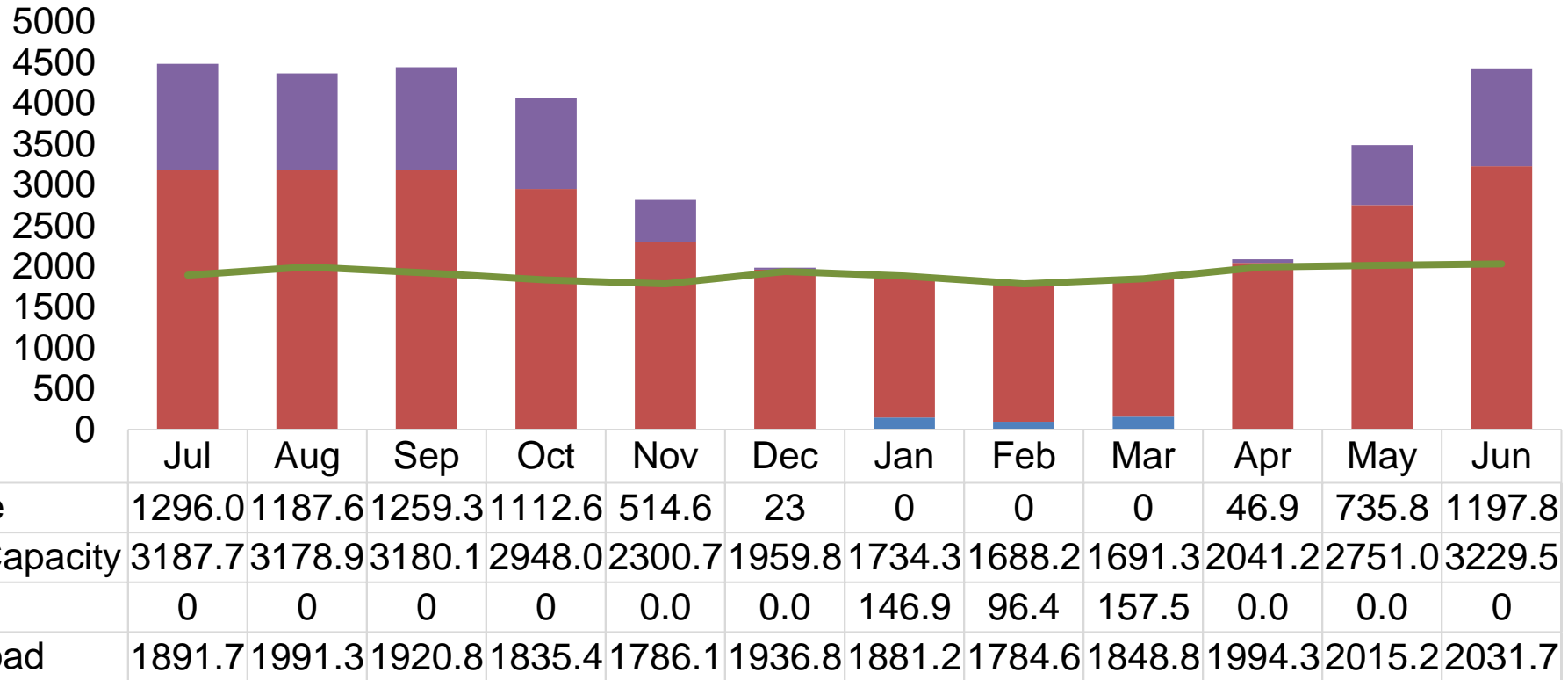
Energy (GWh)



Total Import (GWhr)	754
Surplus Energy (GWhr)	3,790
Export(+)/Import(-) (GWhr)	3,036

Energy/Capacity Simulation - FY 2023/24

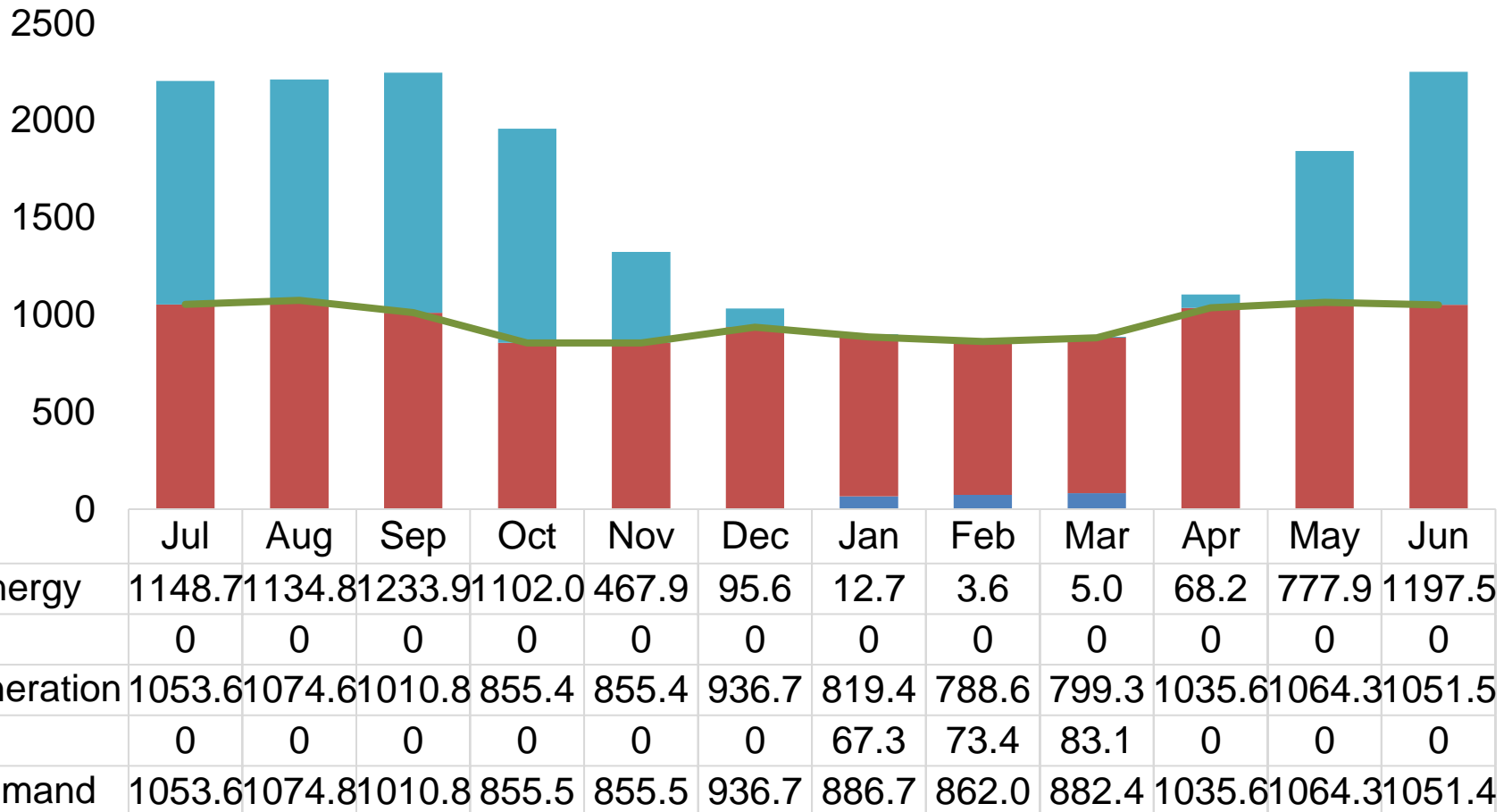
Capacity (MW)



Maximum Import Quantity (MW)	157.5
Maximum Peak Load (MW)	2031.7

Energy/Capacity Simulation - FY 2023/24

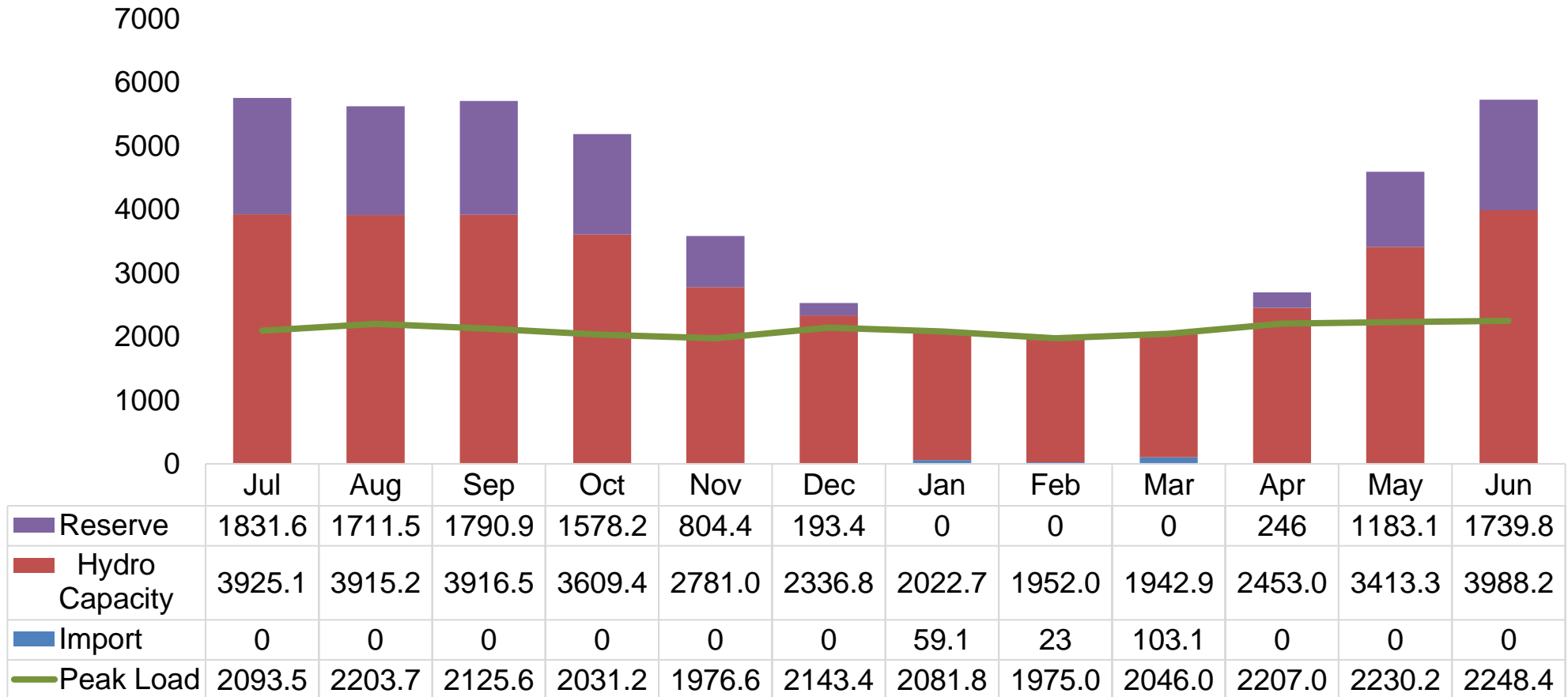
Energy (GWh)



Total Import (GWhr)	224
Surplus Energy (GWhr)	7,248
Export(+)/Import(-) (GWhr)	7,024

Energy/Capacity Simulation - FY 2024/25

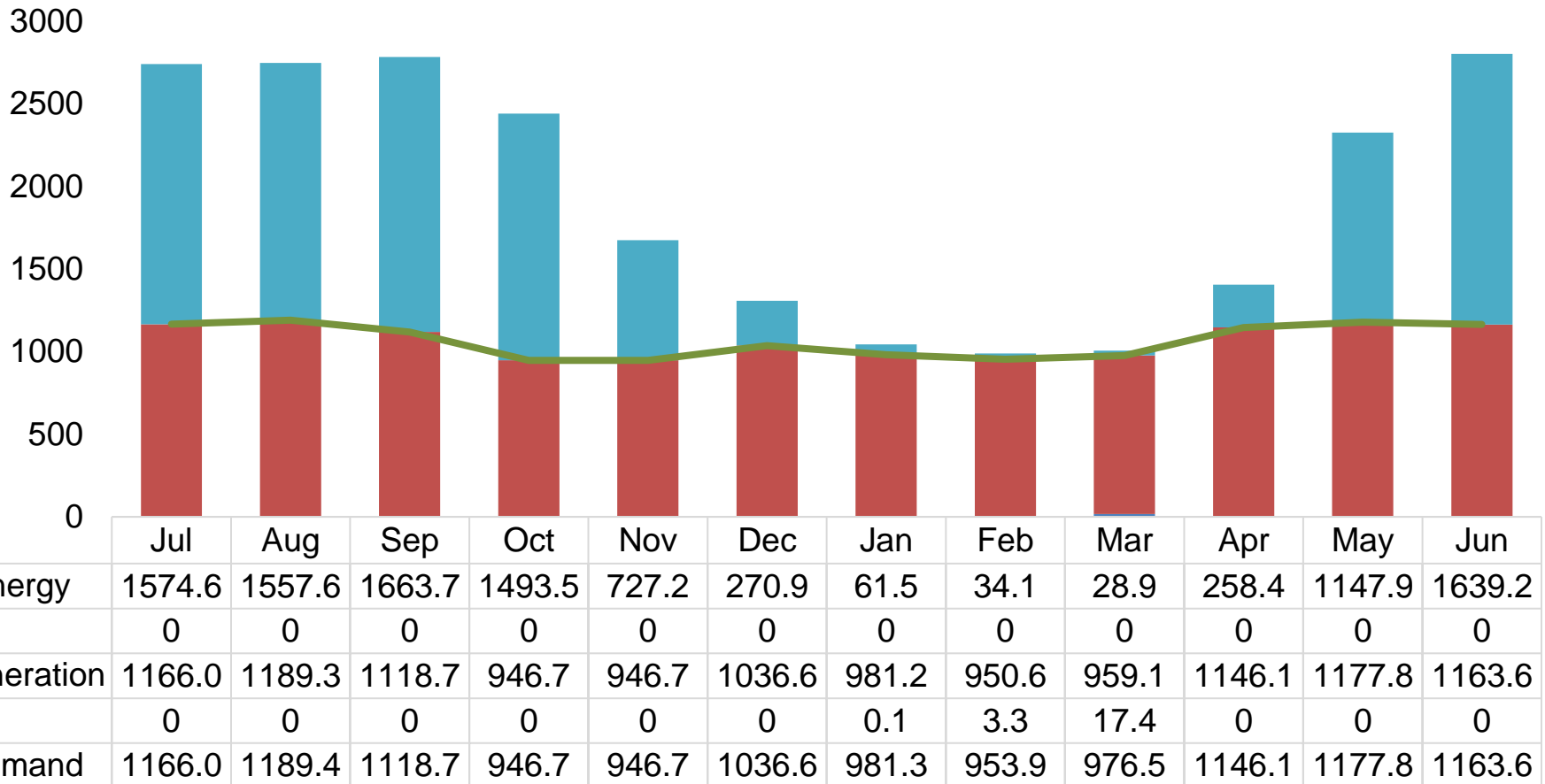
Capacity (MW)



Maximum Import Quantity (MW)	103.1
Maximum Peak Load (MW)	2248.4

Energy/Capacity Simulation - FY 2024/25

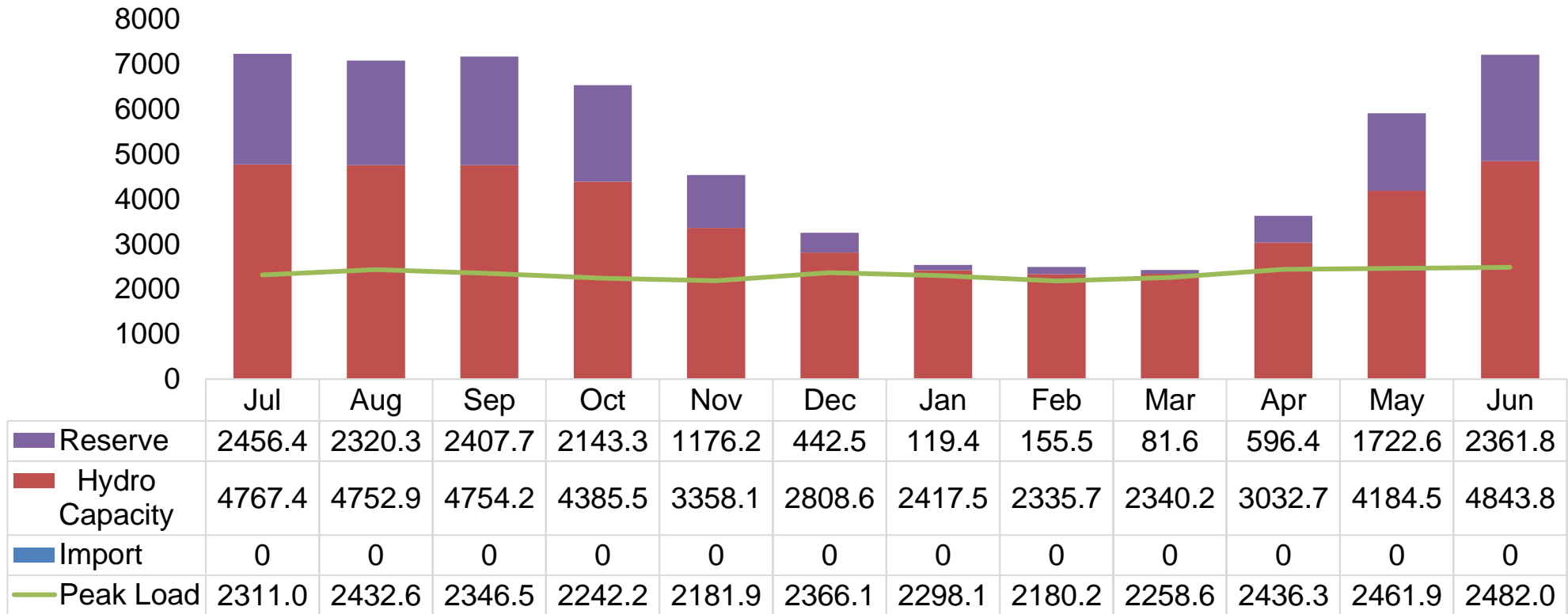
Energy (GWh)



Total Import (GWhr)	21
Surplus Energy (GWhr)	10,458
Export(+)/Import(-) (GWhr)	10,437

Energy/Capacity Simulation - FY 2025/26

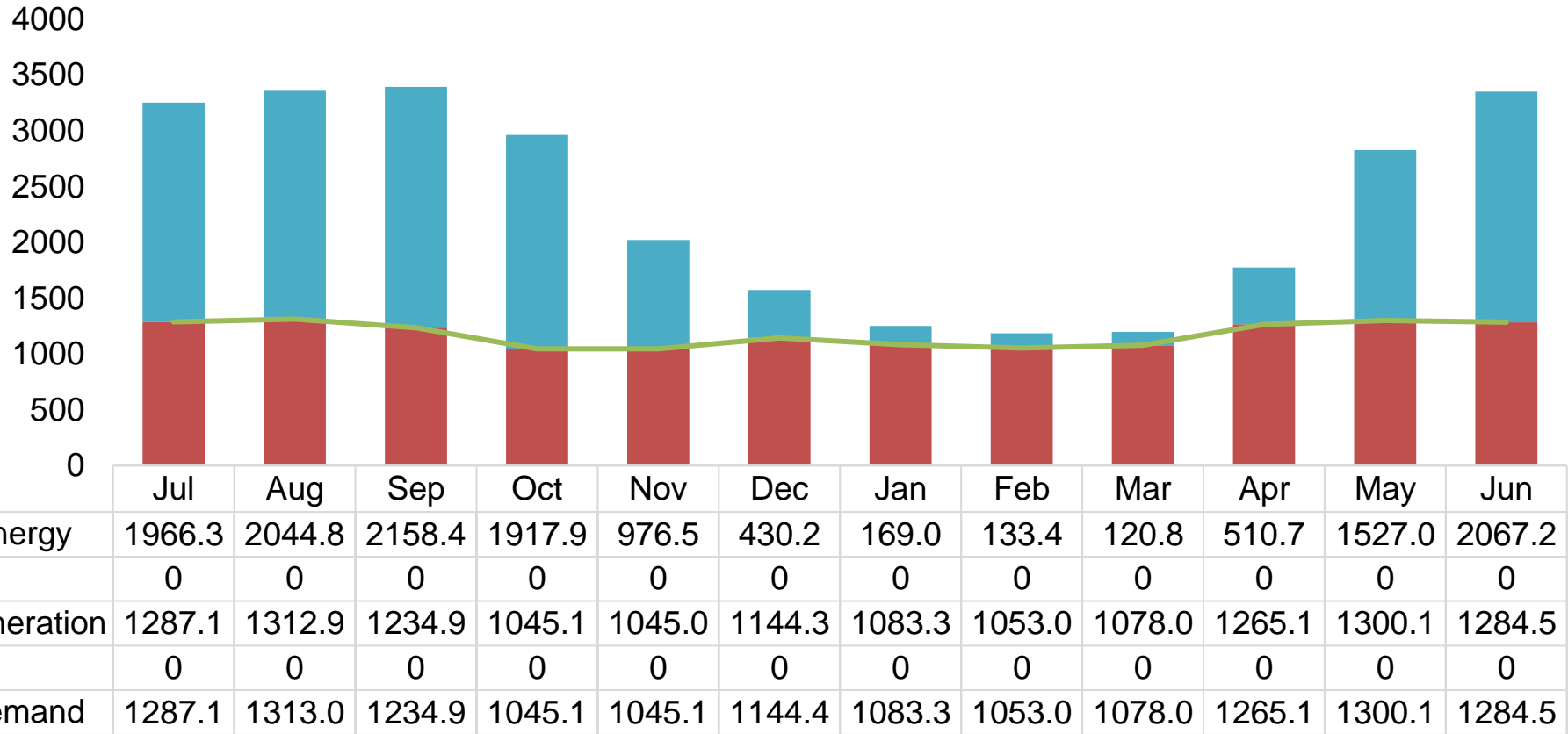
Capacity (MW)



Maximum Import Quantity (MW)	0.0
Maximum Peak Load (MW)	2482.0

Energy/Capacity Simulation - FY 2025/26

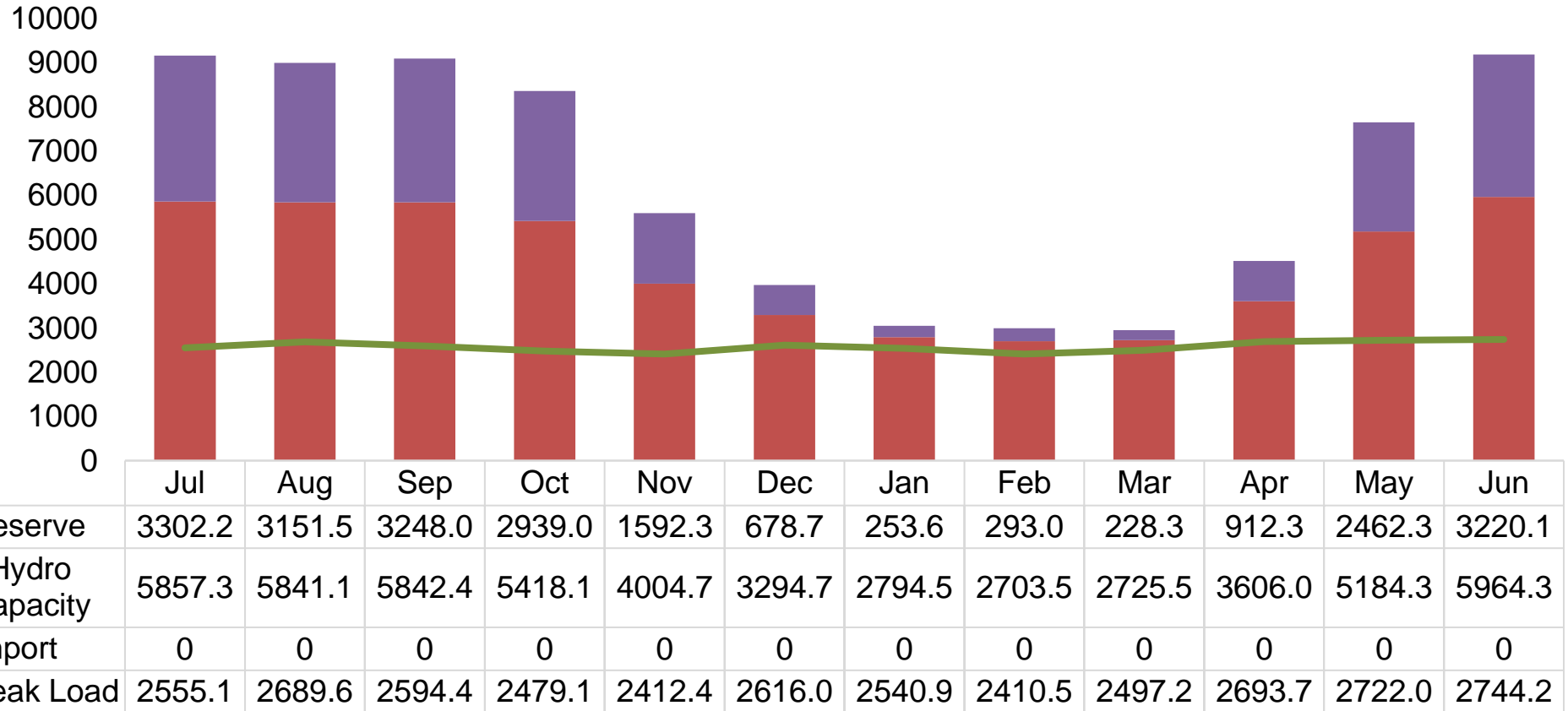
Energy (GWh)



Total Import (GWhr)	0
Surplus Energy (GWhr)	14,022
Export(+)/Import(-) (GWhr)	14,022

Energy/Capacity Simulation - FY 2026/27

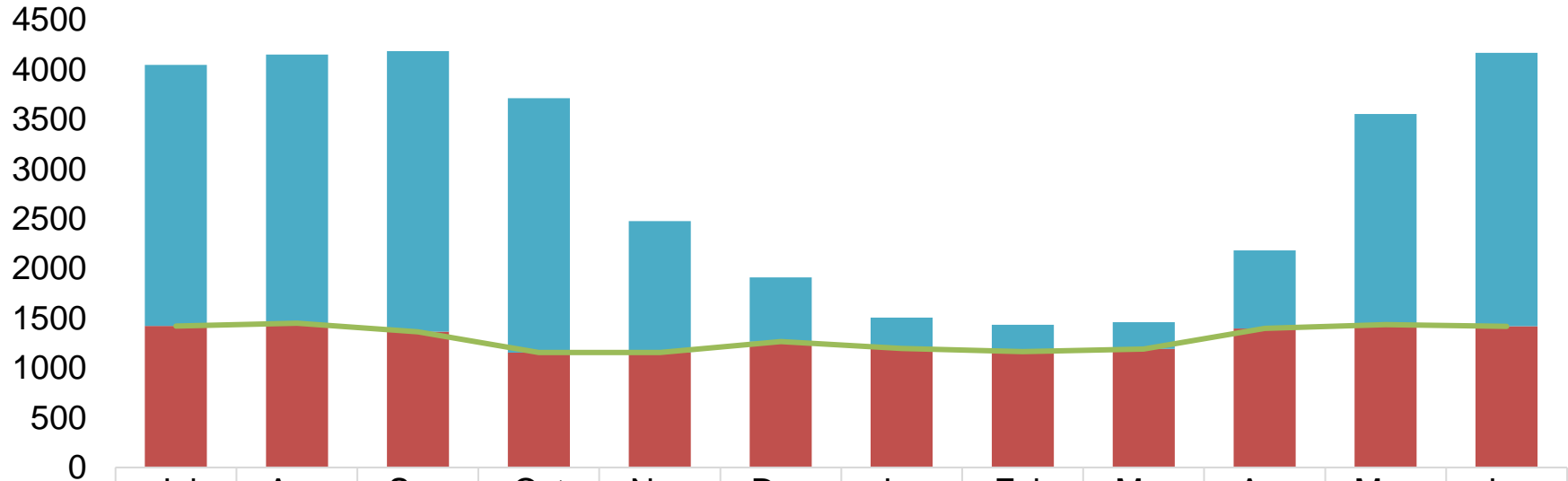
Capacity (MW)



Maximum Import Quantity (MW)	0.0
Maximum Peak Load (MW)	2744.2

Energy/Capacity Simulation - FY 2026/27

Energy (GWh)

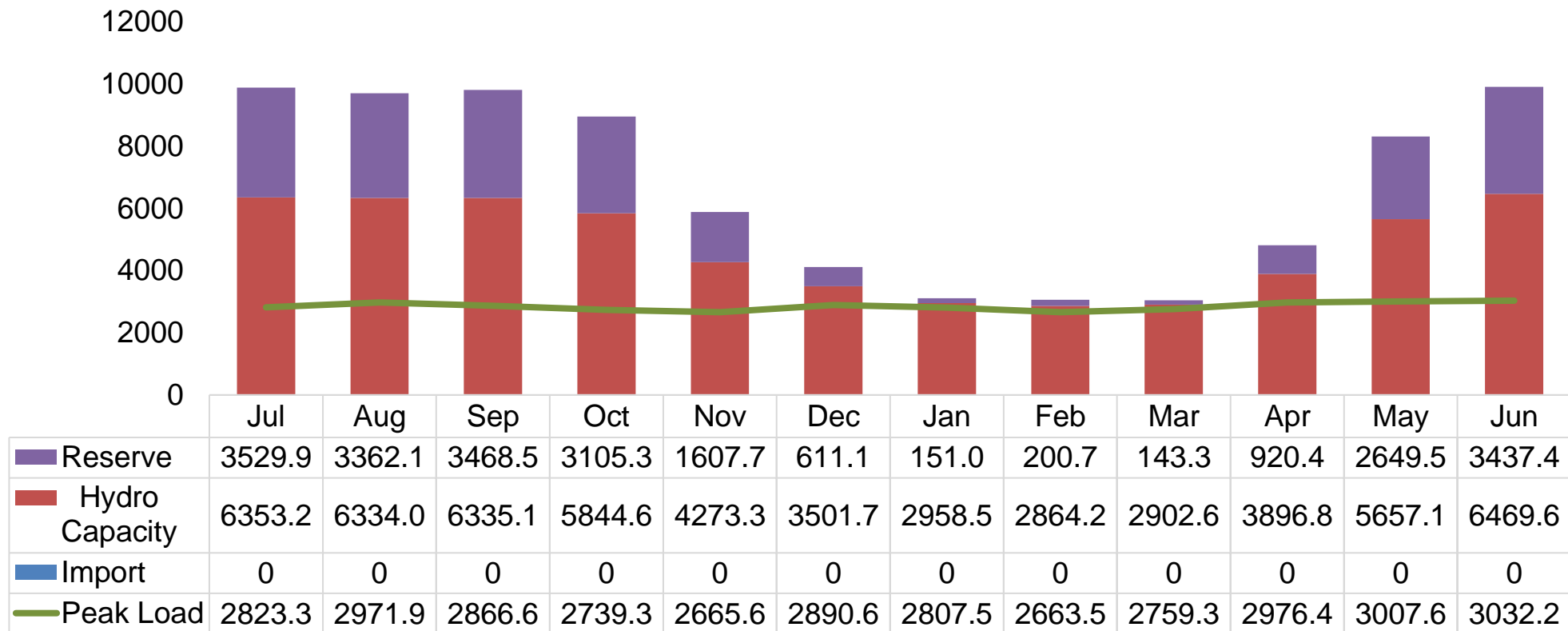


	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Surplus Energy	2625.0	2699.5	2821.4	2559.3	1323.4	645.9	309.3	270.3	268.7	784.6	2118.5	2749.3
ENS	0	0	0	0	0	0	0	0	0	0	0	0
Hydro Generation	1423.1	1451.7	1365.3	1155.5	1155.4	1265.2	1197.7	1164.3	1191.9	1398.8	1437.5	1420.2
Import	0	0	0	0	0	0	0	0	0	0	0	0
Energy Demand	1423.1	1451.7	1365.3	1155.5	1155.5	1265.2	1197.7	1164.3	1191.9	1398.8	1437.5	1420.1

Total Import (GWhr)	0
Surplus Energy (GWhr)	19,175
Export(+)/Import(-) (GWhr)	19,175

Energy/Capacity Simulation - FY 2027/28

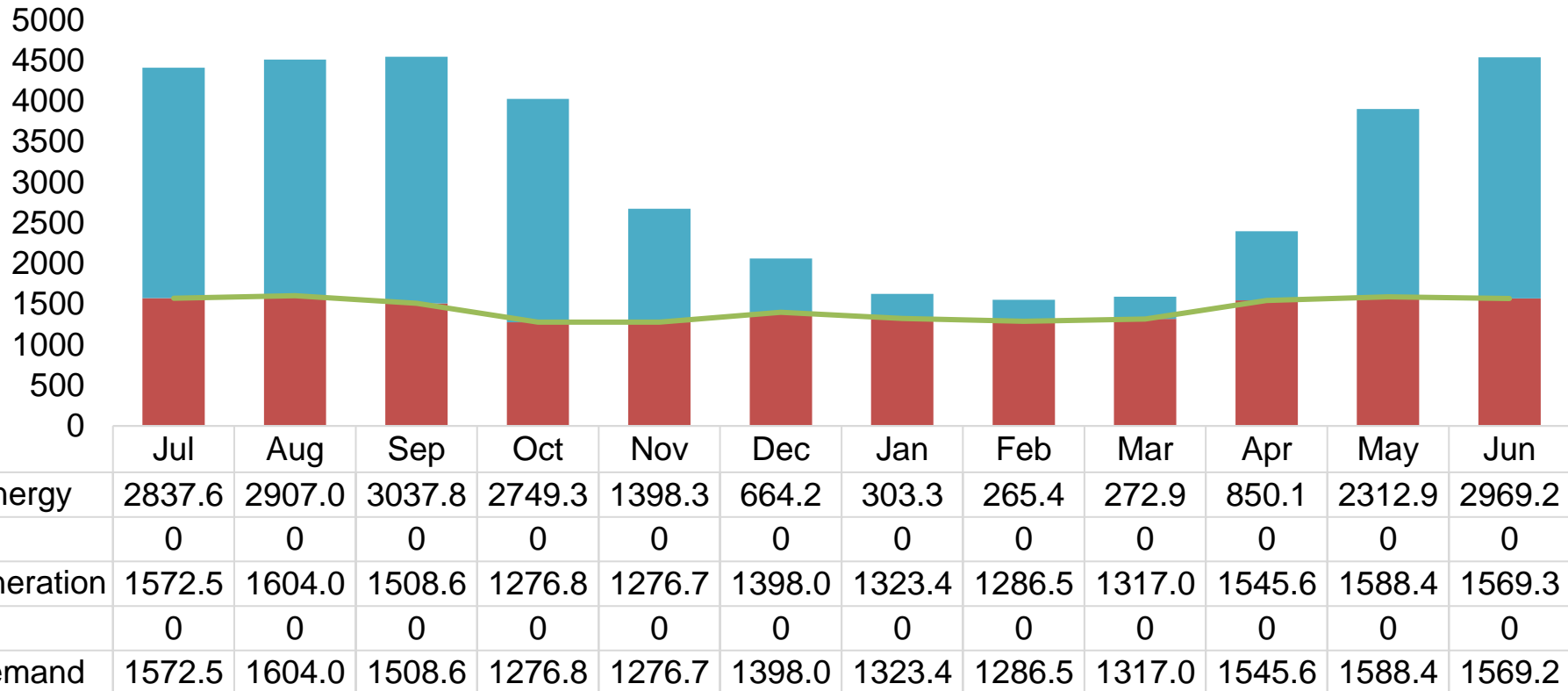
Capacity (MW)



Maximum Import Quantity (MW)	0.0
Maximum Peak Load (MW)	3032.2

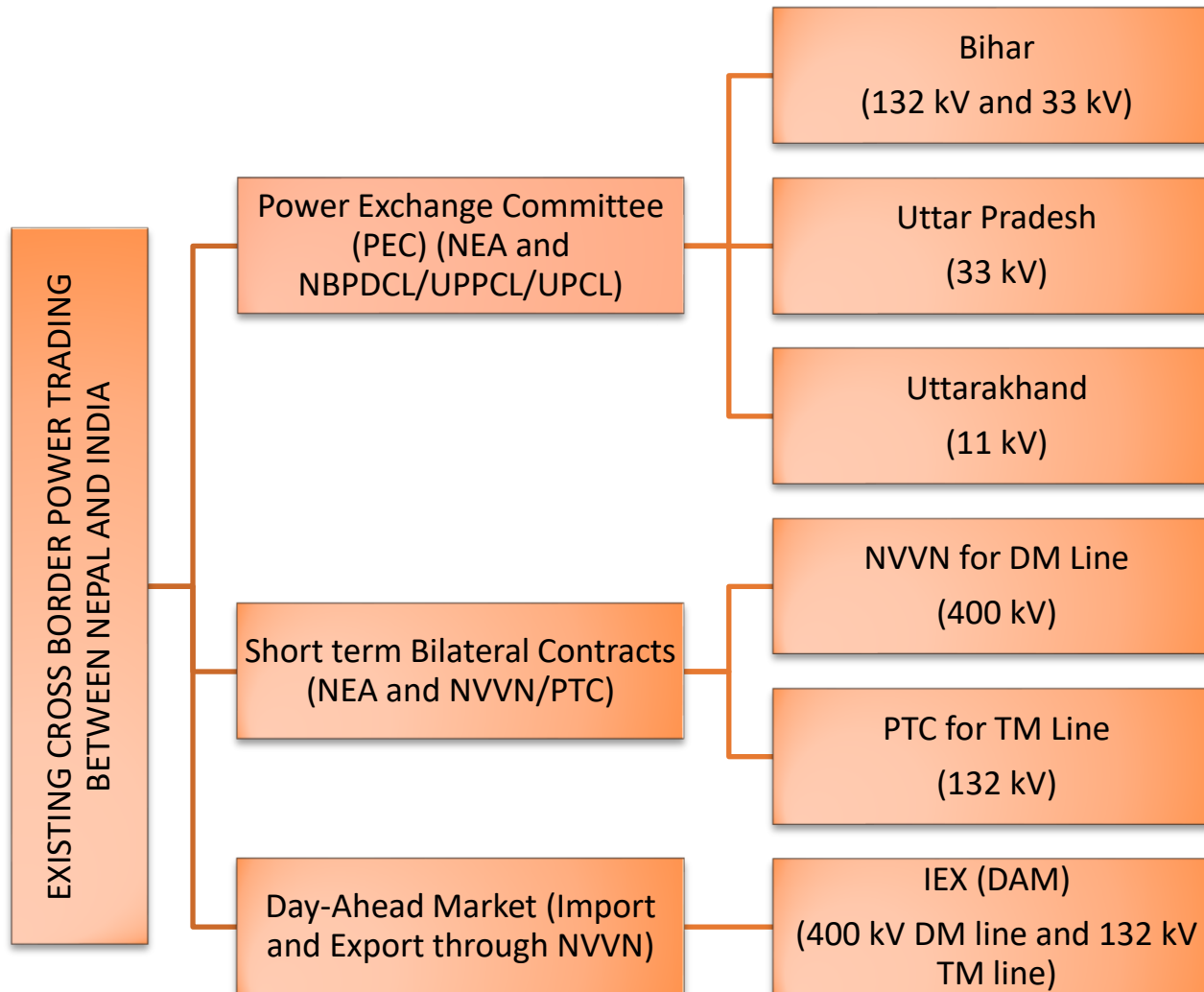
Energy/Capacity Simulation - FY 2027/28

Energy (GWh)



Total Import (GWhr)	0.0
Surplus Energy (GWhr)	20,568
Export(+)/Import(-) (GWhr)	20,568

CROSS BORDER POWER TRADE AND EXCHANGE (Between Nepal and India)



- PTC since 2008 & NVVN since 2016
- Import up to 350 MW from IEX (DAM) since May 1, 2021
- Export for 39 MW since November 3, 2021
- Export for total 462 MW since June 2, 2022

OPTIONS FOR
CROSS BORDER
POWER TRADING
AS PER INDIA'S
GUIDELINES FOR
IMPORT/EXPORT
(CROSS BORDER)
OF ELECTRICITY -
2018

- **G2G Agreement** : No such agreements signed yet for exporting power to India
- **Tripartite Agreement** : Nepal has requested India for tripartite meeting among Nepal, India and Bangladesh, but it has not taken place yet.
- **Competitive bidding** : NEA participated in a bidding to sell power from Upper Bhotekoshi HEP through NVVN but was not issued Lol.
- **Mutual agreement between entities** : NEA has signed term agreements with NVVN and PTC on annual basis.
- **Day ahead market in IEX:** NEA started to import power up to 350 MW from IEX (DAM) since May 1, 2021 subsequent to the issuance of DA's Procedure by India on Feb 26, 2021, export for 39 MW has been started since November 2021. Now, 507 MW from eleven different power plants has been agreed to export power to India.



AGREEMENT WITH INDIA FOR POWER EXPORT

S.N.	Name of Powerplant	Capacity (MW)
1	Kaligandaki	144
2	Middle Marshyandi	70
3	Marshyandi	69
4	Trishuli	24
5	Devighat	15
6	Likhu IV	52.4
7	Upper Solu	23.5
8	Mistri Khola	42
9	Chilime	22.1
10	Kabeli B1	25
11	Lower Modi	20
Total		507



EXISTING CROSS BORDER LINKS AND QUANTUM OF POWER

Interconnection Points	Voltage Level (kV)	Import /Export Power Capacity (MW)
Dhalkebar Muzzafarpur	400	600
Kataiya – Kusaha	132	120
Kataiya – Kusaha II	132	85
Raxaul-Parwanipur	132	90
Ramnagar-Gandak	132	65
Tanakpur-Mahendranagar	132	75
33 kV and 11 kV other import	33 & 11	45
Total		1080

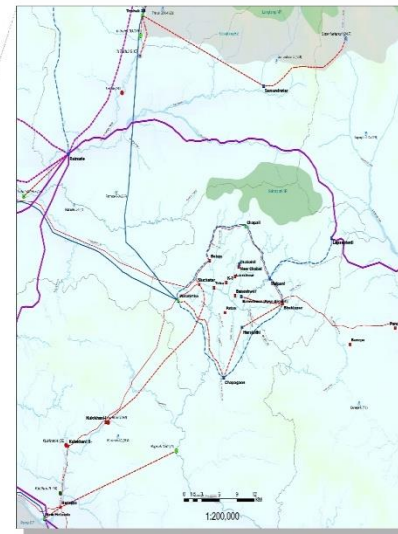
INDIA-NEPAL 400 kV CROSS-BORDER TRANSMISSION LINES

Time-frame	India – Nepal Cross-Border Interconnection
Existing	Muzaffarpur – Dhalkebar 400kV D/C (Twin) line
Aug'23	Sitamarhi – Dhalkebar 400kV D/C (Quad) line: <i>being taken by M/s SAPDC (developer of Arun-3 HEP)</i>
2025-26	Gorakhpur – New Butwal 400kV D/C (Quad) line: <i>being taken up by JV of NEA and POWERGRID</i>
2026-27	Purnea (New) – Inaruwa 400kV D/C (Quad) line
2027-28	Bareilly – Lamki (Dododhara) 400kV D/C (Quad) line



Nepal Power Transmission Network Map

400 kV Transmission Line Between Nepal and India



Bareilly

Lucknow

Gorakhpur

Muzaffarpur

Purnea

LEGEND

NEPAL HYDROPOWER PLANTS

- CONSTRUCTION LICENSE APPLICATION
- SURVEY LICENSE APPLICATION
- CONSTRUCTION LICENSE
- IN OPERATION
- GOVERNMENT RESERVED PROJECT
- SURVEY LICENSE
- UNDER CONSTRUCTION

NEPAL SUBSTATIONS

- EXISTING 545
- UNDER CONSTRUCTION 545
- FUTURE 545

TRANSMISSION LINES

- EXISTING UNDER CONSTRUCTION 400 KV
- EXISTING UNDER CONSTRUCTION 220 KV
- EXISTING 132 KV

PROTECTED AREAS

- SUPPLY ZONE
- CONSERVATION AREA
- HUNTING RESERVE
- NATIONAL PARK
- MULIUPA RESERVE

Copyright © Nepal Electric Power Corporation Ltd. All Rights Reserved. 2073
7/10/22, 2:42:10 PM
Scale: 1:1,500,000
Date: 10/20/22
Author: [Name]
Project: [Name]

INDIA

CHINA

Prospects for sharing energy resources

- Nepal, India, Bhutan, Bangladesh and Sri Lanka have **diverse** energy resources.
- There exists **supply and demand complementarities** among the countries.
- So, there exists prospects for **sharing of energy resources** by having interconnections of grid among these countries.
- Transmission connectivity is the **minimum requirement** for sharing the resources.
- **Nepal-India, India-Bhutan, and India-Bangladesh** already connected to some extent and there exists some trading/power exchange mechanism.
- Now we also need to work toward the **connectivity beyond the border countries** e.g. **Nepal-Bangladesh** for the optimal utilization of resources.

WHITE PAPER, MOEWRI, 2018

Generation Target of GoN:

3 years	3000 MW
5 years	5000 MW
10 years	15000 MW

Generation Mix:

ROR	30-35%	4500-5250 MW
PROR	25-30%	3750-4500 MW
Storage & Pumped	25-30%	4500-5250 MW
Alternative Sources	5-10%	750-1500 MW





CHALLENGES



- Political and Governance related
- Legal, Institutional and Policy related
 - New Electricity Bill, CBET Guideline
- Infrastructure related
- Financial related
- Market related





CHALLENGES



Infrastructure related

- ❖ Lack of adequate transmission lines.
- ❖ Traditional approach of project specific transmission line development for domestic needs only.
- ❖ Significant difference between planned TL development and actual realized to date.
- ❖ Delay in construction of transmission line projects.





CHALLENGES



Financial related

- ❖ Huge upfront investment is required in Mega projects. Without foreign investments, not possible to develop these projects in Nepal.
- ❖ With foreign investments, the different issues also come together.
 - ❖ Foreign Currency Risk
 - ❖ Repatriation
(If the share is sold in Local currency, only 75% repatriation facility in HDP 2001 but it is not in FITT Act 1992.)
 - ❖ PPA in dollar





CHALLENGES



Market related

- ❖ Relatively small domestic market as compared to other South Asian countries such as India, Bangladesh & Pakistan.
- ❖ Water related issues (tri-partite rights, downstream benefits, use of national resources) supersedes the cross border electricity trade. Ex. Pancheshwar
- ❖ Import duty on electricity and classification of electricity as a “restrictive commodity” for trade.





WAY FORWARD/CONCLUSION



- ❖ Amendment in Electricity Act, 1992 has initiated.
- ❖ Focus on tripartite Agreement
- ❖ Regional Grid Code
- ❖ Expedite the National Grid Code
- ❖ Cross Boarder Transmission Line Project
- ❖ Strengthen the in house System
- ❖ Easy Demand and Supply

“Slow and Steady Win the race”



THANK YOU

