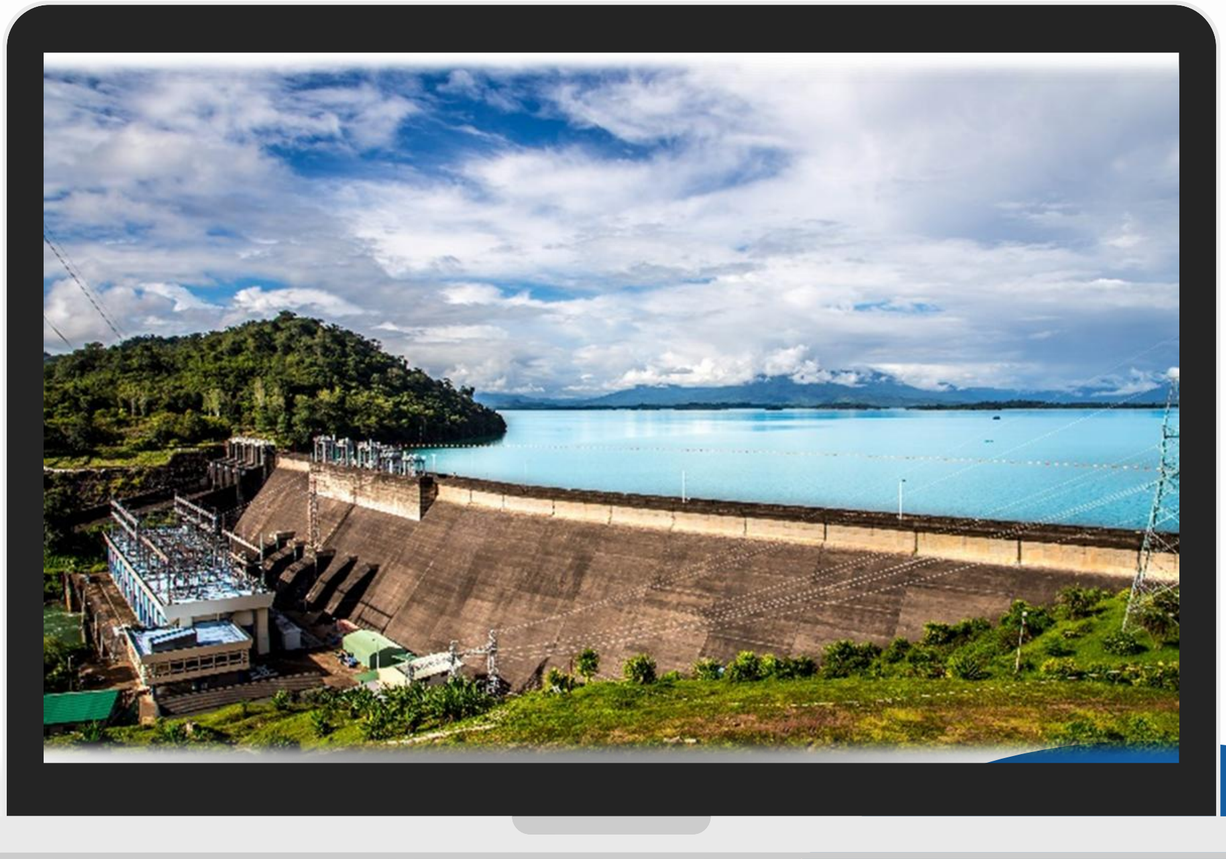
Lao PDR's Power Sector Development and Planning

4th GMS Energy Transition Task Force Meeting
December 10-12, 2024, Jakarta, Indonesia



Ministry of Energy and Mines (MEM)
Électricité Du Laos (EDL)

Overview

- National Power Development Strategy
- Current Status of Power Sector
- Power Development Plan
- Cross Border Interconnection Plan

National Power Development Strategy

01 Develop potential power sources in the country with power generation mixed for domestic use and export

02 Power generation mixed for domestic use come from Hydro accounts for 75%, Coal-based 14% and Renewable Energy 11%

03 Electricity Distribution System Development. The government has set targets of 95% for 2020, 98% for 2025, and 100% for 2030

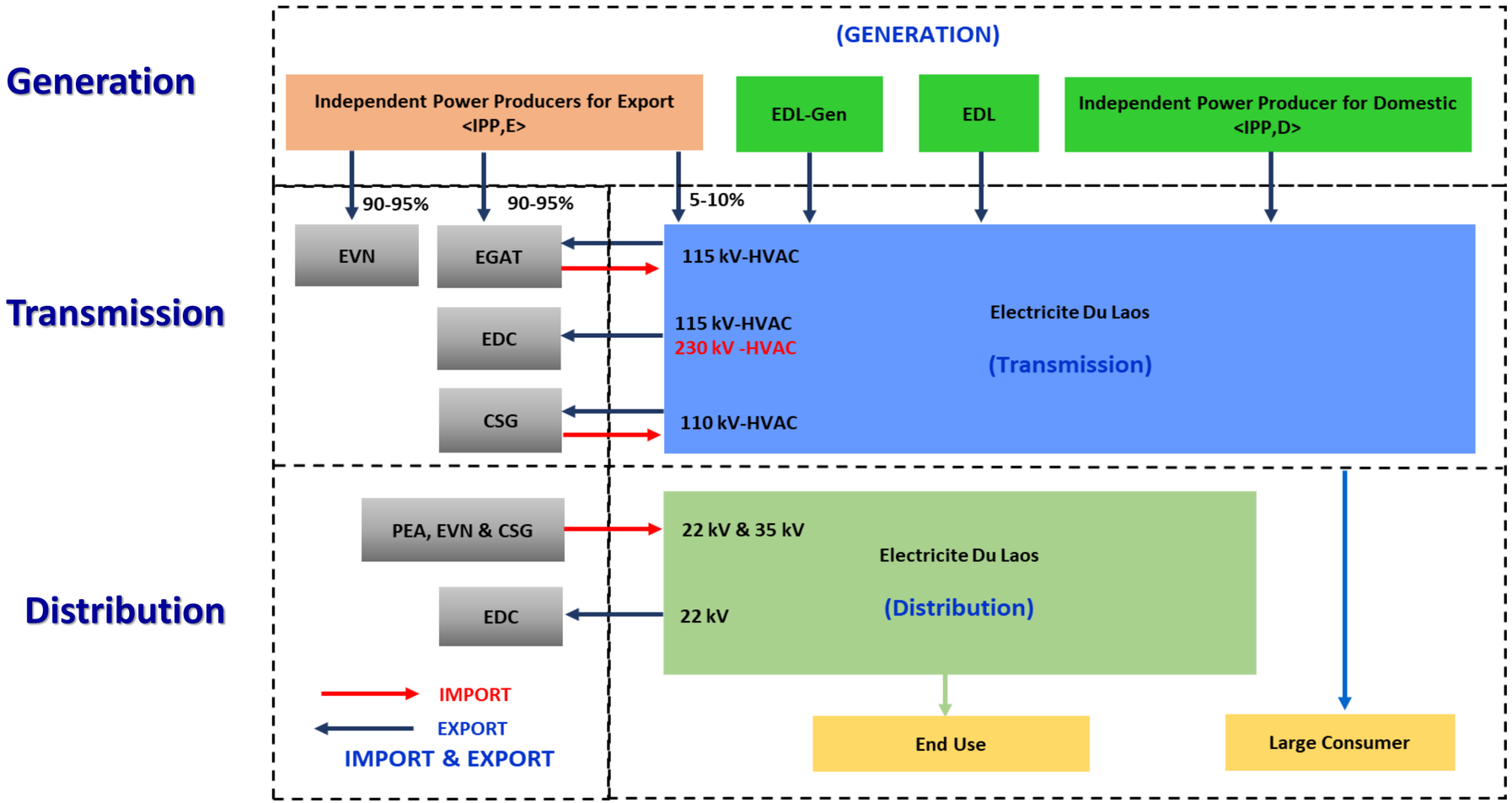
04 Promote power generation for export and power exchange among neighboring countries

05 Promote electricity exportation across GMS countries to achieve under MOU that was signed and the ASEAN Power Grid especially Lao-Thai-Malaysia-Singapore (LTMS) project

06 Promote the use of electrically-powered vehicles in the transportation sector, EV target in 2025 cover 15% of the total vehicle in country and up to 2030 will be increased to 30%

Current Status of power sector

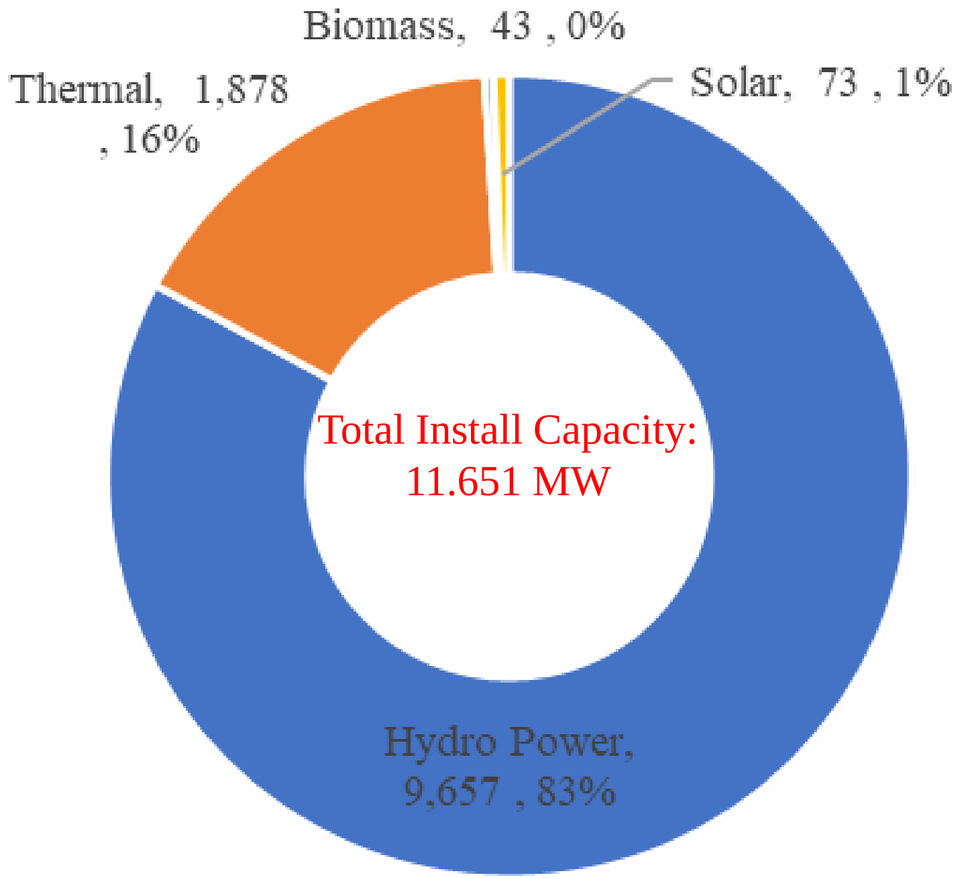
Present Statas of Electricity Supply Industry (ESI) in Laos



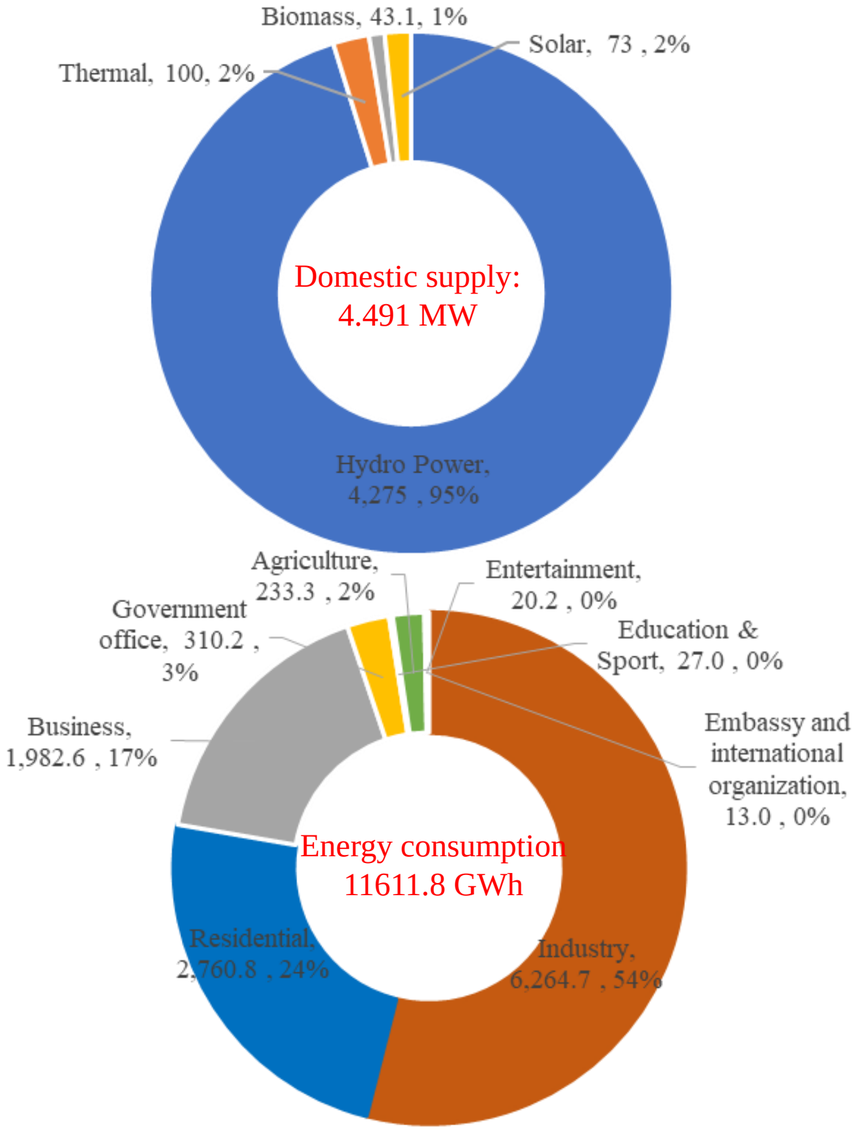
- EVN: Electricity of Vietnam
- EDC: Electricite Du Cambodia
- CSG: China Southern Power Grid
- EGAT: Electricity Generating Authority of Thailand
- PEA: Provincial Electricity Authority

Current situation of power sector

- **Whole country Generation Capacity in 2023**

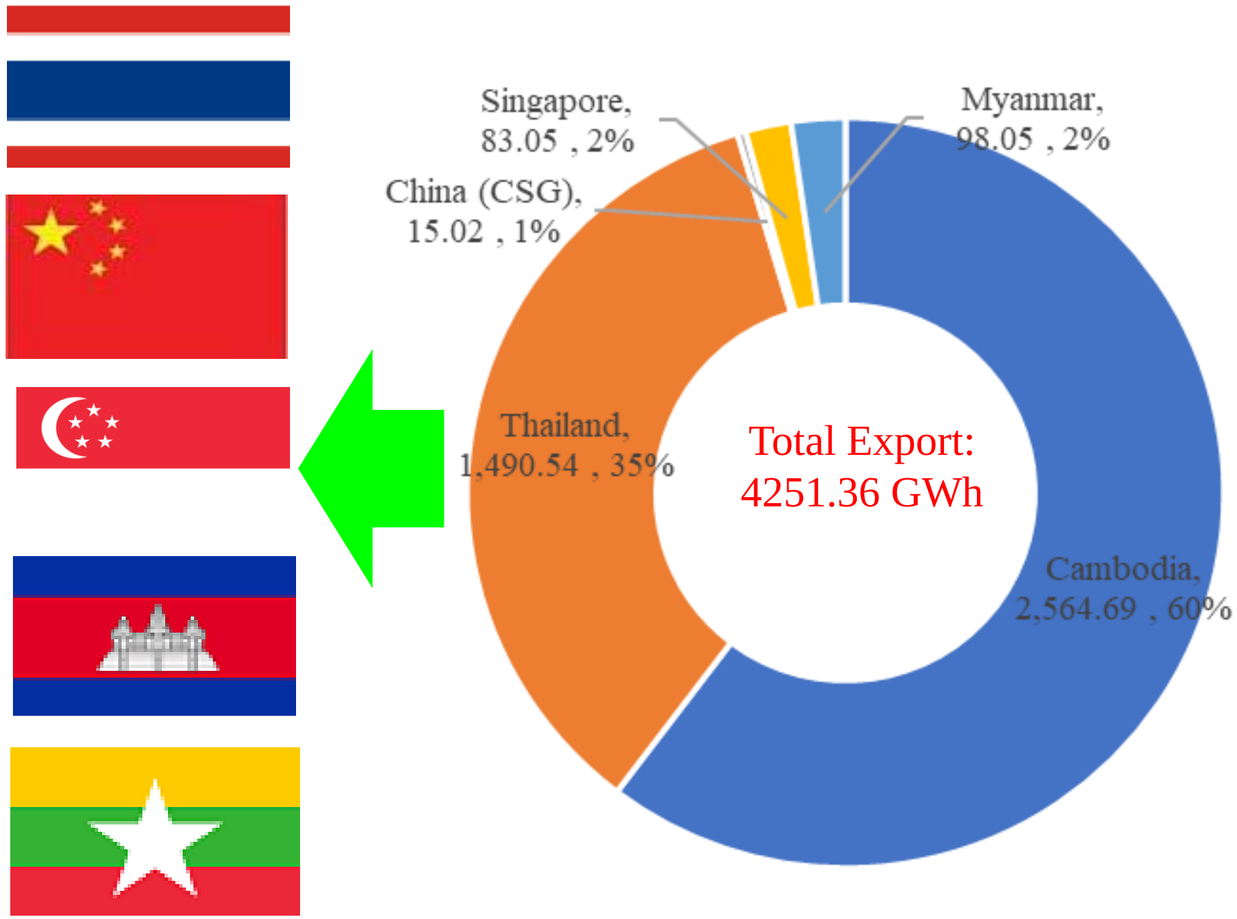


- **Domestic Generation Capacity in 2023**

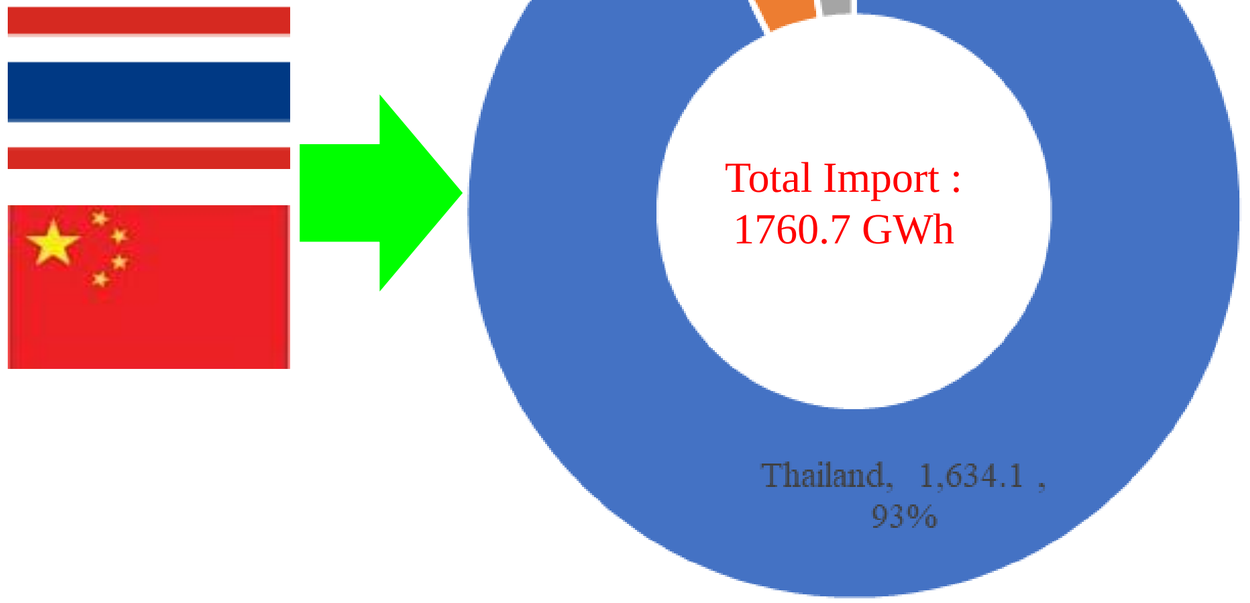


Current situation of power sector

- **Annual Energy Export, 2023 (GWh)**

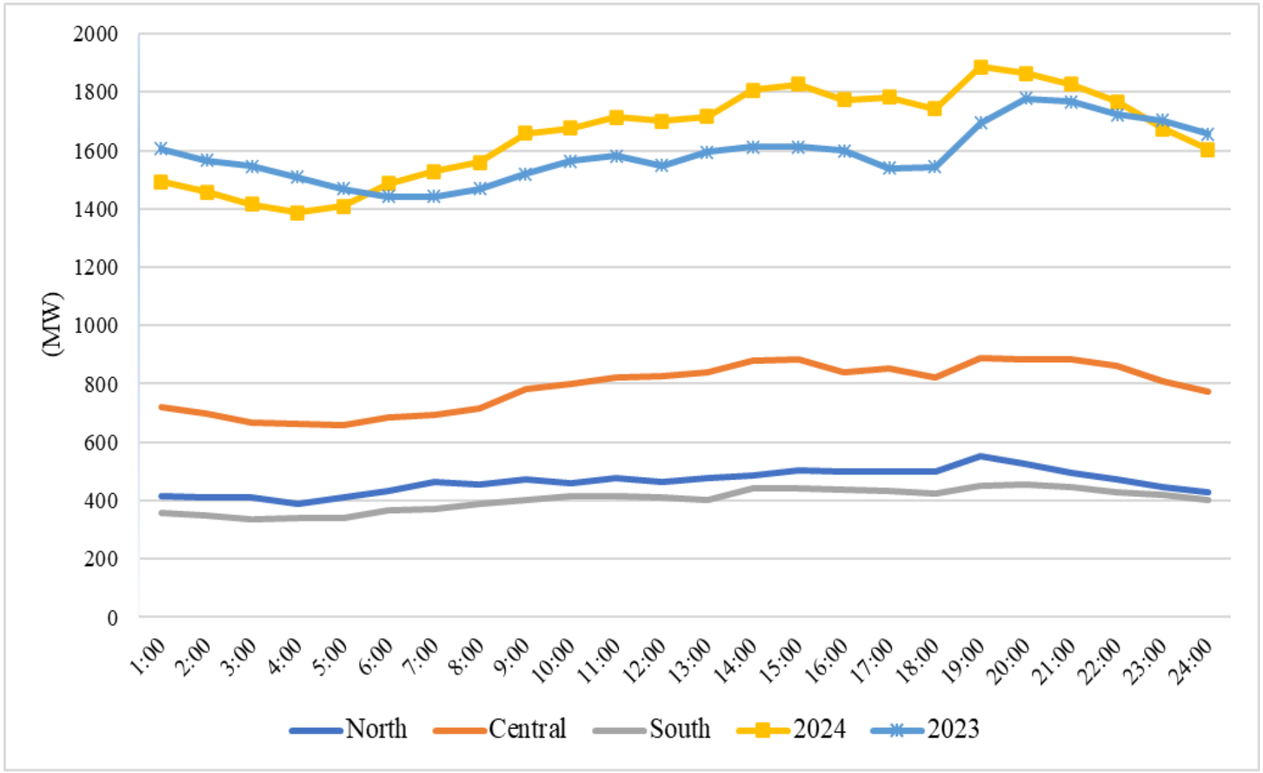


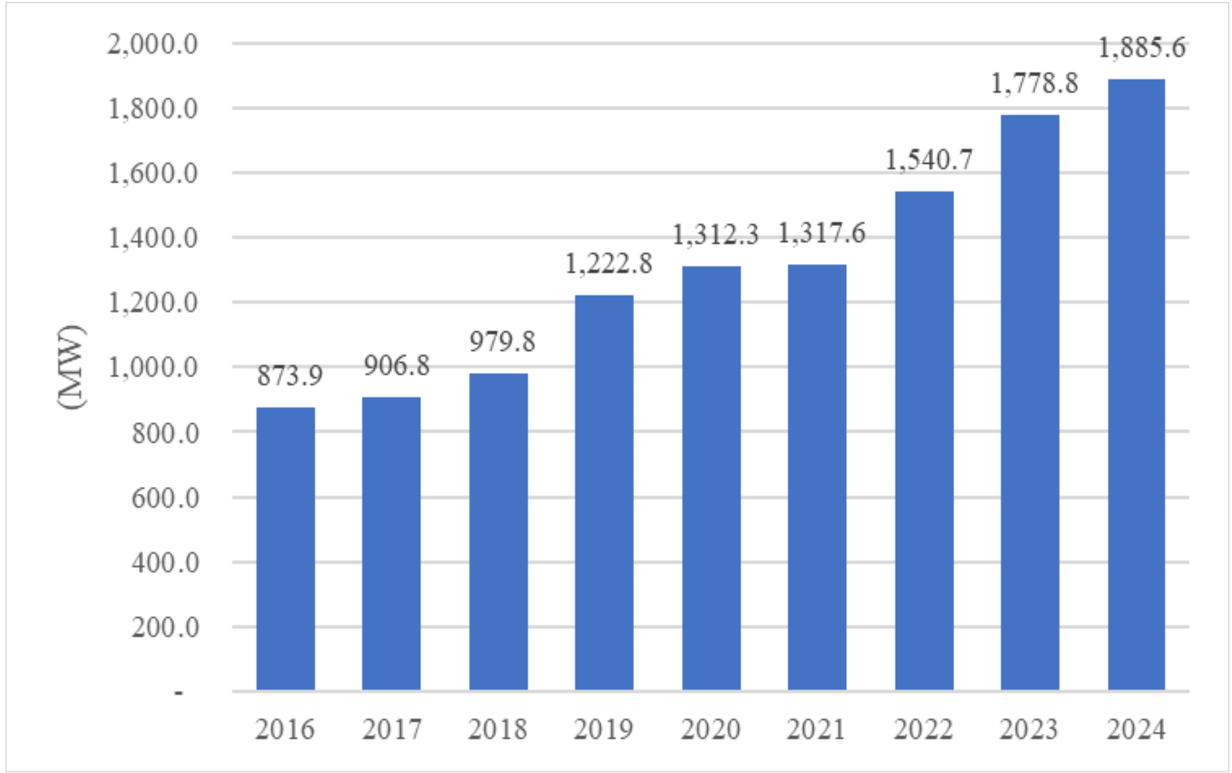
- **Annual Energy Import, 2023 (GWh)**



Current situation of power sector

- **Peak Power Demand in 2023**





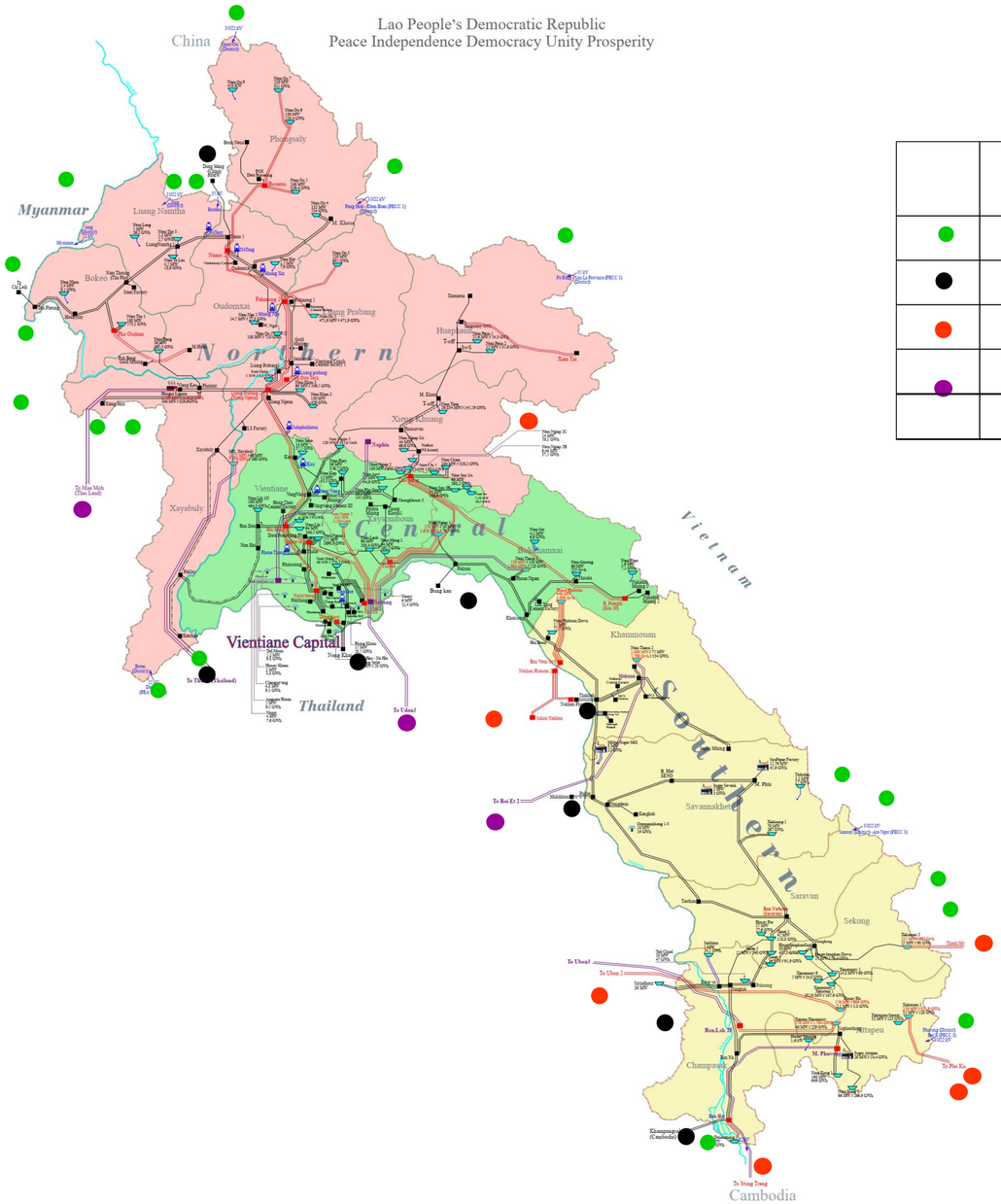
Current situation of power sector

- **Transmission and Substation facilities 2023**

Regions	No. Substation		Transformer Capacity (MVA)			Transmission Line (cct-km)		
	(115 kV)	(230 kV)	(115 kV)	(230 kV)	Total	115 kV	(230 kV)	Total
North	24	6	830	1,210	2,040	2,722	1,463	4,186
Central	25	7	1,615.5	1,900	3,516	2,188	1,303	3,491
South	17	2	701.0	550	1,251	3,340	504	3,844
Whole country	66	15	3,146.5	3,660	6,807	8,250	3,270	11,521

II. Current Status of power sector

- **Existing Grid System and cross – border interconnection**



	Voltage Level	EDC	EVN	CSG	Myanmar	Thailand		Total
						EGAT	PEA	
●	22/35 kV	1	7	3	1		7	19
●	115 kV	1		1	1	6		9
●	230 kV	1	4			4		9
●	500 kV					4		4
	Total	3	11	4	2	14	7	41

Remarks:

22/35kV – Import
115kV – Exchange
230kV – Purely Export
500kV – Purely Export

Legend : 115 kV
230 kV
500 kV

Current Status of Power Sector

- ## Cross-border Power Trade (EDL)

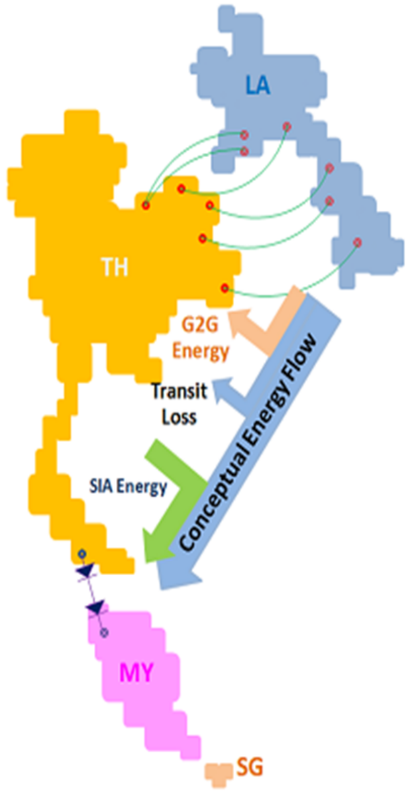
Laos – Thailand Grid to Grid Power Exchange					
No.	**Connection Point**	**Voltage**	**Circuit**	**Conductor Type**	**Conductor Size**
1	Kenthao – Thali	115	1	ACSR	1X240
2	Thanaleng – Nong Khai	115	1	ACSR	1X240
3	Dongphosy – Nong Khai	115	2	ACSR	1X240
4	Pakxan – Bung Kan	115	1	ACSR	1X240
5	Thakhek – Nakhon Phanom	115	2	ACCC	1X325
6	Pakbo – Mukdahan 2	115	1	ACSR	1X240
7	Bangyo – Sirindhorn	115	2	ACSR	2X410

LTM, LTMS-PIP (Use the existing TL 115 kV Grid to Grid)						
	Connection Point	**Capacity PPA (MW)**	**Voltage**	**Circuit**	**Conductor Type**	**Conductor Size**
1	Lao–Thailand–Malaysia (Phase 1)	100	115	9		
2	Lao-Thailand-Malaysia (Phase 2)	300				
3	Lao–Thailand–Malaysia–Singapore	30 (100)				

Laos – Myanmar Grid and Load Power Export						
No.	**Connection Point**	**Capacity PPA (MW)**	**Voltage (kV)**	**Circuit**	**Conductor Type**	**Conductor Size**
1	Tonpheun –Tachileik	30	115	1	ACSR	1X240

Laos – China Grid to Grid Power Exchange						
No.	**Connection Point**	**Capacity PPA (MW)**	**Voltage (kV)**	**Circuit**	**Conductor Type**	**Conductor Size**
1	Namo 1 – MengLa	40-60	110	1	ACSR	1X185

Laos – Cambodia Grid to Load and Gen to Grid Export						
No.	**Connection Point**	**Capacity PPA (MW)**	**Voltage (kV)**	**Circuit**	**Conductor Type**	**Conductor Size**
1	BanHat – Preah Vihear	Up to 70	115	2	ACSR	1X240
2	Donsahong – BanHat – Strung Treng BanHat – Strung Treng	195 500	230	2	ACSR	4X500



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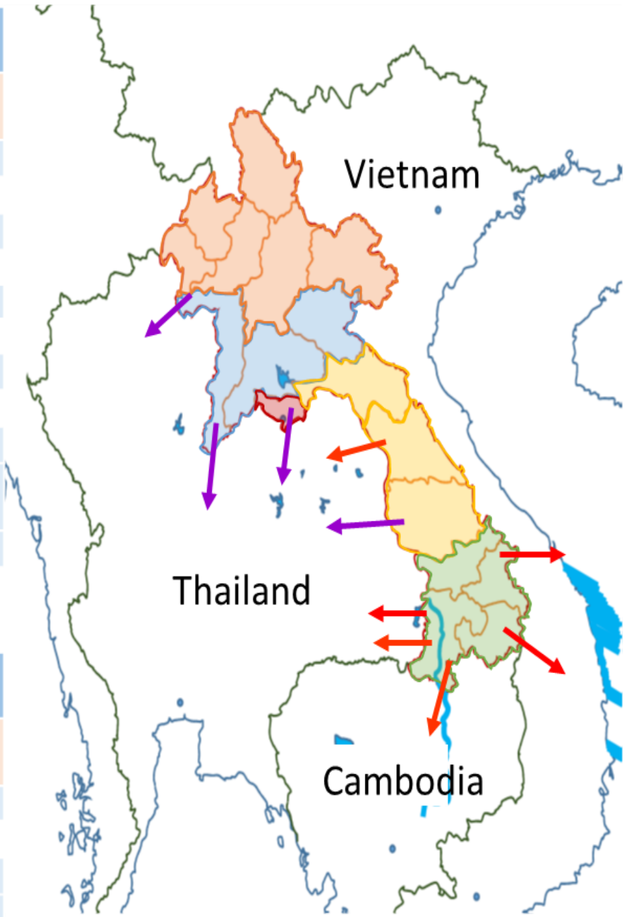
Laos – Thailand Generator to Grid							
No.	**Connection Point**	**Capacity (MW)**	**Voltage**	**Circuit**	**Conductor Type**	**Conductor Size**	**COD**
1	Theun Hinboun (HP) – Nakhon Phanom 2	434	230	2 + 2	ACSR	2X400	1998&2012
2	Houay Ho (HP) – Ubon Ratchathani 2	126	230	2	ACSR	2X400	1999
3	Nam Theun 2 (HP) – Roi Et 2	948	500	2	ACSR	4X630	2010
4	Nam Ngun 2 (HP) – Nabong S/S – Udon Thani 3	597	500	2	ACSR	4X630	2011
	Nam Ngiep 1 (HP) – Nabong S/S – (Udon Thani 3)	261	500	2	ACSR	1X630	2019
	Nam Theun 1 (HP) – Nabong S/S – (Udon Thani 3)*	514	500	2	ACSR	4X400	2022
5	Hongsa (T) – Nan	1,473	500	2	ACSR	4X410	2015-16
6	Mekong Xaiyaburi (HP) – Thali	1,220	500	2	ACSR	4X410	2019
7	Ban Lak 25 – Ubon Rachathani 3	370	230	2	ACSR	4X630	2020
	Xe-Pain Xe-Namnoy (HP) – Ban Lak 25 – (Ubon Rachathani 3)		230	2	ACSR		
	Total	5,943					

Laos – Vietnam Generator to Grid							
No.	**Connection Point**	**Capacity (MW)**	**Voltage**	**Circuit**	**Conductor Type**	**Conductor Size**	**COD**
1	Xekaman 1 (HP) – BoY	290	220	2	ACSR	4X400	2018
2	Xekaman Xansay (HP) – Xekaman 1	32	110	2	ACSR	1X240	2018
3	Xekaman 3 (HP) – ThanhMy	250	220	2	ACSR	2x400	2022
	Total	572					

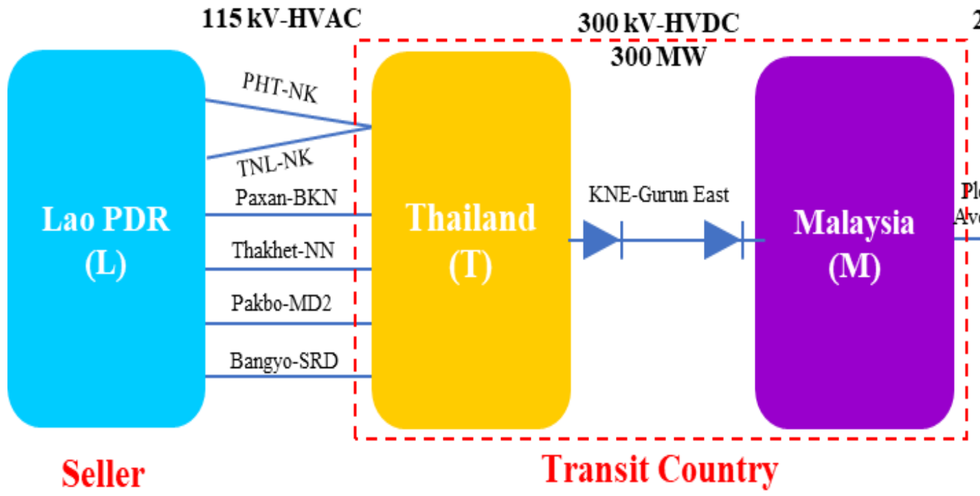


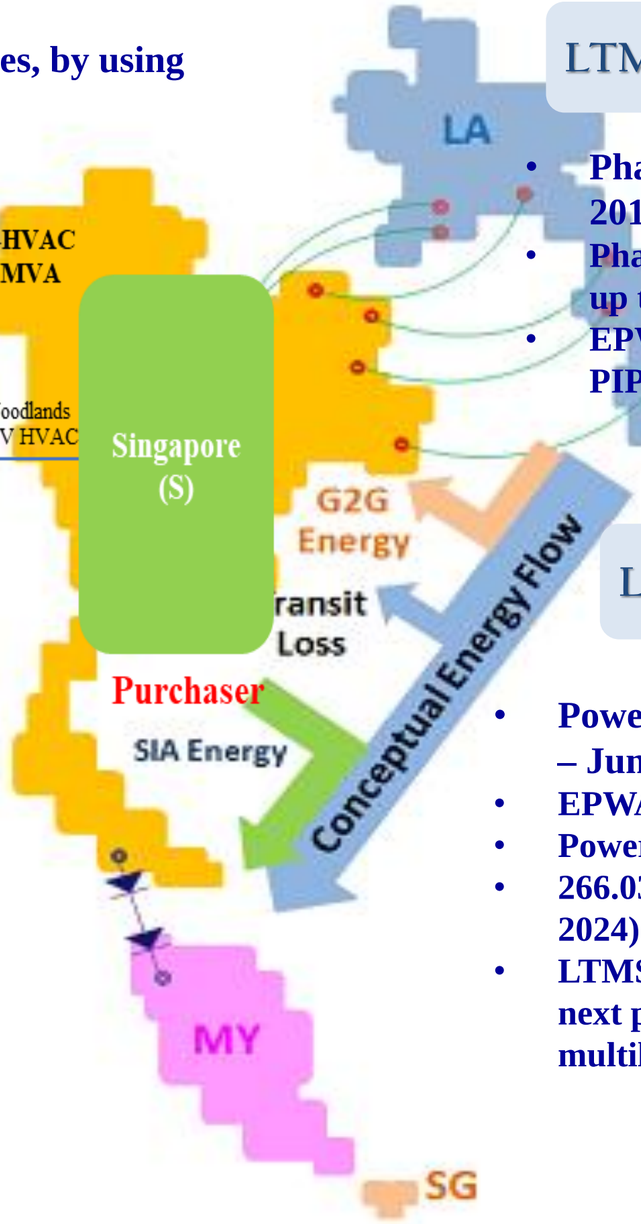
Remark: Hydro Powerplant: HP
Thermal Powerplant: T

Current Status of power sector

- **Cross-border Power Trade (EDL)**

First multilateral power trade in ASEAN countries, by using the existing Interconnection facilities





Power Flow Control through interconnection:

ao-Thailand: without power flow control (without ACE)
hailand-Malaysia: Controlled by pole control of HVDC
Ialaysia-Singapore: AGC setting of Area Control Error (ACE)

LTM PIP: Phase 1&2

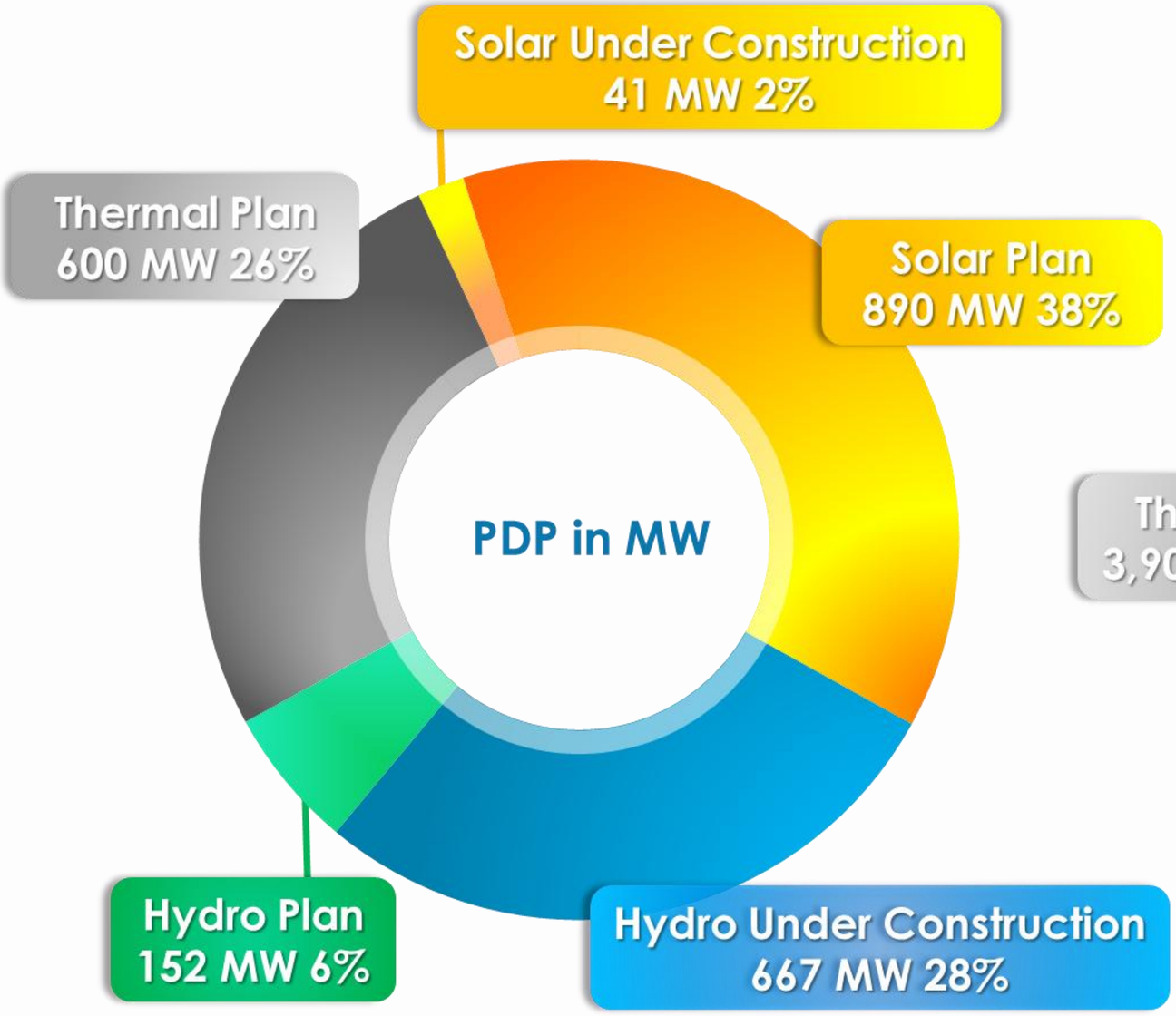
- **Phase 1: Power Purchase amount is up to 100 MW, 2018-2019 (EDL – EGAT – TNB)**
- **Phase 2: Power purchase amount has been expanded up to 300 MW, 2020 – 2021**
- **EPWA was signed among tri-parties push the LTM – PIP phase 2 in to operation on December 27, 2019**

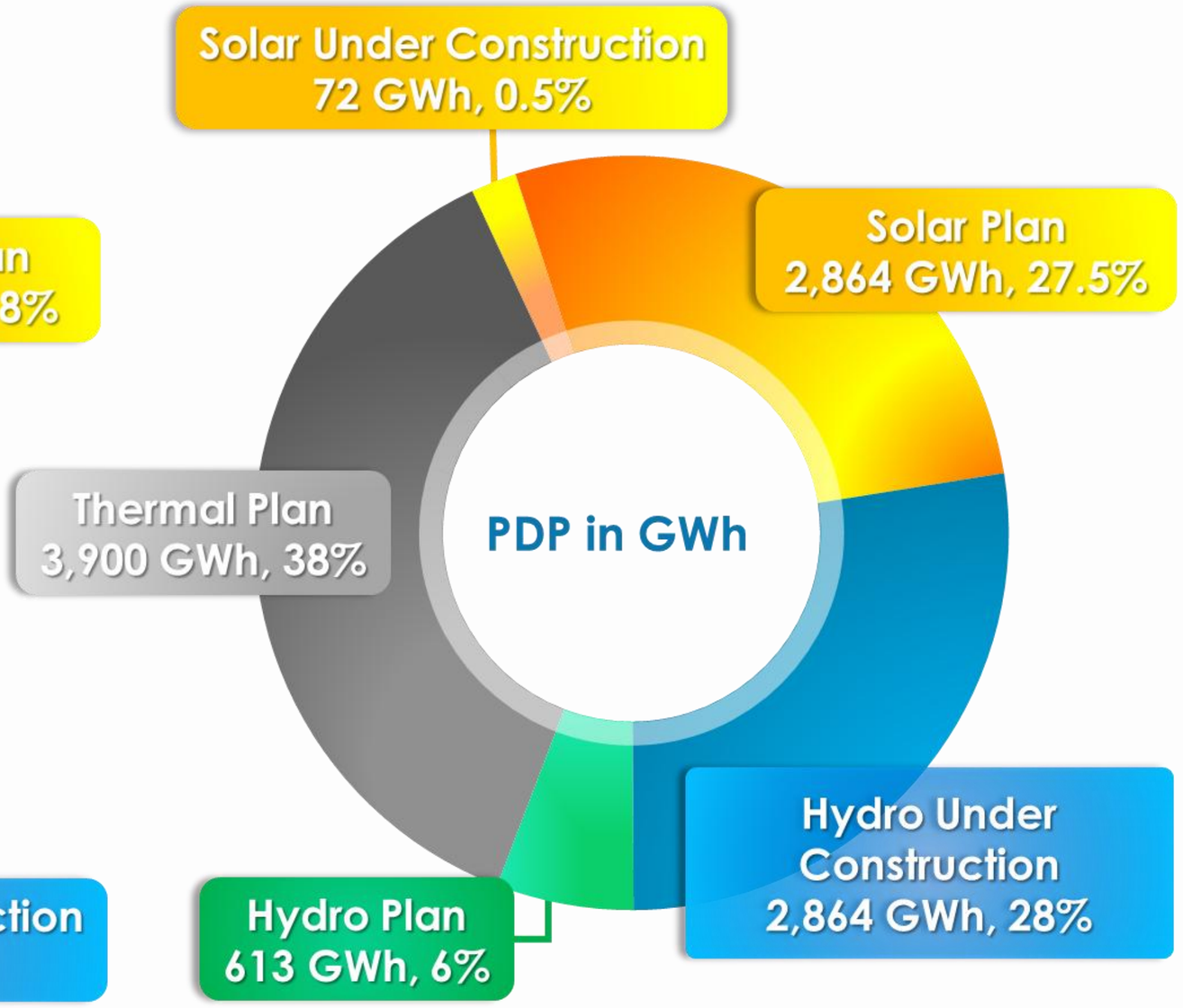
LTMS – PIP:

- **Power Purchase amount is up to 100 MW, June2022 – June 2024 （ EDL – EGAT – TNB – KEPPEL）**
- **EPWA was signed and effective date 22nd June 2022**
- **Power flow date 23rd June 2022**
- **266.03 GWh electricity has been traded (as of march 2024)**
- **LTMS members are in the process of discussion on the next phase of LTMS – PIP which aiming to achieve multilateral and multidirectional power trade**

Power Development Plan

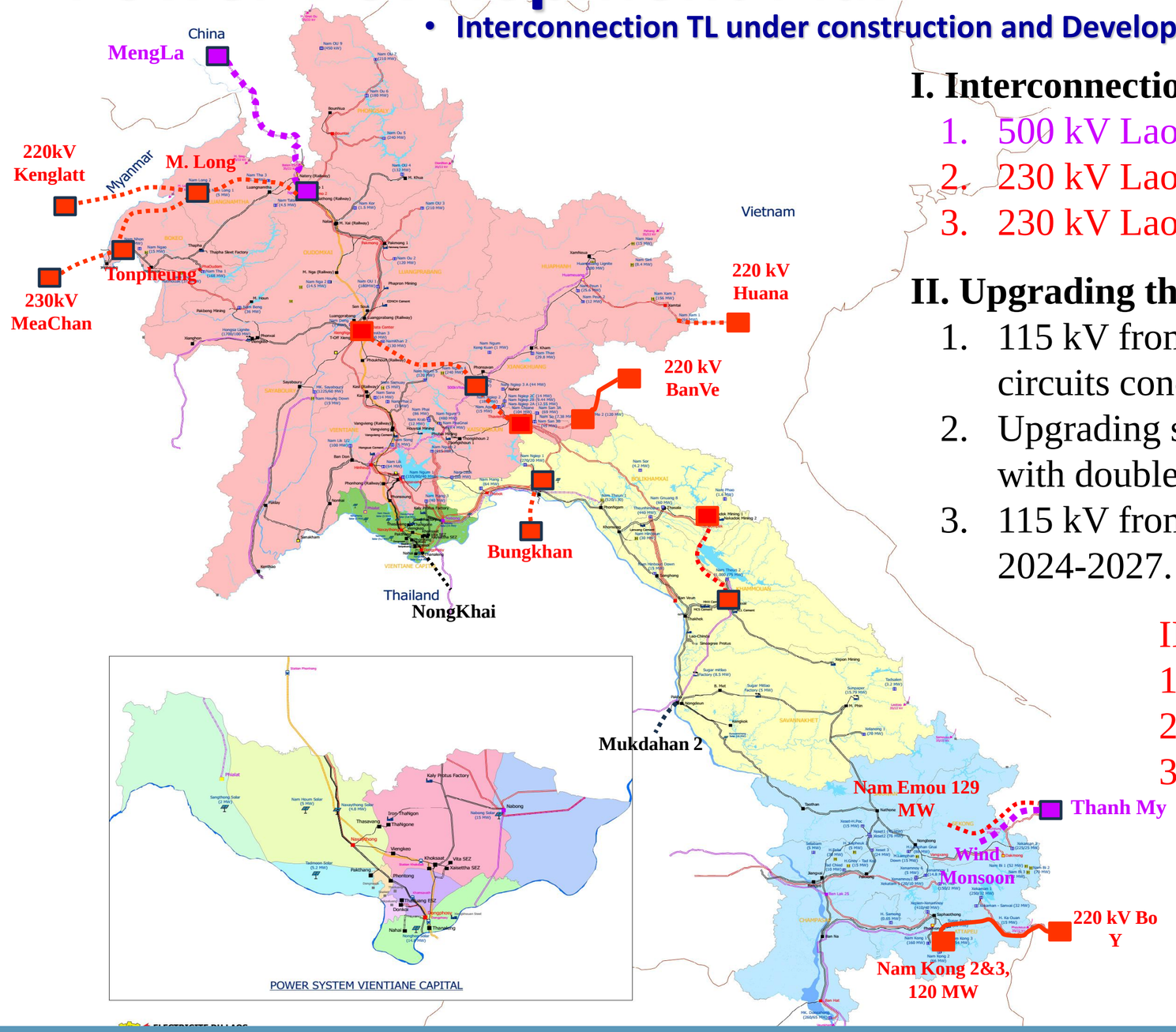
- Power Development Plan 2022-2030





Power Development Plan

- **Interconnection TL under construction and Development Plan**



I. Interconnection Grid to Grid

1. 500 kV Laos-China from MengLa - Namo 3, COD 2025
2. 230 kV Laos-Myanmar from M. Long - Kenglatt, COD 2026
3. 230 kV Laos-Thailand from TonPhueng - Meachan, COD 2030

II. Upgrading the existing Laos-Thai projects

1. 115 kV from Dongphosy-Nongkhai, upgrading conductor of 3 circuits conductor 240 sq.mm to 410 sq.mm, COD 2027
2. Upgrading single circuit 115 kV Pakxan-Bungkhan to 230 kV with double circuit (New line route). COD 2027
3. 115 kV from Pakbo-Mukdahan 2, additional new 1 circuit, COD 2024-2027.

III. IPP dedicate intmMo-BanVe

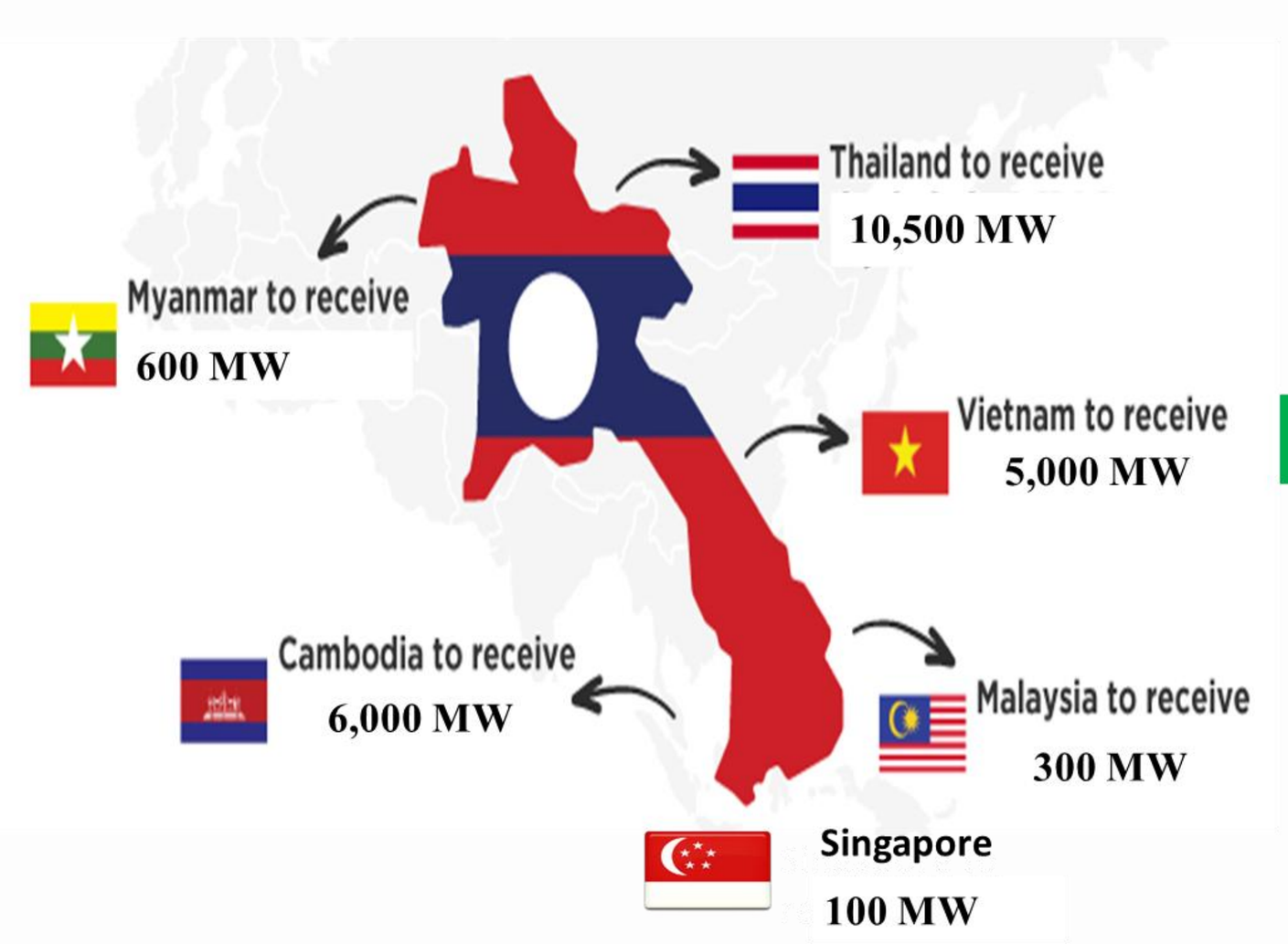
1.500 kV Momsoon wind project-ThanhMy

2.220 kV Nam Xam-Nong Cong

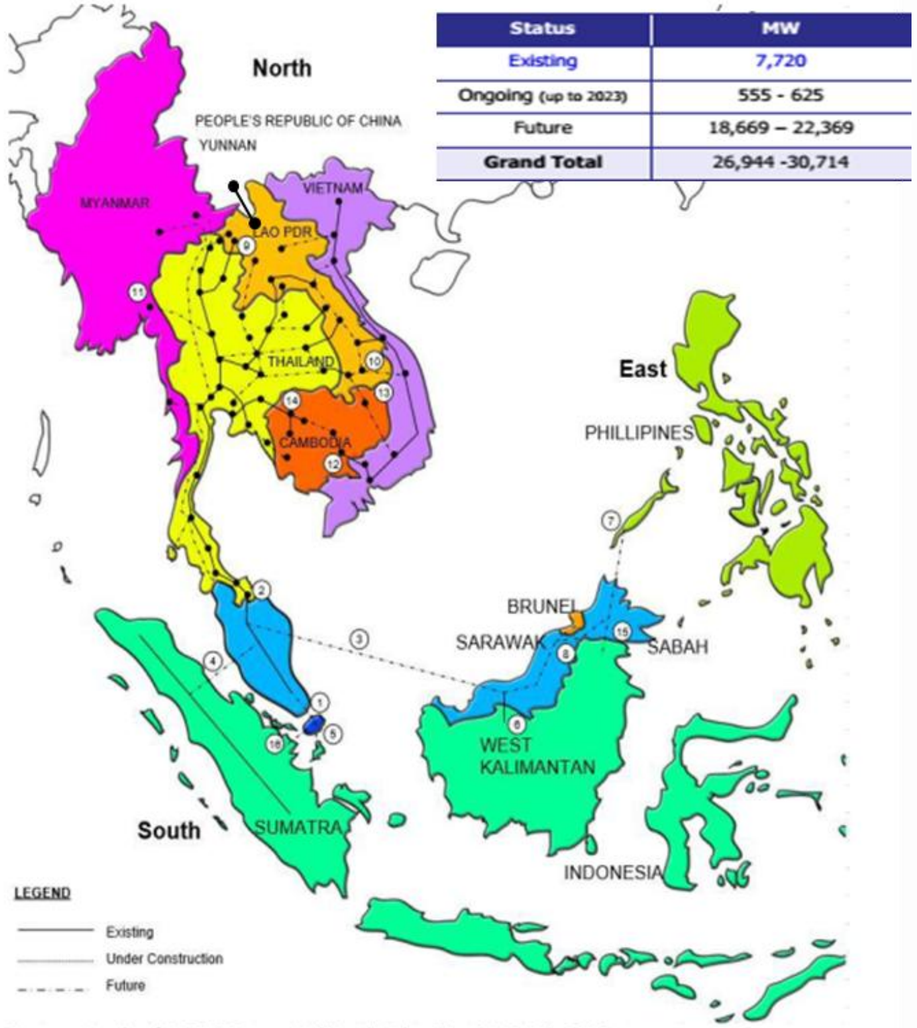
3.220 kV Truong Son-Do Luong

Cross-Border Power Trade

- Cross-Border Power Trade with Neighboring Countries



Status	MW
Existing	7,720
Ongoing (up to 2023)	555 - 625
Future	18,669 – 22,369
Grand Total	26,944 -30,714



Source: Heads of ASEAN Power Utilities/Authorities (HAPUA), 2017.

Cross-Border Power Trade

Power Export Achieved and Plan

Export to	Target	Achieved	Plan	Owner
Thailand	10,500 MW	• 9 projects exported with 5,941 MW	• In 2022 will export one more project with 514 MW • In 2026-2033 will export 7 more projects with 4,557 MW.	IPP(E)
Vietnam	5,000 MW	• 8 projects exported with 827 MW	10 under-construction projects with 1,400 MW expects to be COD before December 2025.	IPP(E)
Cambodia	3,000 MW	• 2 project exported with 445 MW	• In 2025 expects to export from EDL's grid with 250 MW. • In 2026-2029 expects to export from 2 Coal Thermal Power Plants with 2,400 MW	EDL and IPP(E)
Myanmar	300-600 MW	Phase 1: exported through 115 kV with 30 MW from Tonpheung-Tachileik.	Phase 2: export through 230 kV with 300 MW from Meuang Long-Kenglatt expect to be exported during 2025-2026 based on Myanmar's power plan	EDL

Cross-Border Power Trade

Power Export Achieved and Plan

Export to	Target	Achieved	Plan	Owner
China		• Exchange power through 115 kV capacity 40 MW from Namo1-Mengla (China).	• Power exchange Laos-China 500 kV power interconnection project. Expected COD end of 2025	EDL
Malaysia (LTM-PIP)	300 MW	• Phase 1: exported 100 MW, 2018-2019 • Phase 1: exported 300 MW, 2020-2021	Completed	EDL APG Multilateral Power Trade
Singapore (LTMS-PIP)	100-200 MW	PPA signed on 17 June 2022 and EWA will be effective date on 22 June 22 and Energy Flow on 23 June 2022	LTMS member agree and support joint statement of the LTMS-PIP phase 2	EDL APG Multilateral Power Trade

Benefits and Challenges on Cross-Border Power Trade

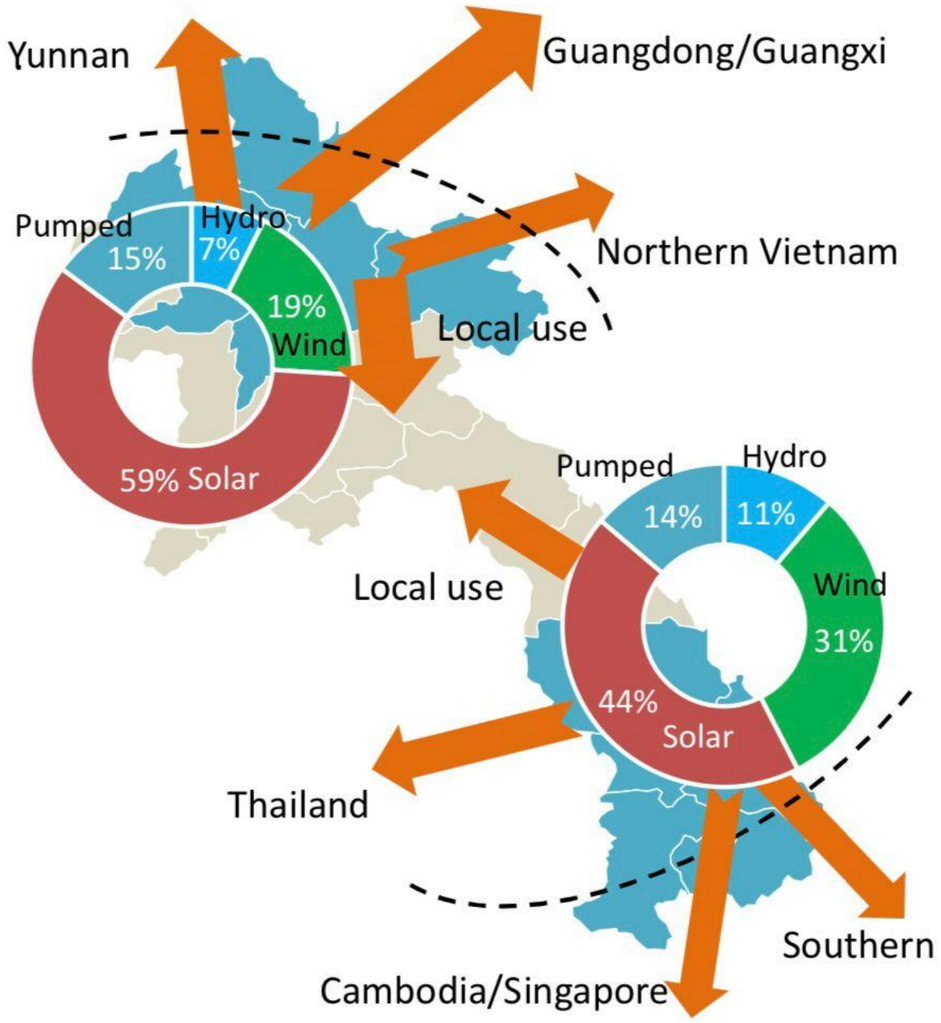
Benefits

- Optimization of developing national energy infrastructure, by reducing investments in power reserves to meet peak demand, lower operation costs, which will achieve a more reliable power supply and reduce system losses and reduce tariff
- To enhance reliability and security of electricity supply in the region
- To promote economic growth in the ASEAN region by creating new markets for electricity and other energy products

Challenges

- Differences in national power trade policies in the region
- Differences in performance standards and grid codes
- Barriers in power trade regulation; power market principles, tariff model and structure.
- Laos and Thailand interconnection is system to System power exchange. However, our system still cannot be synchronized with other GMS countries and requires HVDC system and high investment.

Planning of RE development



Hydropower	No	MW
Existing	83	9,768.6
Under-Construction	21	1,259.3
CA	18	2,466.2
PDA	109	6,431.9
MOU	245	8,143.4
Total	**476**	**28,069.4**

Solar	No	MW
Existing		
Under-Construction	0	0
CA	4	2,688
PDA	13	873
MOU	25	12,147
Total	**50**	**15,781**

Wind	No	MW
Existing	0	0
Under-Construction	0	0
CA	1	600
PDA	1	187.2
MOU	28	14,150
Total	**30**	**14,937.2**

Capacity building needs needed in the energy transition

- Technical standards for RE grid connection;
- EV platform and grid impact study;
- Regional power pool and electricity market design;
- Hybridization of Hydro and RE.

THANK YOU!