



**FEDERATION OF MYANMAR ENGINEERING SOCIETIES**  
**TECHNICAL DIVISION OF ELECTRICAL POWER ENGINEERING**

**"POWER SYSTEM IN ASEAN COUNTRIES"**

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**Vice President**

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# ELECTRIC POWER SYSTEM



- **Power Generation**

Electricity generated from fossil fuels, nuclear power plants, hydro power plants, geothermal systems, solar panels, biofuels, wind, etc.

- **Power Transmission**

Power transmission is the movement of energy from its place of generation to a location where it is applied to perform useful work.

- **Power Distribution**

The distribution system is the part of an electric system after the transmission system that is dedicated to delivering electric energy to an end-user.

# ASEAN MAP

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## COUNTRIES :

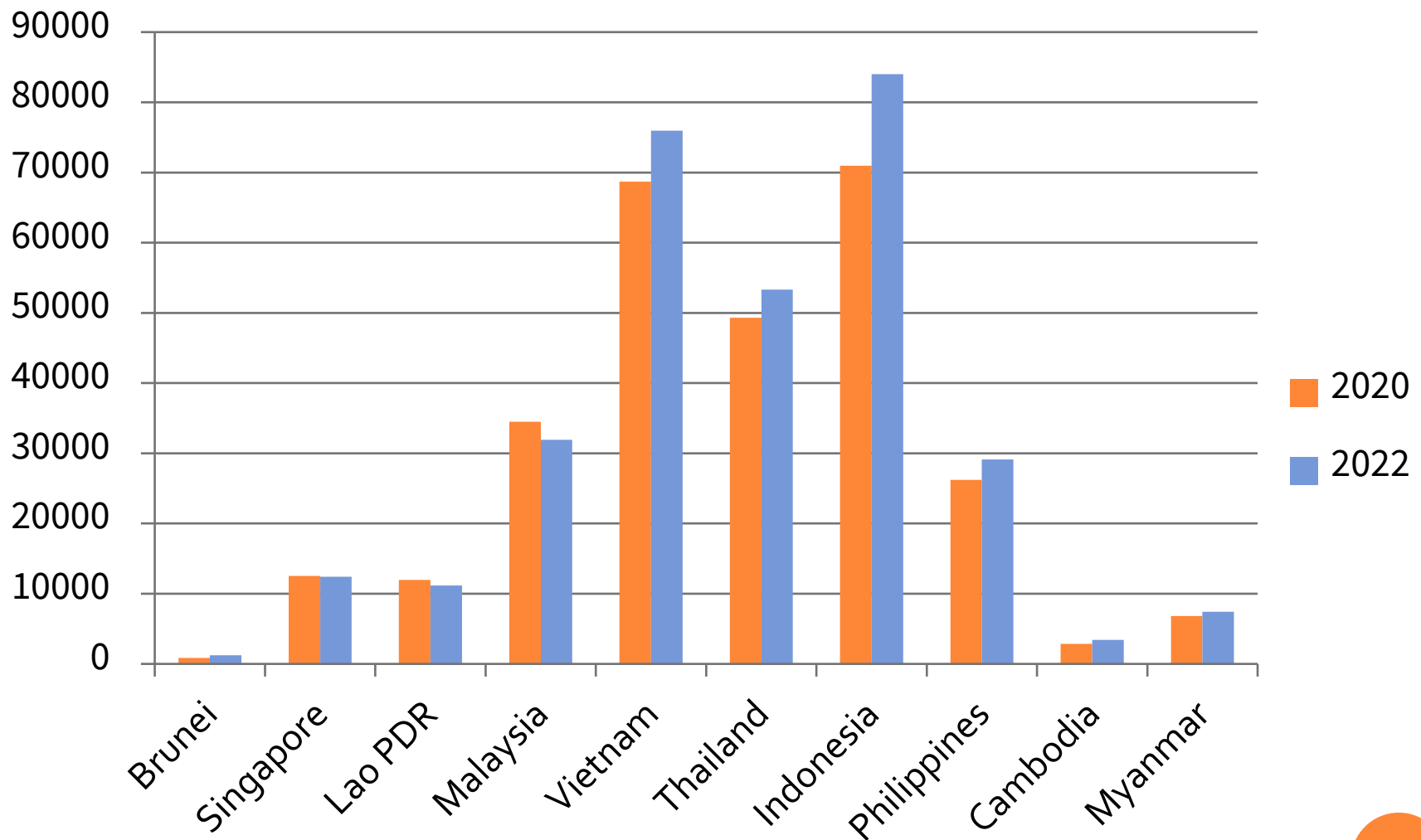
 MYANMAR	 PHILIPINES	 SINGAPORE	 THAILAND	 MALAYSIA
 VIETNAM	 BRUNEI	 INDONESIA	 CAMBODIA	 LAOS

## ASEAN INSTALLED POWER CAPACITY (285 GW & 310 GW) BY COUNTRY IN 2020 & 2022

S/ N	Country	Installed Capacity (MW)	Installed Capacity (MW)	Population	Population	Per Capita (Watt)	Per Capita (Watt)
		2020	2022	2020	2022	2020	2022
1	Brunei	855	1,240	441725	449,002	1,935.59	2,761.68
2	Singapore	12,540	12,400	5,909870	5,975,688	2,121.87	2,075.07
3	Lao PDR	11,970	11,160	7,319399	7,529,475	1,635.38	1,482.18
4	Malaysia	34,485	31,930	33,199993	33,938,222	1,038.71	940.83
5	Vietnam	68,685	75,950	96648685	98,186,856	710.67	773.53
6	Thailand	49,305	53,320	71,475,664	71,697,030	689.82	743.68
7	Indonesia	70,965	84,010	271,857,970	275,501,339	261.04	304.93
8	Philippines	26,220	29,140	112,190,977	115,559,009	233.71	252.17
9	Cambodia	2,850	3,410	16,396,860	16,767,842	173.81	203.37
10	Myanmar	6,840	7,440	53,423,198	54,179,306	128.03	137.32
11	ASEAN	284,715	310,000	668,864,341	679,783,769	425.67	456.04

*SOURCE : ASEAN POWER UPDATES 2023, DATABASE.EARTH*

## ASEAN INSTALLED POWER CAPACITY (MW) IN 2020 & 2022



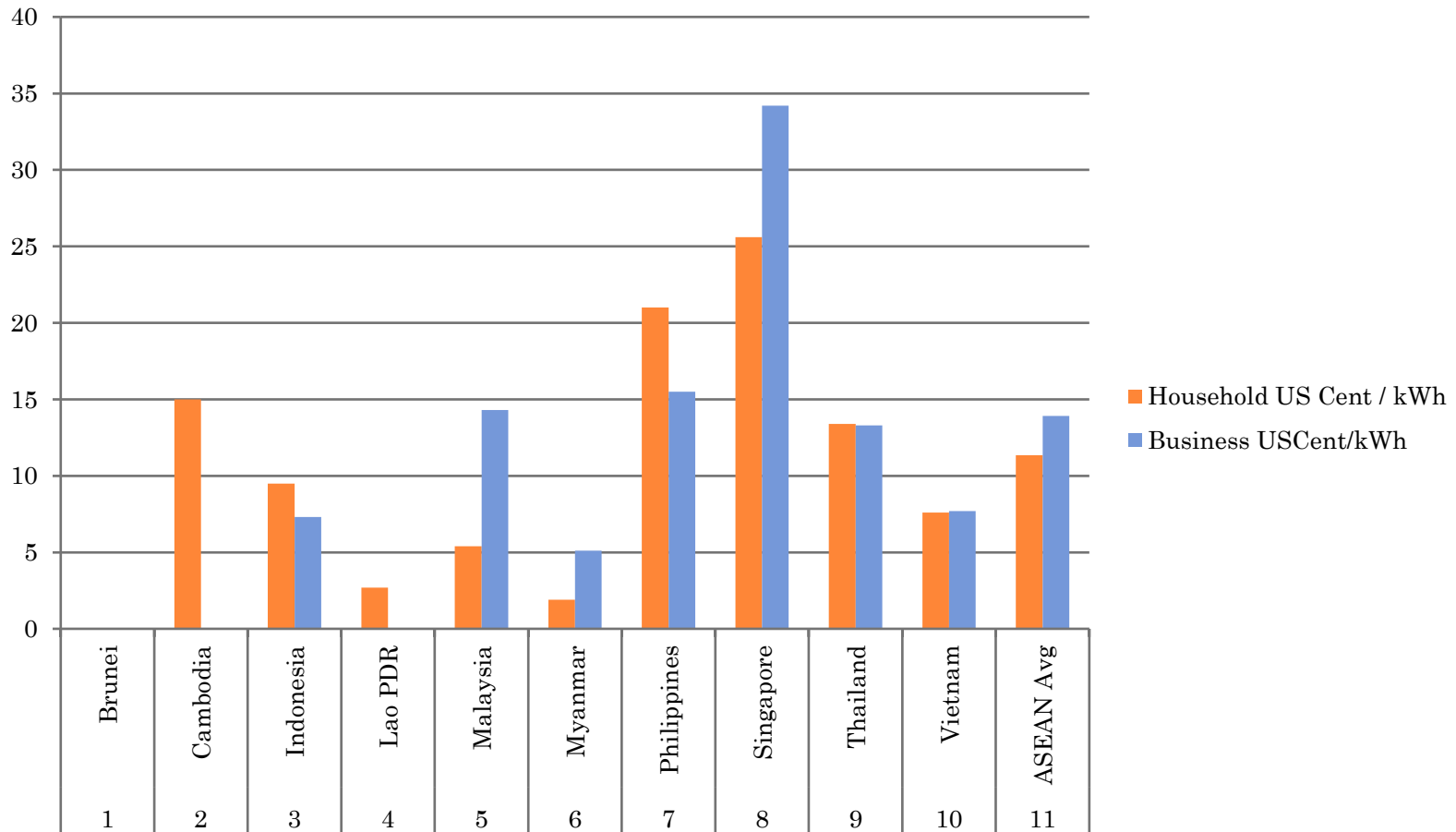
Source : ASEAN POWER UPDATES 2023

# ASEAN ELECTRICITY PRICES FOR HOUSEHOLD & BUSINESS @ Q3, 2024

Sr.	Country	Household USCent/kWh	Business USCent/kWh
1	Brunei	-	-
2	Cambodia	15.0	-
3	Indonesia	9.5	7.3
4	Lao PDR	2.7	-
5	Malaysia	5.4	14.3
6	Myanmar	1.9	5.1
7	Philippines	21.0	15.5
8	Singapore	25.6	34.2
9	Thailand	13.4	13.3
10	Vietnam	7.6	7.7
11	ASEAN Avg.	11.34	13.91

Source : [GlobalPetrolPrices.com](https://GlobalPetrolPrices.com)

# ASEAN ELECTRICITY PRICES @ Q3, 2024



Source : [GlobalPetrolPrices.com](https://www.globalpetrolprices.com)

# THE NATIONAL POWER DEVELOPMENT PLANS

- Brunei : Input by Department of Electricity Services (DES)
- Cambodia : PDP 2022 – 2040 (new)
- Indonesia : PDP 2021 – 2030 (new)
- Lao PDR : Input from Electricity du Laos (EDL) (new)
- Malaysia : Input by Tenaga National Berhad (TNB) & Sarawak Electricity Bhd;
- Myanmar : Input from Department of Electricity Policy Planning (DEPP) (new)
- Philippines : PDP 2020 – 2040
- Singapore : SEMO 2021; Singapore Energy Statistics 2022
- Thailand : PDP 2018 rev.1
- Vietnam : Draft PDP8

*Source : ASEAN POWER UPDATES 2023, ACE*

# VIETNAM

COUNTRY AREA: 331,210 SQKM

POPULATION : 100.77 MILLION @ 2024

GDP NOMINAL IN USD : 468,814 MILLION

GDP PER CAPITA IN USD : 4,623



# VIETNAM INDUSTRY STRUCTURE

**Vietnam Electricity (EVN)** : report directly to Prime Minister , under Ministry of Industry and Trade (MOIT).

**The Directorate General of Energy**: under MOIT, responsible for overall energy planning and policy.

**Electricity Regulatory Authority of Vietnam (ERAV)** : responsible for establishing & supervising the power market, power planning, tariff regulation and licensing.

MOIT released the National Power Development plan for 2012-2030 (PDP8)

# VIETNAM'S POWER GENERATION

Power Generation: 77,737 MW in March, 2022.

Power Consumption: 10-12% annually through 2030.

As per PDP8, No more new coal-fired power plants.

Renewable energy sources : 31.5% in 2030.

Wind power onshore 5,000MW & offshore 3,000MW Solar power 22,000MW reach up by 2030.

The tariff is set at 9.35 UScents/kWh of all solar projects. (Normal residential : 7.9 UScent/kWh)

Biomass power plant will reach 1,730MW by 2030.

Hydropower plant 20,400MW & 25,900MW by 2030.

Coal thermal power reduced from 34% to 27% by 2030

# VIETNAM POWER GENERATION

AS OF 31<sup>ST</sup> DECEMBER, 2022

Sr.	Power Source	Capacity (MW)	Output Million kWh
1	Hydropower	22,492	97,814
2	R.E (small HPPs+wind+solar +Biomass)	20,544	36,476
3	Coal Fired	25,312	95,271
4	Gas and Oil Fired	8,817	28,868
5	Import (BOT & Other Investors)	572	3,257
	<b>Total in (MW)</b>	<b>77,737</b>	<b>261,686</b>

# POWER GENERATION BY COMPANIES

Sr.	Owner	Capacity (MW)	Output(Million kWh)
1	EVN	11,974	43,277
2	GENCO 1	7,014	29,933
3	GENCO 2	4,420	16,376
4	GENCO 3	6,450	31,744
5	Others		140,356
5.1	EVNCPC	42	
5.2	PVN	6,163	
5.3	Vinacomin	1,815	
5.4	BOT	7,556	
5.5	Other Investors	31,731	
5.6	Imported	572	
	<b>TOTAL IN MW</b>	<b>77,737</b>	<b>261,686</b>

## POWER SALES BY CUSTOMER TYPE IN 2022

Sr.	Customer	Million kWh	%
1	Agriculture, Forestry and Aquaculture	8,424	4%
2	Industry and Construction	131,367	54%
3	Commercial & Hotels, Banks	12,028	5%
4	Adminstration & Residential	80,744	33%
5	Others	10,154	4%

## INSTALLED CAPACITY BY OWNERSHIP

Sr.	Owner Name	Capacity (MW)
1	EVN	11,974
2	GENCO 1	7,014
3	GENCO 2	4,420
4	GENCO 3	6,450
5	EVNCPC	42
6	PVN	6,163
7	Vinacomin	1,815
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9	Other Investors	31,731
10	<u>Imported</u>	<u>572</u>
<b>Total in MW</b>		<b>77,737</b>

## INVESTMENT PROJECTS UNTIL 2030

Sr.	Projects	Capacity (MW)	Operation Year
1	Phuoc Thai 2 SPP	150	2024
2	Phuoc Thai 3 SPP	50	2024
3	Ialy HPP extension	2 x 180	2024
4	Hao Binh HPP extension	2 x 240	2025
5	Quang Trach I TPP	2 x 600	2026
6	Tri An HPP extension	200	2026
7	Quang Trach II TPP	2 x 600	2026-2030
8	Dung Quat I TPP	750	2026-2030
9	Quang Trach III TPP	750	2026-2030
10	Bac Ai PSHP	4 x 300	2028-2030
	<b>TOTAL in MW</b>	<b>6,340</b>	<b>2024-2030</b>

# POWER TRANSMISSION AND DISTRIBUTION VIETNAM, 31<sup>ST</sup> DECEMBER, 2022.

Sr.	Item	Unit	Quantity
1	500~220 kV Grid Lines	km	29,552
2	500~220 kV Grid Transformers	MVA	119,525
3	110kV Grid Lines	km	21,861
4	110kV Grid Transformers	MVA	75,523
5	Total Lines	km	51,413
6	Total Transformers	MVA	195,048

## TRANSMISSION SYSTEM EXPANSION PLAN UP TO 2030 (FUTURE PLAN)

Sr.	Item	Unit	2016-2020	2021-2025	2026-2030
1	500 kV Lines	km	2,746	3,592	3,714
2	220 kV Lines	km	7,488	4,076	3,435
3	500 kV Substations	MVA	26,700	26,400	23,550
4	220 kV Substations	MVA	34,966	33,888	32,750



## IMPROVED TECHNICAL INDICATORS

- In 2022, total commercial electricity generated reached 242.7 billion kWh. (225.3 in 2021)
- EVN has taken steps towards modernizing its grid system, reducing power loss, achievements of revolution 4.0 and digital transformation.
- System Average Interruption Duration Index (SAIDI) being 276.1 minutes.( 51.9 minutes less than in 2021)
- Power loss rate in 2022, 6.25% ( 6.27% in 2021)



## ELECTRICITY MARKET OPERATION

- Vietnam Wholesale Electricity Market (VWEM) has officially operated since 2019.
- By the end of 2020, 100 power plants directly participated in the power market with a total installed capacity of 27,640 MW, accounting for 40% of the national power system.
- EVN will conduct price marketization to encourage investment in the electricity industry and follow the state-regulated market mechanism.



# THAILAND

**COUNTRY AREA: 513,120 SQKM**

**POPULATION : 65.975 MILLION @ 2024**

**GDP NOMINAL IN USD : 548,890 MILLION**

**GDP PER CAPITA IN USD : 7,812**



# THAILAND INDUSTRY STRUCTURE

**The Energy Regulatory Commission (ERC)** : responsible for regulating the generation, transmission and distribution of electricity in Thailand.

**The Electricity Generating Authority of Thailand (EGAT)** : responsible for the regulation of (1) Electric power generation, (2) Transmission (3) Bulk sale , State-owned agency, purchases electricity from IPPs & SPPs.

**Metropolitan Electricity Authority (MEA)** : responsible for the generation, procurement, distribution, and sale of electricity to the Bangkok metropolitan area and the provinces of Nonthaburi & Samutprakan.

**Provincial Electricity Authority (PEA)** : responsible for the generation, pro- curement, distribution, and sale of electricity to the 74 provinces with exception of Bangkok, Nonthaburi and Samutprakan.

# GOVERNMENT POLICY OBJECTIVES

- ❑ The development of the country under Thailand 4.0 framework, the Government emphasized importance of achieving a renewable energy transition.
- ❑ Power Development Plan was support technological tools and grassroots solutions, including blockchain energy trading schemes and residential and community-based renewable energy (rooftop solar panels to sold back to the grid).
- ❑ Power Development Plan for 2018 to 2037 (PDP 2018) was approved by the National Energy Policy Council (NEPC) and the Cabinet in April, 2019.

# REGULATORY AUTHORITIES

- Ministry of Energy manages the energy sector in Thailand, including granting energy operating licenses and issuing energy pricing regulations.
- Department of Alternative Energy Development & Efficiency.
- Department of Energy Business.
- Energy Policy and Planning Office.
- **EGAT**: responsible for electric power generation, operation & transmission nationally, engaging in energy-related services businesses and expending business and investment in electricity and other energy-related businesses and selling electricity and related services to the MEA and the PEA, a number of direct consumers prescribed by law, and neighbouring countries.

# CORE BUSINESS IN ELECTRICITY GENERATION

## ❖ 1. *Electricity Generation*

Electricity is generated from 53 **EGAT** power plants located in every part of the country. With a total installed capacity of 16,920.32 MW, EGAT's power plants consist of 3 thermal power plants, 6 combined cycle power plants, 30 hydropower plants, 9 renewable energy power plants (wind, solar, and geothermal), 4 diesel power plants, and 1 other power plant.

## ❖ 2. *Electricity Purchase*

In addition to operating its power plants, **EGAT** also purchases bulk electricity from 12 independent Power Producers (IPPs) totaling 16,748.50 MW, from Small Power Producers (SPPs) totaling 9,195.08 MW, and from neighboring countries, namely Lao PDR and Malaysia totaling 6,234.90 MW.

## ❖ 3. *Electricity Transmission*

EGAT's transmission lines comprise different voltages ranging from 500 kV, 230 kV, 132 kV, 115 kV, and 69 kV. EGAT sells electricity to its direct customers as well as to MEA and PEA to distribute electricity to their retail customers countrywide. EGAT sells electricity to the power utilities of Lao PDR at 115 kV and 22 kV lines and Malaysia at 300 kV HVDC lines.

# EGAT'S BUSINESS OPERATIONS

- **EGAT** is stateowned enterprise under the supervision of the Ministry of Energy and Ministry of Finance.
- The principal mission of **EGAT** is electricity generation, electricity acquisition, and electricity sales to the Metropolitan Electricity Authority (**MEA**), Provincial Electricity Authority (**PEA**), direct customers by law, and neighboring countries.
- **EGAT** is also responsible for other related business as stipulated by the **EGAT** Act.

## TOTAL GENERATION CAPACITY AS OF DEC, 2022

Sr	Power Plants	Capacity (MW)	%
1	EGAT (52 plants = Thermal 3+Combine 6+Hydro 29+Renewable 9+Diesel 4+Other 1)	16,920.32	34.46
2	Independent Power Producers (IPPs) 12 plants	16,748.50	34.11
3	Small Power Producers (SPPs)	9,195.08	18.73
4	Imported Power from Neighboring Countries	6,234.90	12.70
	<b>Total Generation in MW</b>	<b>49,098.80</b>	<b>100.00</b>

# EGAT'S ELECTRICITY GENERATION AND PURCHASE AS OF DECEMBER, 2022

Sr.	Types of Plants	Million kWh	%
1	Natural Gas	104,867.82	52.15
2	Coal Fired	33,704.48	16.76
3	R.E (Hydro, wind, solar, geothermal, and biomass)	14,688.35	7.31
4	Oil Fired (fuel oil, palm oil, diesel oil, and black rubber oil)	10,675.50	5.31
5	Pumped-storage hydropower plant	333.92	0.17
6	Waste and waste gas	1329.33	0.66
7	Imported Power	35,471.75	17.64
	<b>Total Electricity Generation and Purchase</b>	<b>165,599.40</b>	<b>100</b>

## ENERGY SALES IN 2022

Sr.	Power Purchasers	Million kWh	%
1	Metropolitan Electricity Authority (MEA)	53,369.19	27.12
2	Provincial Electricity Authority (PEA)	140,680.96	71.48
3	Direct Customers	930.46	0.47
4	Neighbouring Countries (Laos, Malaysia, and Cambodia)	1,410.69	0.72
5	Temporary and Standby use	404.06	0.21
	<b>Total in Million kWh</b>	<b>196,795.37</b>	<b>100</b>

## ELECTRICITY TARIFFS (1.1)

Sr.	Schedule 1 Residential	Energy Charge (Baht/kWh)	Service (Baht/ Month)
	Normal Rate		
1.1.1	Consume up to 150kWh, per month		8.19
	First 15 kWh. (0 – 15 <sup>th</sup> )	2.3488	
	Next 10 kWh. (16 <sup>th</sup> – 25 <sup>th</sup> )	2.9882	
	Next 10 kWh. (26 <sup>th</sup> – 35 <sup>th</sup> )	3.2405	
	Next 65 kWh. (36 <sup>th</sup> – 100 <sup>th</sup> )	3.6237	
	Next 50 kWh. (101 <sup>st</sup> – 150 <sup>th</sup> )	3.7171	
	Next 250 kWh. (151 <sup>st</sup> – 400 <sup>th</sup> )	4.2218	
	Over 400 kWh. (401 <sup>st</sup> and over)	4.4217	

## ELECTRICITY TARIFFS(1.2)

Sr.	Schedule 1 Residential	Energy Charge (Baht/kWh)		Service (Baht/Month)
1.1.2	Consume over 150kWh per month			24.62
	First 150 kWh (0 – 150 <sup>th</sup> )	3.2484		
	Next 250 kWh (151 <sup>st</sup> – 400 <sup>th</sup> )	4.2218		
	Over 400 kWh (401 <sup>st</sup> and over)	4.4217		
1.2	Time of Use Rate (TOU)	Peak	Offpeak	
1.2.1	At Voltage Level 22 – 33kV	5.11	2.60	312.24
1.2.2	At Voltage level lower than 22kV	5.79	2.63	24.62
	Peak: 0630pm ~ 0930pm Off-peak : 0930pm ~0630pm			

## ELECTRICITY TARIFFS (2)

Sr.	Schedule 2 Small General Service	Energy Charge (Baht/kWh)	Service (Baht/Month)
2.1	Normal Rate		
2.1.1	At voltage level 22 - 33kV	3.9086	312.24
2.1.2	At voltage level lower than 22kV		33.29
	First 150 kWh (0 – 150 <sup>th</sup> )	3.2484	
	Next 250 kWh. (151 <sup>st</sup> – 400 <sup>th</sup> )	4.2218	
	Next 400 kWh. (401 <sup>st</sup> and over)	4.4217	
2.2	Time of Use Rate (TOU)	Peak    Off-peak	
2.2.1	At voltage level 22 – 33kV	5.1135    2.6037	312.24
2.2.2	At voltage level lower than 22kV	5.7982    2.6369	33.29

## ELECTRICITY TARIFFS (3)

Sr.	Schedule 3 Medium General Service	Demand Charge (Baht/ kW)	Energy Charge (Baht/kWh)	Service (Baht/ Month)
3.1	Normal Rate			
3.1.1	At voltage level $\geq 69\text{kV}$	175.7	3.1097	312.24
3.1.2	At voltage level 22- 33kV	196.26	3.1471	312.24
3.1.3	At voltage level $\leq 22\text{kV}$	221.5	3.1751	312.24
3.2	Time of Use Rate (TOU)	Peak	Peak    Offpeak	
3.2.1	At voltage level $\geq 69\text{kV}$	74.14	4.1025    2.5849	312.24
3.2.2	At voltage level 22-33kV	132.93	4.1839    2.6037	312.24
3.2.3	At voltage level $\leq 22\text{kV}$	210.0	4.3297    2.6369	312.24

## ELECTRICITY TARIFFS (4)

Sr.	Schedule 4 Large General Service	Demand Charge (Baht/kW)	Energy Charge (Baht/kWh)	Service (Baht/ Month)
4.1	Time of Day Rate (TOD)	Peak Partial		
4.1.1	At voltage level $\geq 69\text{kV}$	224.3 29.91	3.1097	312.24
4.1.2	At voltage level 22 - 33kV	285.0 58.88	3.1471	312.24
4.1.3	At voltage level $\leq 22\text{kV}$	332.71 68.22	3.1751	312.24
4.2	Time of Use Rate (TOU)	Peak	Peak offpeak	
4.2.1	At voltage level $\geq 69\text{kV}$	74.14	4.102 2.585	312.24
4.2.2	At voltage level 22 – 33kV	132.93	4.184 2.604	312.24
4.2.3	At voltage level $\leq 22\text{kV}$	210.00	4.329 2.637	312.24
	Peak : 0630pm~0930pm Partial : 0800am~0630pm OffPeak: 0930pm~0800am	everyday everyday everyday		

## ELECTRICITY TARIFFS (5)

Sr.	Schedule 5 Specific Business Services	Demand Charge (Baht/kW)	Energy Charge (Baht/kWh)		Service (Baht/ Month)
5.1	Time of Use Rate (TOU)	Peak	Peak	Offpeak	
5.1.1	At voltage level $\geq$ 69kV	74.14	4.102	2.585	312.24
5.1.2	At voltage level 22 - 33kV	132.93	4.184	2.604	312.24
5.1.3	At voltage level $\leq$ 22kV	210.00	4.329	2.637	312.24
5.2	Whom does not installed with TOU Meter				
5.2.1	At voltage level $\geq$ 69kV	220.56	3.1097		312.24
5.2.2	At voltage level 22-33kV	256.07	3.1471		312.24
5.2.3	At voltage level $\leq$ 22kV	276.64	3.1751		312.24

## ELECTRICITY TARIFFS (6)

Sr.	Schedule 6 Non-Profit Organizations	Demand Charge (Baht/kW)	Energy Charge (Baht/kWh)	Service (Baht/Month)
6.1	Normal Rate			
6.1.1	At voltage level $\geq 69\text{kV}$		3.4149	312.24
6.1.2	At voltage level 22 - 33kV		3.5849	312.24
6.1.3	At voltage level $\leq 22\text{kV}$			
	First 10kWh (0 – 10 <sup>th</sup> )		2.8013	
	Over 10kWh (11 <sup>th</sup> onwards)		3.8919	
6.2	Time of Use Rate (TOU)	Peak	Peak Offpeak	
6.2.1	At voltage level $\geq 69\text{kV}$	74.14	4.102 2.585	312.24
6.2.2	At voltage level 22-33kV	132.93	4.184 2.604	312.24
6.2.3	At voltage level $\leq 22\text{kV}$	210.00	4.329 2.637	312.24

## ELECTRICITY TARIFFS (7)

Sr.	Schedule 7 Agricultural Pumping	Demand Charge (Baht/kW)	Energy Charge (Baht/kWh)		Service (Baht/Month)
7.1	Normal Rate				115.16
7.1.1	First 100 kWh (0 – 100 <sup>th</sup> )		2.0889		
7.1.2	Over 100 kWh (101 <sup>st</sup> & onward)		3.2405		
7.2	Time of Use Rate (TOU)	Peak	Peak	Offpeak	
7.2.1	At voltage level 22 – 33kV	132.93	4.184	2.604	204.07
7.2.2	At voltage level < 22kV	210.0	4.329	2.637	204.07



## ELECTRICITY TARIFFS (8)

- Schedule 8 Temporary Services
- Energy Charge (At all voltage levels) 6.8025 Baht/kWh

### Electricity Tariffs' Conditions

1. Power Factor charge will be collected from the customer who causes the lag of Power Factor. When the maximum of an average reactive power (kVAR) demand in 15 minutes in any period of time is more than 62.97% of the maximum of an average active power (kW) demand in 15 minutes in any period of time, 56.07 Baht/kVAR will be added.
2. Monthly Electricity Charge is composed of the electricity tariffs which has mentioned above, Automatic Tariff Adjustment Mechanism (Ft), and VAT.
3. The electricity tariffs which has mentioned above are not excluding a Value Added Tax (VAT).

# SINGAPORE

COUNTRY AREA: 719.2 SQKM

POPULATION : 5.938 MILLION @ 2024

GDP NOMINAL IN USD : 525,228 MILLION

GDP PER CAPITA IN USD : 88,446





# SINGAPORE INDUSTRY STRUCTURE

- ❑ The Energy Market Authority of Singapore (EMA) is the lead agency for energy matters in Singapore – a statutory board under the Ministry of Trade and Industry, is the economic and technical regulator of Singapore's electricity and gas industries. EMA is the regulator of Singapore's electricity and gas industries.
- ❑ *Mission: To Forge a Progressive Energy Landscape for Sustained Growth.*

## **KEY POLICY OBJECTIVES:-**

- ❑ (i) A secure Energy Supply: Power System Operation
- ❑ (II) A Competitive Energy Market: Regulation
- ❑ (iii) A Dynamic Energy Section: Energy Planning & Development



# KEY POLICY OBJECTIVES

- ❖ **1. A Secure Energy Supply; Power System Operation.**
  - ❖ Reliability
  - ❖ Security
  - ❖ Stability
  
- ❖ **2. A Competitive Energy Market; Regulation.**
  - ❖ Electricity
  - ❖ Gas
  - ❖ District Cooling
  
- ❖ **3. A Dynamic Energy Sector; Energy Planning & Development.**
  - ❖ Planner
  - ❖ Promoter
  - ❖ Development



# EMA PERFORMS THREE KEY ROLES

- ❑ **1. Power System Operator (PSO);**
- ❑ Operates the power system in Singapore, is responsible for the reliable supply of electricity to consumers in Singapore. Its Power System Control Centre acts as nerve centre to oversee the electricity transmission system and power generation plants.
  
- ❑ **2. Industry Regulator;**
- ❑ EMA regulates the gas and electricity industries in Singapore as well as district cooling services in designated areas.
  
- ❑ **3. Industry Developer;**
- ❑ EMA fosters a dynamic energy sector by catalyzing research and innovation, facilitating development of promising energy solutions, developing a future-ready workforce and engaging both regional and international stakeholders.

# MARKET WORK FLOW

- PSO produces forecast of demand for energy and reserve and sends it to the EMC
- PSO extracts current network condition and send these to EMC
- Market Participants offer Energy, Reserve and Regulation
- EMC produce Dispatch Schedule using Market IT System
- EMC sends Dispatch Schedule to PSO
- EMC publishes Dispatch Schedules
- EMC publishes Market Clearing Prices to Participants
- PSO dispatches Energy and Reserve using MCE Schedule of Energy, Reserve and Regulation
- PSO monitors compliance with dispatch instructions
- Market Assessment Unit (MAU) monitors compliance with market rules, manuals
- MSSL collects and adds up Meter Data
- EMC pays Metered Energy at the Market Price

# SP GROUP: SINGAPORE POWER LIMITED

- **SP Limited ("SP Group")** : is a state-owned electricity and gas distribution company in Singapore and the sole electricity and gas transmission, distribution services, and market support services to more than a million households in Singapore.
- **SP Services Ltd ("SPS")** : is the Market Support Services Licensee ("MSSL"). It provides services such as reading meters, management of meter data, and integrated customer billing services.
- **SP Power Assets** : It holds the Transmission Licensee and owns the electricity transmission and distribution network of Singapore including Substations and underground cables with a value of S\$ 6.5 billion (as at 31 March, 2006).
- **SP Power Grid** : Manages the nation's electricity transmission network & operation of the operation of distribution network.

# POWER GENERATION

■ Energy Market Company Pte Ltd (“EMC”) : It operates the Singapore wholesale Electrical Market @ 2023		
■ Oil-fired Thermal	2,680.0 MW	3 Cos.
■ Gas	9,780.9 MW	8 Cos.
■ Waste to Energy	256.8 MW	4 Cos.
■ Solar	60.0 MW	1 Co.
<hr/>		
■ <b>TOTAL</b>	<b>12,697.7 MW</b>	<b>16 Cos.</b>

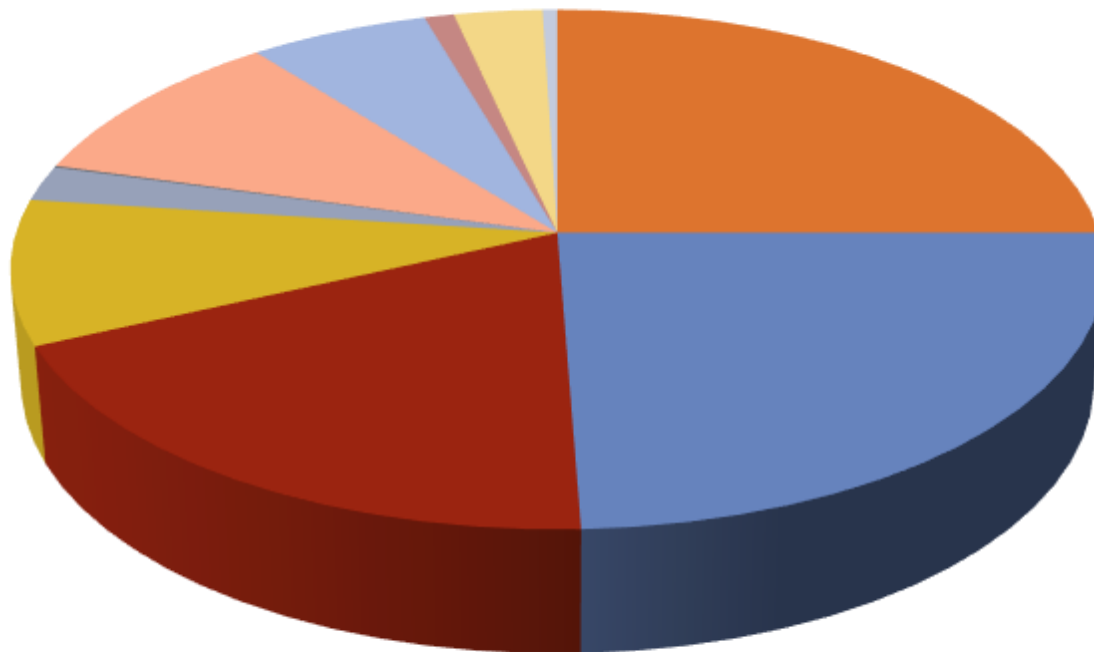
## ■ POWER ASSESTS

■ Substations	11,000 nos.
■ Cable	over 28,000 km

# SINGAPORE GENERATION CAPACITY 2021



## Generation Capacity



- Senoko Energy 25.0%
- YTL Power Seraya 24.4%
- Tuas Power 18.7%
- Semb Cogen 9.0%
- Incineration Plants 2.2%
- PV 0.1%
- Keppel Cogen 10%
- Pacific Light 6.1%
- Tembusu 1.0%
- Exxon Mobil 3.0%
- Shell Ular 0.5%

# THE ELECTRICITY TARIFF CALCULATION (1)

- For Q1 2023 (wef 1<sup>st</sup> Jan ~ 31<sup>st</sup> Mar 2023).
- [Market Admin & PSO Fee + MSS Fee + Network Cost + Energy Cost]
- $0.06 \text{ ¢/kWh} + 0.40 \text{ ¢/kWh} + 5.94 \text{ ¢/kWh} + 22.55 \text{ ¢/kWh} = 28.95 \text{ ¢/kWh}$
- For Q2 2023 (wef 1<sup>st</sup> Apr ~ 30<sup>th</sup> Jun 2023).
- $0.06 \text{ ¢/kWh} + 0.43 \text{ ¢/kWh} + 6.25 \text{ ¢/kWh} + 20.69 \text{ ¢/kWh} = 27.43 \text{ ¢/kWh}$
- *Market Admin & Power System Operation Fee* : [Paid to Energy Market Company and Power System Operator]. This fee is reviewed annually to recover the costs of operating the electricity wholesale market and power system.

## THE ELECTRICITY TARIFF CALCULATION (2)

- **Market Support Services Fee:** [ Paid to SP Services]. This fee is reviewed annually. This is to recover the cost of billing and meter reading, data management, retail market systems as well as for market development initiatives.
- **Network Cost :** [Paid to SP Power Assests]. This fee is reviewed annually. This is recover the cost of transporting electricity through the Power Grid.
- **Energy Cost :** [Paid to the generation companies]. It is adjusted quarterly to reflect changes in cost of fuel & power generation covers mainly the costs of operating the power stations, such as the manpower & maintenance costs, as well as the capital cost of the stations.

## DETAILS OF THE ELECTRICITY TARIFFS

- ❑ As a default option, residential consumers in Singapore buy electricity from SP Group, a market support services company regulated by EMA. The tariff set by SP Group is reviewed every quarter, and is regulated by EMA to reflect the actual cost of electricity.
- ❑ The tariff comprises two key components : fuel cost & non-fuel cost.
- ❑ *Fuel Cost* : This component of the tariff is calculated using the average of daily natural gas price between April and June is used to set the tariff for July to September. Around 95% of Singapore's electricity is generated from imported natural gas are indexed to oil prices. This is market practice in Asia for natural gas contracts.
- ❑ *Non-fuel Cost* : This part of the tariff reflects the cost of generating and delivering electricity to consumers. It includes;
- ❑ *Power Generation Cost*: This covers manpower and maintenance cost, as well as the capital costs of the stations.

A close-up photograph of a hand holding a red pen, pointing at a piece of white paper with a red border. The word "Tariff" is written in bold blue letters on the paper. The background is a light-colored, textured surface.

**Tariff**



# SINGAPORE ELECTRICITY DEMAND OUTLOOK

Year	Projected System Peak Demand (MW)	Projected System Peak Demand (MW)
	Low Level	High Level
2022	7,750	8,100
2023	8,300	8,600
2024	8,500	8,900
2025	8,800	9,300
2026	9,000	9,500
2027	9,200	9,800
2028	9,400	10,100
2029	9,600	10,400
2030	9,800	10,600
2031	10,000	10,800
2032	10,100	11,000

## PROJECTED TOTAL ELECTRICITY SUPPLY

Year	Projected Total Electricity Supply (MW)
2022	11,800
2023	11,100
2024	11,400
2025	11,600

## Reserve Margin Formula

Reserve Margin =

Total Electricity Supply (Capacity) – System Peak Demand x 100%

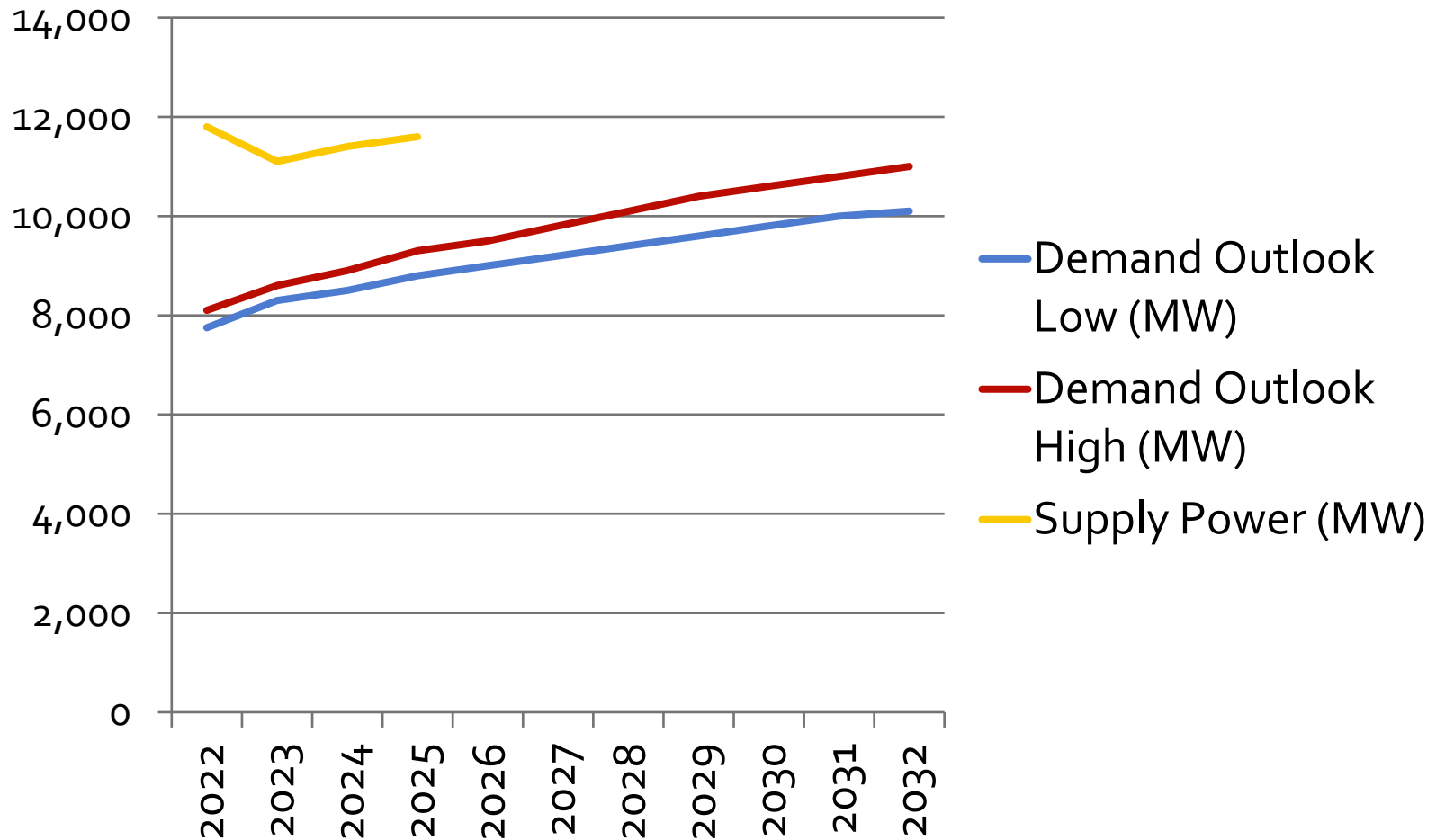
System Peak Demand

= 11100 – 8300 x 100% = 33.74% for 2023

8300

IN SINGAPORE, THE MINIMUM RESERVE MARGIN HAS BEEN SET AT 27% TO ENSURE SYSTEM SECURITY.

# SINGAPORE DEMAND OUTLOOK & SUPPLY



# SINGAPORE FUTURE PLAN

- ❖ Singapore seeks bids for New Power Plant in Energy Security push.
- ❖ The Energy Market Authority is inviting proposals to build, own and operate a gas-fired power plant for operation by 2028, it said in a statement . Participants are expected to also develop hydrogen and low-carbon solutions in order to develop a greener power system.
- ❖ Singapore's power consumption has been steadily increasing, with hot weather pushing peak demand to an all-time high in May. The new 600- megawatt power plant could help alleviate periods of tight supply that have triggered spikes in spot electricity rates.
- ❖ "With the anticipated growth in energy demand, it is crucial that we establish measures to meet future needs", said Ngiam Shih Chun, EMA's Chief Executive Officer.

# COMPARISON STATEMENT OF ELECTRICITY POWER SYSTEM IN 3 ASEAN COUNTRIES (1)

Sr	Description	Vietnam	Thailand	Singapore
1	Ministry	Ministry of Industry & Trade (MoIT)	Ministry of Energy (MoE)	Ministry of Trade & Industry (MoTI)
2	Overall Energy Planning & Policy	Directorate General of Energy	The Energy Regulatory Commission (ERC)	The Energy Market Authority of Singapore (EMA)
3	Regulaory Authority	Electricity Regulatory of Vietnam (ERAV)	The Energy Regulatory Commission (ERC)	Energy Market Authority (EMA)
4	Power Generation Companies	Vietnam Electricity (EVN) + GENCOs	Electricity Generating Authority of Thailand (EGAT) + IPPs + SPPs	Senoko, Seraya, Tuas, Sembcog, Kappel, Shell, ExxonMobil, Jurong, others
5	Transmission	EVN	EGAT	S'pore Power (SP)
6	Distribution	EVN	MEA, PEA	SP
7	Generation @2022	77,737 MW @ 2022	30,600 MW @2022	12,697 MW @ 2022

## COMPARISON STATEMENT OF ELECTRICITY POWER SYSTEM IN 3 ASEAN COUNTRIES (2)

Sr	Description	Vietnam	Thailand	Singapore
8	Generation Output	261,686 Million kWh	196,795 Million kWh	58,100 Million kWh
9	Country Area	331,210 sqkm	513,120	719.2 sqkm
10	Population @ 2023	100.345 Million	70.171 Million	5.659 Million
11	GDP USD @2023	433,356 Million	512,193 Million	497,347 Million
12	Per Capita GDP USD	4,316	7,297	87,884
13	Electricity Price Household @ 2023	7.91 USCent/kWh	11.21 USCent/kWh	22.21 USCent/kWh
14	Per Capita Utilized	773 Watt @ 2022	743 Watt @ 2022	2,075 Watt @ 2022

# TECHNICAL DIVISION OF ELECTRICAL POWER ENGINEERING



# THANK YOU

Engr. Khin Maung Win (VP)

P.E, A.C.P.E, F.AFEO, M.IEEE

Federation of Myanmar Engineering Societies

5<sup>th</sup> October, 2024