## FEDERATION OF MYANMAR ENGINEERING SOCIETIES

# "POWER GENERATION SYSTEMS IN ASEAN COUNTRIES"

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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.

# VIETNAM

COUNTRY AREA: 331,210 SQKM

POPULATION : 100.345 MILLION @ 2023, OCT.

GDP NOMINAL IN USD : 433,356 MILLION

GDP PER CAPITA IN USD : 4,316

# VIETNAM INDUSTRY STRUCTURE

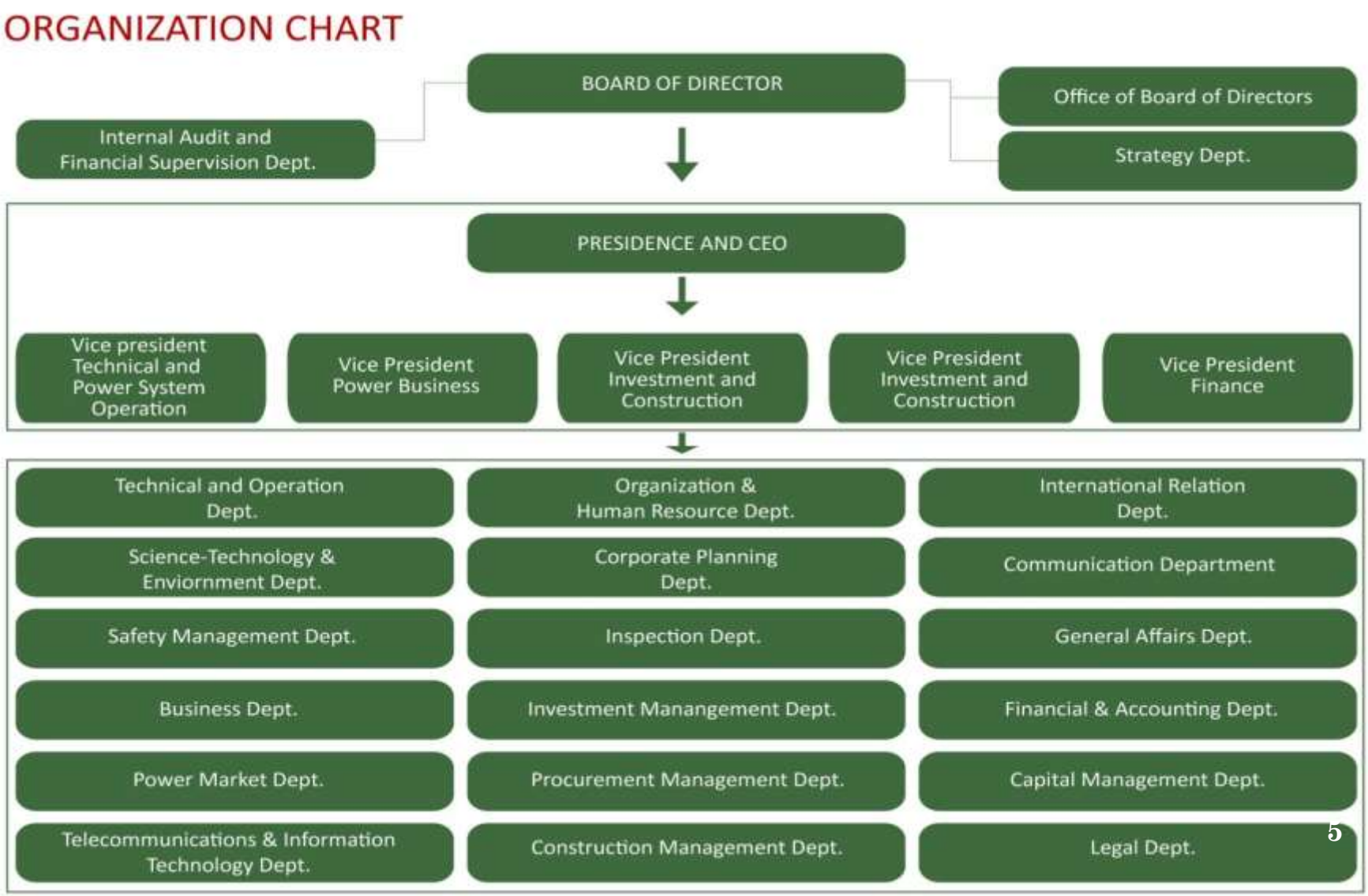
**Vietnam Electricity (EVN) : report directly to Prime Minister , under Ministry of Industry and Trade (MOIT).**

**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)**

# EVN ORGANIZATION CHART



# 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
# 31ST 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 |
| | Total in (MW) | 77,737 | 261,686 |

# 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 | |
| | TOTAL IN MW | 77,737 | 261,686 |

# 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 |
| 8 | BOT | 7,556 |
| 9 | Other Investors | 31,731 |
| 10 | Imported | 572 |
| | Total in MW | 77,737 |

# 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 |
| | TOTAL in MW | 6,340 | 2024-2030 |

# POWER TRANSMISSION AND DISTRIBUTION 31ST 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.

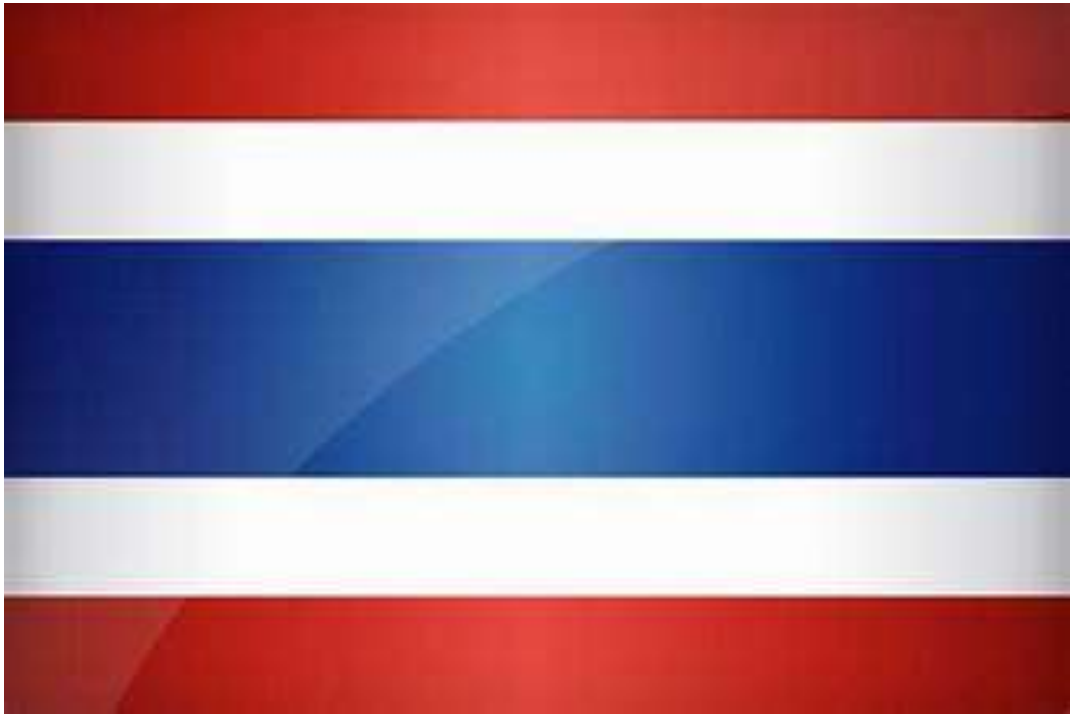
# THAILAND

COUNTRY AREA: 513,120SQKM

POPULATION : 70.171 MILLION @ 2023, OCT.

GDP NOMINAL IN USD : 512,193 MILLION

GDP PER CAPITA IN USD : 7,297



# 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.

# EGAT ORGANIZATION CHART

# 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 |
| | Total Generation in MW | 49,098.80 | 100.00 |

# EGAT's Electricity Generation and Purchase as of December, 2022

| Sr. | | 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 |
| | Total Electricity Generation and Purchase | 165,599.40 | 100 |

# The new power plants and decommissioned power plants in 2022

| Sr. | Power Plants | Capacity (MW) | Operation Date / Decommissioned Date |
|---|---|---|---|
| 1.1 | EGAT's New Power Plants | 1,400 | Sep,2022 |
| 1.2 | EGAT's Decommissioned Plant | (562) | Jan, 2022 |
| 2 | Independent Power Producers (IPPs) | 1,250 | Oct, 2022 |
| 3.1 | Small Power Producers (SPPs), Renewable Energy R E | 82.13 | Dec, 2022 |
| 3.2 | SPP's Decommissioned Plant R E | (6) | April, 2022 |
| 4.1 | SPPs Cogeneration System NewPower Plants | 290 | Dec. 2022 |
| 4.2 | SPPs Cogen Decommissioned | (285) | Dec, 2022 |
| 5 | ImportedNew Power Plant | 514.30 | Aug, 2022 |
| | Total in MW | 2,683.43 | |

# 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 |
| | Total in Million kWh | 196,795.37 | 100 |

# EGAT'S PERFORMANCE INDEX

| | |
|---|---|
| System Average Interruption Frequency Index (SAIFI) (Number of Occurrence/Delivery Point) | 0.0904 |
| System Average Interruption Duration Index (SAIDI) (Minute/Delivery Point) | 0.9041 |
| Service Availability (SA) % | 99.89346 |
| Transmission Circuit Availability (%) | 99.98268 |
| Transformer Availability (%) | 99.07899 |
| Voltage Deviation (VD) (ppm) (%) | 0.0573 |
| Frequency Deviation (FD) (%) | 0.0000 |

# Electricity Tariffs (1.1)

| | 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$^{th}$) | 2.3488 | |
| | Next 10 kWh. (16$^{th}$ – 25$^{th}$) | 2.9882 | |
| | Next 10 kWh. (26$^{th}$ – 35$^{th}$) | 3.2405 | |
| | Next 65 kWh. (36$^{th}$ – 100$^{th}$ ) | 3.6237 | |
| | Next 50 kWh. (101$^{st}$ – 150$^{th}$) | 3.7171 | |
| | Next 250 kWh. (151$^{st}$ – 400$^{th}$) | 4.2218 | |
| | Over 400 kWh. (401$^{st}$ and over) | 4.4217 | |

# ELECTRICITY TARIFFS(1.2)

| | 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$^{th}$) | 3.2484 | | |
| | Next 250 kWh (151$^{st}$ – 400$^{th}$) | 4.2218 | | |
| | Over 400 kWh (401$^{st}$ 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<br>Off-peak : 0930pm ~0630pm | | | |

# ELECTRICITY TARIFFS (2)

| | Schedule 2<br>Small General Service | Energy Charge<br>(Baht/kWh) | Service<br>(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$^{th}$) | 3.2484 | |
| | Next 250 kWh. (151$^{st}$ – 400$^{th}$) | 4.2218 | |
| | Next 400 kWh. (401$^{st}$ 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)

| | 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 ≥ 69kV | 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 ≤ 22kV | 221.5 | 3.1751 | | 312.24 |
| 3.2 | Time of Use Rate (TOU) | Peak | Peak | Offpeak | |
| 3.2.1 | At voltage level ≥ 69kV | 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 ≤ 22kV | 210.0 | 4.3297 | 2.6369 | 312.24 |

# ELECTRICITY TARIFFS (4)

| | Schedule 4<br>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 ≥ 69kV | 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 ≤ 22kV | 332.71 68.22 | 3.1751 | 312.24 |
| 4.2 | Time of Use Rate (TOU) | Peak | Peakoffpeak | |
| 4.2.1 | At voltage level ≥ 69kV | 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 ≤ 22kV | 210.00 | 4.329 2.637 | 312.24 |
| | Peak : 0630pm~0930pm<br>Partial :0800am~0630pm<br>OffPeak:0930pm~0800am | everyday<br>everyday<br>everyday | | |

# ELECTRICITY TARIFFS (5)

| | Schedule 5<br>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 ≥ 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 ≤ 22kV | 210.00 | 4.329 2.637 | 312.24 |
| 5.2 | Whom does not installed with TOU Meter | | | |
| 5.2.1 | At voltage level ≥ 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 ≤ 22kV | 276.64 | 3.1751 | 312.24 |

# ELECTRICITY TARIFFS (6)

| | Schedule 6<br>Non-Prifit Organizations | Demand Charge (Baht/kW) | Energy Charge (Baht/kWh) | Service (Baht/Month) |
|---|---|---|---|---|
| 6.1 | Normal Rate | | | |
| 6.1.1 | At voltage level ≥ 69kV | | 3.4149 | 312.24 |
| 6.1.2 | At voltage level 22 - 33kV | | 3.5849 | 312.24 |
| 6.1.3 | At voltage level ≤ 22kV | | | |
| | First 10kWh (0 – 10$^{th}$) | | 2.8013 | |
| | Over 10kWh (11$^{th}$ onwards) | | 3.8919 | |
| 6.2 | Time of Use Rate (TOU) | Peak | Peak Offpeak | |
| 6.2.1 | At voltage level ≥ 69kV | 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 ≤ 22kV | 210.00 | 4.329 2.637 | 312.24 |

# ELECTRICITY TARIFFS (7)

| | 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 – 100th) | | 2.0889 | | |
| 7.1.2 | Over 100 kWh (101st & 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 : 5.659 MILLION @ 2023,OCT.

GDP NOMINAL IN USD : 497,347 MILLION

GDP PER CAPITA IN USD : 87,884

# 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.**

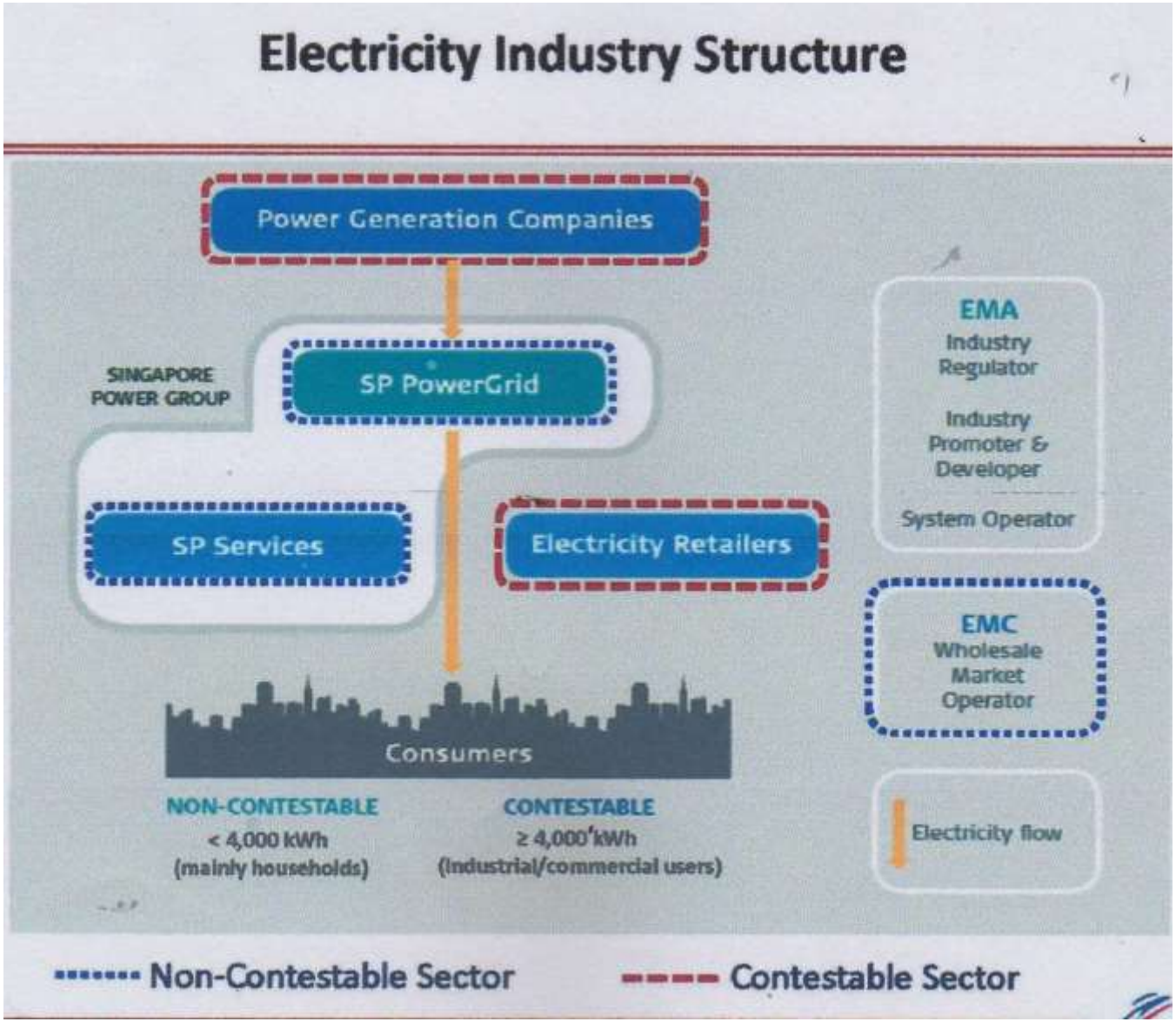
- *2. Industry Regulator;*
- **EMA regulates the gas and electricity industries in Singapore as well as district cooling services in designated areas.**

- *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.**

# 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.**

# SINGAPORE INDUSTRY STRUCTURE



# 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. |
| TOTAL | 12,697.7 MW | 16 Cos. |

- POWER ASSESTS

| | | |
|---|---|---|
| Substations | | 11,000 nos. |
| Cable | over | 28,000 km |

# THE ELECTRICITY TARIFF CALCULATION

- For Q1 2023 (wef 1st Jan ~ 31st Mar 2023).
- [Market Admin & PSO Fee + MSS Fee + Network Cost + Energy Cost]
- 0.06 ¢/kWh + 0.40 ¢/kWh + 5.94 ¢/kWh + 22.55 ¢/kWh = 28.95 ¢/kWh

- For Q2 2023 (wef 1st Apr ~ 30th Jun 2023).
- 0.06 ¢/kWh + 0.43 ¢/kWh + 6.25 ¢/kWh + 20.69 ¢/kWh = 27.43 ¢/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.

- *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.

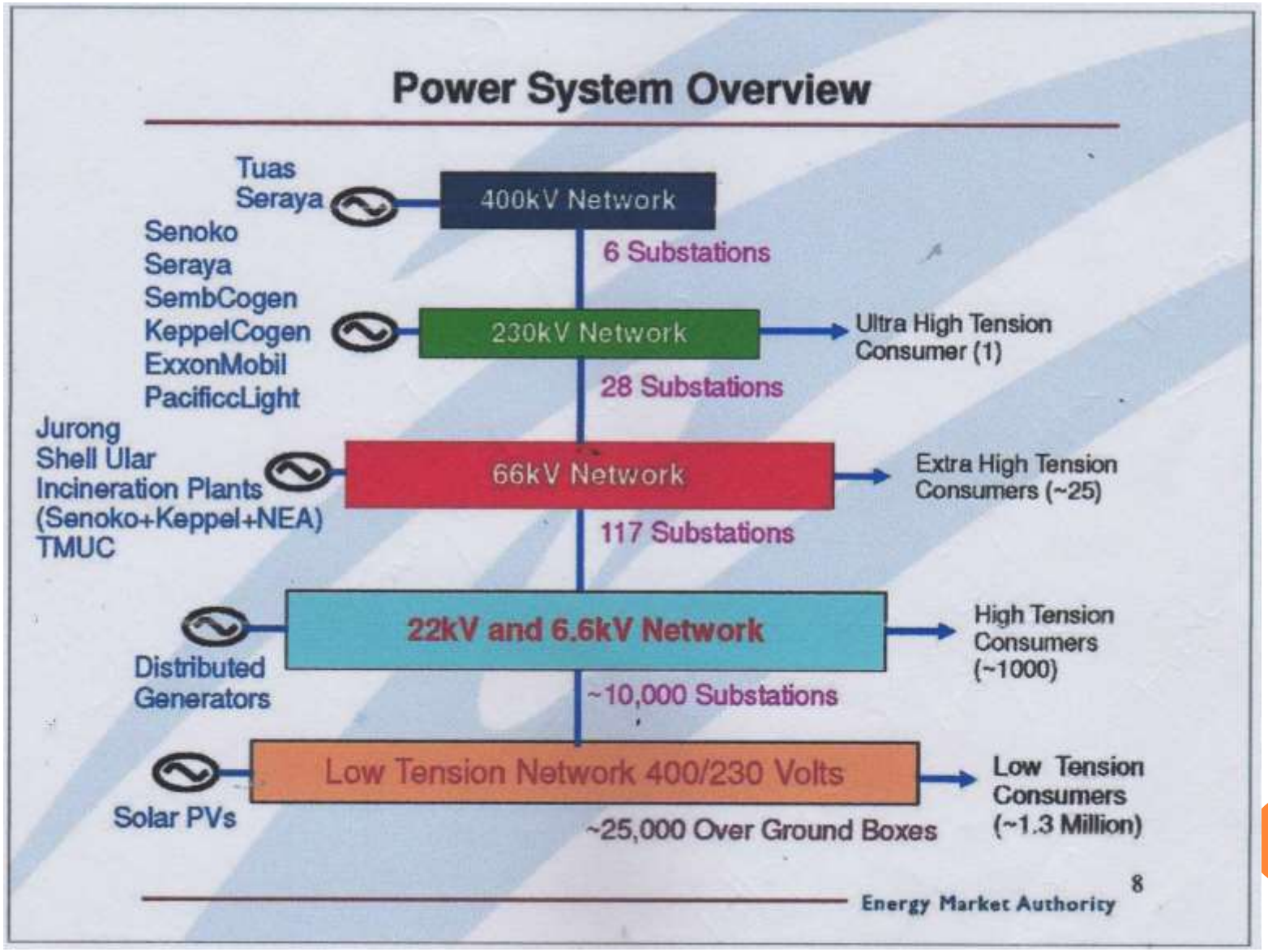
# DETAILS OF THE ELECTRICITY TARIFFS

- 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.

# POWER SYSTEM OVERVIEW

| Sr. | Network | Sub station | Plant Name |
|---|---|---|---|
| 1 | 400 kV | 6 | Tuas, Seraya |
| 2 | 230 kV | 28 | Senoko, Seraya, Sem-Cogen, Keppel-Cogen, Exxon Mobil, Pacific Light |
| 3 | 66 kV | 117 | Jurong, Shell Ular, Incineration Plants ( Senoko+ Keppel + NEA), TMUC |
| 4 | 22 & 6.6 kV | 10,000 | Distributed Generators |
| 5 | 400/230 V | >25,000 | Ground Boxes , Solar PV |

# POWER SYSTEM OVERVIEW



# Singapore Electricity Demand Outlook

| Year | Projected System Peak Demand (MW) |
|---|---|
| 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 =**

$$\frac{\text{Total Electricity Supply (Capacity)} - \text{System Peak Demand}}{\text{System Peak Demand}} \times 100\%$$

$$= \frac{11100 - 8300}{8300} \times 100\% = 33.74\% \quad \text{for 2023}$$

**In Singapore, the minimum reserve margin has been set at 27% to ensure system security.**

# 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.

FEDERATION OF MYANMAR ENGINEERING SOCIETIES

# THANK YOU

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