

STAND BY YOU

**Beside You
All the Way towards
Sustainability**



STAND BY YOU

EGAT is committed to maintaining the country's security and reliability of power supply with social and environmental responsibility throughout its operations, and being beside Thai people all the way towards sustainable.

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SUSTAINABLE DEVELOPMENT GOALS





Prosperity

Ensure prosperous and fulfilling lives in harmony with nature

-  **Goal 7:** Ensure access to affordable, reliable, sustainable and modern energy for all
Pages: 46-56, 70-71
-  **Goal 8:** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Pages: 4, 92
-  **Goal 9:** Build resilient infrastructure, promote sustainable industrialization and foster innovation
Pages: 62-65, 52-55
-  **Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable
Pages: 57, 81-82, 88-89


Planet

Protect our planet's natural resources and climate for future generations

-  **Goal 13:** Take urgent action to climate change and its impacts
Pages: 76-81
-  **Goal 12:** Ensure sustainable consumption and production patterns
Pages: 57-60
-  **Goal 15:** Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss
Pages: 84-87, 106
-  **Goal 6:** Ensure availability and sustainable management of water and sanitation for all
Pages: 74-75

People

End poverty and hunger in all forms and ensure dignity and equality

-  **Goal 2:** End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Pages: 105-106

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Vision

“Innovate power solutions for a better life”

Mission

“Be the country’s main organization to secure the power reliability and enhance competitiveness of the nation through innovation for Thai happiness”



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Message from the Governor

The global spread of COVID-19 in 2020 was a challenge that pressured businesses all over the world into adapting to changed circumstances in order to survive. In response to the pandemic, the Electricity Generating Authority of Thailand (EGAT) has embraced resilience to maintain national power security and build customer confidence while ensuring the safety of employees. Measures were taken to prepare the power system control center to support the business continuity plan (BCP) and improve operational resilience with digital tools and technologies. EGAT also let employees in at-risk areas work from home and planned to put a work from anywhere measure in place after the pandemic. Moreover, EGAT has continued to uphold our responsibilities toward society and communities. In addition to providing a fund to support 75 hospitals across the country, EGAT donated positive and negative pressure swab cabinets, negative pressure beds for moving patients, and protective equipment, such as hand sanitizers and face shields, to medical workers and communities, as well as setting up a quarantine facility at the Bang Pakong Training Center and Mae Moh Training Center. EGAT also supported the government's policies to provide relief during the COVID-19 pandemic, including the electricity bill relief measure and short-term employment to help those who were unemployed.

In 2020, EGAT carried out the following activities in line with the E.G.A.T. Strategy:

E: Electricity Innovation for Stability System and Competition: To improve the efficiency of core business and enhance competitiveness in response to changing circumstances, EGAT implemented activities to support the Thailand Power Development Plan 2018-2037 (PDP2018), including development of main power plants and hydro-floating solar hybrid at Sirindhorn Dam, grid modernization, and an improvement of the transmission system to support grid connectivity.

G: Growth for Sustainability: To build sustainable growth and become a regional energy hub, EGAT collaborated with RATCH and EGCO to establish a joint venture company 'EGAT Innovation Holdings' to develop energy innovations to create economic value for the organization and the nation.

A: Administration and Operation Excellence: To prepare the administration system for future missions, EGAT improved business

practices to support the EGAT Transformation Roadmap, which aims to drive the new S-Curve through the development of new and related businesses, and set up EGAT Proventure, which adopts a team-based structure aligned with objectives and key results (OKRs).

T: Trust and Pride of the Nation: To build trust among stakeholders and create sustainable value together with stakeholders, EGAT developed community power plants in response to the Ministry of Energy's Energy for All Policy. Two pilot projects, Mae Chaem Community Power Plant and Thap Sakae Community Power Plant, integrate the water-energy-food nexus as a framework to achieve sustainable development, aiming to create more income for communities, reduce social inequality, and help the environment through efficient use of agricultural waste. Furthermore, EGAT Energy Excellence Center is established to promote knowledge of renewable energy through hands-on experience. EGAT also put effort in restoring natural resources, building a green society, and reducing waste through the Circular Economy Project.

EGAT took part in the efforts to reduce greenhouse gas emissions in the electricity sector to help Thailand achieve its Nationally Determined Contribution (NDC) through the Renewable Energy Certificate (REC) Scheme. EGAT was authorized by the International REC Standard Foundation (I-REC) to serve as the only local issuer in Thailand to validate RECs for sale to energy purchasers, allowing them to claim the environmental benefits of renewable electricity generation. It is expected that the REC will help promote power generation from renewable energy in the country, thereby creating more jobs and revenue, stimulating the economy, and reducing greenhouse gas emissions in line with the United Nations Sustainable Development Goals. Furthermore, in response to the government's policy on electric vehicles, EGAT aims to become a leader in promoting the use of electric vehicles and has begun to develop EGAT e-bikes and battery swapping stations for use in EGAT's activities, which is expected to help reduce carbon dioxide and particulate matter emissions significantly. EGAT also developed two electric boats powered by a lithium-ion battery. In the first phase of the project, a test will be conducted to study and evaluate the boat performance in EGAT's missions before introducing the electric boats in public 'road-rail-water' transport. EGAT plans to perform the test under the Bang Kruai Green Community Project in 2021 and will expand the results to benefit other government agencies in Bang Kruai District in line with the EGAT Air TIME Strategy to build

natural resource, environment, and energy sustainability under the EGAT Social Responsibility Master Plan 2016-2026 (revised 2020).

EGAT strives to secure the power reliability and enhance competitiveness of the nation through innovation amid the challenges of energy transformation, energy reform, technological advancement, stakeholder needs and expectations, and environmental responsibility. EGAT has implemented an organizational transformation to prepare us to drive toward our vision, **"Innovate Power Solutions for a Better Life,"** in a more sustainable manner. The E.G.A.T. Strategy was revised to guide our operations in 2021 under the EGAT Enterprise Plan 2021-2030 (revised from 2020-2030 edition) as follows: E: Energy Solutions for a Better Life, G: Green Innovation for Sustainability, A: Agile EGAT to the Next Chapter, and T: Trust & Pride by Delivering Value to Regional People.

I would like to thank all of our stakeholders and employees for their contributions to help us drive national power security and enhance the country's competitiveness. No matter what challenges we are facing, EGAT is ready to adapt under our 'Flexible, Timely, and Synergistic' management principles while upholding corporate governance and social responsibility. We believe that this commitment will drive us to achieve sustainable growth together with society. As our **'EGAT for ALL'** concept indicates, EGAT belongs to everyone and works for everyone. And 'everyone,' does not mean just our employees, it includes all Thai people.



Mr. Boonyanit Wongrukmit
EGAT Governor



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EGAT's Sustainable Development Policy

EGAT's Sustainable Development Policy as per the EGAT Notification No. 39/2563 is in line with the Fifth Strategy of the National Strategy on Green Growth Development and the United Nations Sustainable Development Goals 7, 13, 8, 9, 11, 12, 15, 6 and 2.



1. Promote access to affordable and reliable energy through research and development to increase efficiency and stability of renewable energy power generation and transmission system development to support renewable energy.



2. Reduce climate change impact by improving the fossil fuel power generation processes and reducing greenhouse gas emissions.



3. Promote continuous and sustainable economic growth by developing a stable and reliable power generation system, improving and developing the transmission system, expanding the smart grid system, developing infrastructure, promoting local employment, developing dams and power plants into a tourist spot and learning center, and supporting occupational health and safety management.



4. Promote energy and environmental conservation and sustainable production and consumption by means of management of hazardous waste from the power generation process, circular economy development, demand-side management, and smart city development.



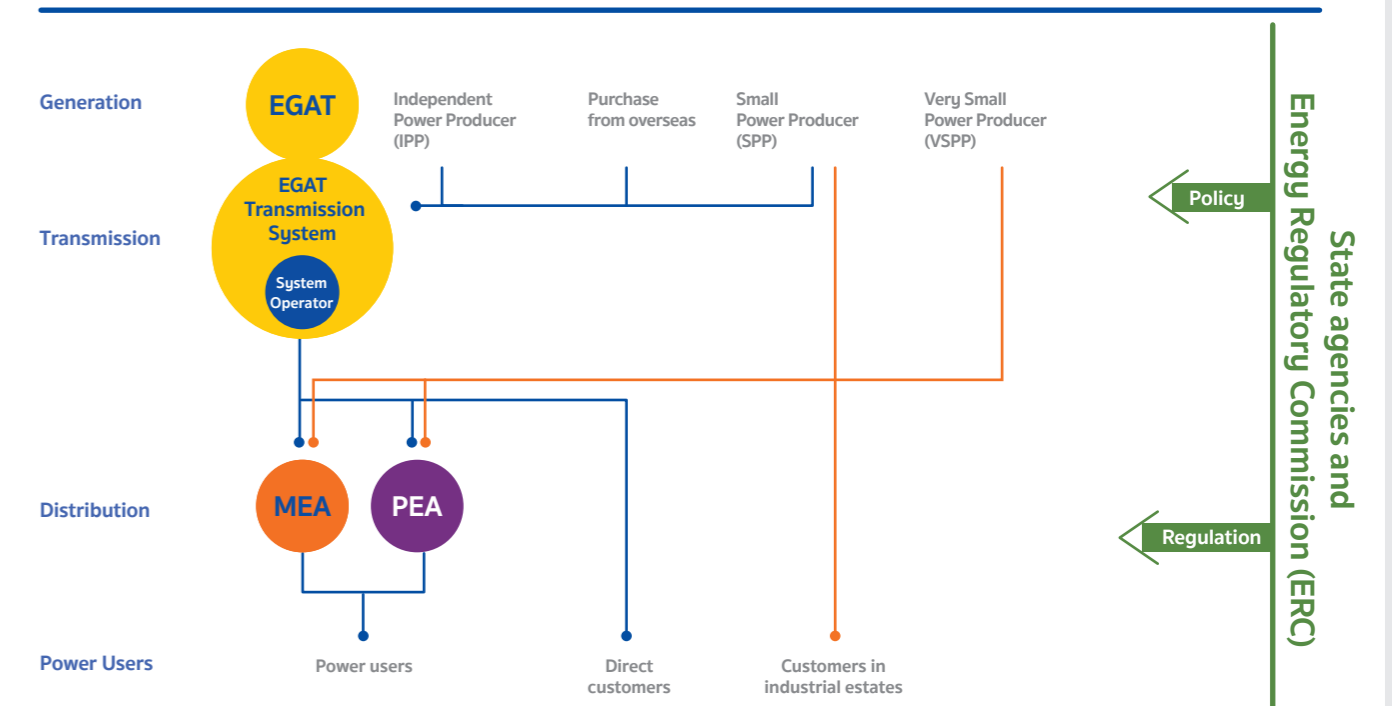
5. Conserve and restore ecosystems, improve access to sustainable water resources, and promote sustainable agriculture by reducing power generation impact, managing water resources efficiently, implementing environmental projects, preventing soil degradation, and promoting natural farming according to the sufficiency economy philosophy to enhance biodiversity and food security.

About EGAT

The Electricity Generating Authority of Thailand (EGAT) was established on 1 May 1969 under the Electricity Generating Authority of Thailand Act B.E. 2511 and presently operates under the B.E. 2535 amendment of the Act. It is a state-owned enterprise that operates energy business under the management of the Ministry of Energy with the Ministry of Finance as its 100 percent shareholder. EGAT engages in generating, acquiring and supplying electricity to the Metropolitan Electricity Authority (MEA), the Provincial Electricity Authority (PEA), legal power user and neighboring countries such as Lao PDR and Malaysia. EGAT is also responsible for power related activities and services, producing and selling lignite and its by-products under the EGAT Act B.E. 2511 (1968) and its amendment.

Under supervision of the Energy Regulatory Commission (ERC), EGAT is in charge of power generation and transmission, as well as serving as a system controller and operator to ensure effective and adequate power supply throughout the country, while managing the environment and being responsible toward communities and society.

Enhanced Single Buyer Model (ESB)



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EGAT's core businesses in electricity generation

- **Power Generation** EGAT's 52 power plants are located in regions across the country, with a total installed capacity of 16,037.32 MW. They are 3 thermal power plants, 6 combine cycle power plants, 29 hydropower plants, 9 renewable energy power plants (wind, solar, and geothermal), 4 diesel power plants, and 1 other type of power plant.
- **Power Purchase** In addition to power generation, EGAT purchases 14,248.50 MW of energy output from 11 independent power producers, 9,473.95 MW from small power producers, and 5,720.60 MW from neighboring countries, including Lao PDR and Malaysia.
- **Power Transmission** EGAT delivers electricity generated from its power plants and purchased from power producers through 500 kV, 230 kV, 132 kV, 115 kV, and 69 kV transmission systems to direct customers, as well as to MEA and PEA for sale to end users in the country. Moreover, EGAT sells electricity through 115 kV and 22 kV transmission systems to Lao PDR and a 300 kV HVDC transmission system to Malaysia.

In 2020, EGAT operated related business in line with the strategy to generate income from its expertise and resources by providing quality energy services to external organizations as follows:

- **Power Plant and Transmission System Engineering and Construction Business** EGAT is responsible for national power security and plays an important role in engineering planning and construction of many power plants across the country. With 50 years of experience working in the industry, EGAT is recognized and trusted by customers at home and abroad. EGAT's services include power plant feasibility studies, contractor selection, engineering consultation, commissioning and testing

- **Power Plant Operation and Maintenance Business** EGAT is recognized and trusted by customers at home and abroad as a leader in integrated operation and maintenance services for power plants. EGAT offers comprehensive solutions from a team of professionals with specialized skills and state-of-the-art technologies to take care of every customer need. EGAT's services include operation and routine maintenance and other maintenance, which are; electrical maintenance, mechanical maintenance, mechanical repair, production and testing, parts management, civil maintenance, and chemical maintenance. Furthermore, EGAT has expanded into new service markets, such as operation and maintenance services for renewable energy power plants, transformer oil testing, and measuring instrument calibration skills development.
- **Transmission System Maintenance Business** EGAT is known for its expertise and experience in high voltage transmission. EGAT's transmission systems deliver electricity to customers across the country under the quality customer service policy. EGAT provides consulting, procurement, planned maintenance, predictive maintenance, preventive maintenance, corrective maintenance, and development and improvement services.
- **By-Product Business** EGAT promotes a circular economy by creating value from by-products such as lignite fly ash, lignite bottom ash, and synthetic gypsum derived from lignite-fired power generation process at Mae Moh Power Plant, Lampang. In 2020, EGAT reduced 880,065 metric tons of carbon dioxide (CO₂) emissions in the concrete industry by using lignite fly ash instead of cement. Moreover, EGAT also focuses on product innovation by collaborating with leading educational institutes in the country, as well as researchers and experts from various

fields to study and develop by-products with properties that better meet the needs of customers. An example of the research projects carried out in 2020 is the 'Use of Lignite Bottom Ash for Improving Horizontal and Slope Bearing Capacity of Soil.'

- **Telecommunications Business** EGAT uses optical fibers in the high voltage transmission system to provide telecommunications and international private leased circuit (IPLC) services under the Type III Telecommunications Business License granted by the National

Broadcasting and Telecommunication Commission (NBTC). Services provided to public and private sector customers include domestic and international bandwidth and dark fiber. EGAT is ready to support the expansion of 4G, 5G, IoT, and other telecommunications infrastructure that may take place in the future, as well as the implementation of the government's digital economy policy to drive the country toward a better future.

In addition, EGAT has made investments to expand power generation and other related businesses with the EGAT Group, which is comprised of the following five companies.

Company	Abbreviation	Registered Capital	Shareholding Proportion	Status
		(Million Baht)	(%)	
Ratch Group PCL	RATCH	14,500	45	Subsidiary
EGAT International Co., Ltd.	EGATI	12,197.40	99.99	Subsidiary
EGAT Diamond Service Co., Ltd.	EDS	623	45	Subsidiary
Electricity Generating PCL	EGCO	5,300	25.41	Associate
District Cooling System and Power Plant Co., Ltd.	DCAP	1,670	35	Joint venture

Revenue, Net Profit and Levies

No.	Table	2020	2019	2018
1	Revenue (baht)	513,860,750,590.46	576,412,302,651.00	523,244,137,189.64
2	Net profit (baht)	25,480,422,542.62	45,738,130,782.00	39,263,478,564.16
3	Levies/State Remittance (baht)	12,985,595,855.62	22,443,365,299.26	20,850,100,000.00

Remark: According to the audited financial statements

Supply Chain

Key Suppliers	Roles
Equipment manufacturers	Deliver equipment and services to support the development of power plants, transmission systems, and high voltage substations.
PTT and other oil suppliers	Supply sufficient fuel to support the annual power production plan.
Independent power plants (IPP, SPP)	Produce electricity to the grid under a power purchase agreement and in line with the annual power production plan.

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Procurement Volume and Value

Functional Units		Contracts	Items	Value (million baht)
Generation	Central	2,470	7,423	4,976.28
	Provincial	24,372	60,420	3,846.39
Total		26,842	67,843	8,822.66
Transmission	Central	2,584	16,167	9,257.66
	Provincial	4,300	10,660	388.04
Total		6,884	26,827	9,645.70
Fuel	Central	147	315	473.14
	Provincial	3,702	8,777	4,029.12
Total		3,849	9,092	4,502.27
Business and others	Central	7,156	20,577	4,826.27
	Provincial	6,478	13,398	1,819.68
Total		13,634	33,975	6,645.95
Total		51,209	137,737	29,616.58

EGAT is a member of national and international organizations, including: Thailand Business Council for Sustainable Development, which was established by a group of business leaders to promote the concept of 'sustainable development' among the business leaders, and encourages the business sector to play a role in determining environmental policies that will lead to sustainable development and preventing and solving environmental problems of the country. It also builds environmental awareness in business organizations. International Transmission Operation and Maintenance Study (ITOMS), which was formed by transmission companies across the world. ITOMS

attempts to build a foundation for the assessment of service and performance, as well as the spending efficiency in transmission activities in order to identify, develop and compile the best practices. EGAT uses the information obtained from benchmarking with other ITOMS members to further improve its operating efficiency.

EGAT's headquarters is located at 53 Moo 2, Charan Sanitwong Road, Bang Kruai District, Nonthaburi Province 11130. The Transmission Operations has 5 offices: two in Nonthaburi, one in Phitsanulok, one in Khon Kaen, and one in Krabi.

Contracted Capacity Broken Down by Energy Source and Region

Power Plant / Energy Source	Metropolitan (MW)	Central (MW)	Northeast (MW)	South (MW)	North (MW)	Total Output (MW)	Proportion (%)
1. EGAT power plants							
1.1 Firm							
- Fuel oil	0.00	0.00	0.00	315.00	0.00	315.00	0.69
- Natural gas	3,990.00	3,298.00	650.00	1,476.00	0.00	9,414.00	20.70
- Lignite	0.00	0.00	0.00	0.00	2,220.00	2,220.00	4.88
- Hydropower from large dams	0.00	1,090.00	237.20	324.00	1,321.20	2,972.40	6.54
- Others (pumped-storage hydropower)	0.00	0.00	1,000.00	0.00	0.00	1,000.00	2.20
Total	3,990.00	4,388.00	1,887.20	2,115.00	3,541.20	15,921.40	35.01
1.2 Non-Firm							
- Wind power	0.00	0.00	26.50	0.19	0.00	26.69	0.06
- Diesel	0.00	0.00	0.00	26.00	4.40	30.40	0.07
- Solar energy	0.00	5.02	1.26	0.01	0.51	6.80	0.01
- Hydropower from large dams	0.00	16.82	8.31	1.28	22.82	49.23	0.11
- Hydropower from small dams	0.00	0.00	0.00	0.00	2.50	2.50	0.01
- Geothermal energy	0.00	0.00	0.00	0.00	0.30	0.30	0.00
Total	0.00	21.84	36.07	27.48	30.54	115.92	0.25
Total net energy output produced by EGAT	3,990.00	4,409.84	1,923.27	2,142.48	3,571.74	16,037.32	35.26
2. Private power producers							
2.1 Independent power producers (IPP) and EGAT Group							
- Natural gas	0.00	11,312.00	0.00	930.00	0.00	12,242.00	26.92
- Bituminous coal	0.00	2,006.50	0.00	0.00	0.00	2,006.50	4.41
Total	0.00	13,318.50	0.00	930.00	0.00	14,248.50	31.33
2.2 Foreign power producers							
2.2.1 Lao People's Democratic Republic (Lao PDR)							
- Hydropower	0.00	0.00	3,947.60	0.00	0.00	3,947.60	8.68
- Lignite	0.00	0.00	0.00	0.00	1,473.00	1,473.00	3.24
2.2.2 Federation of Malaya							
- Others (Thailand - Malaysia HVDC Interconnection Project)	0.00	0.00	0.00	300.00	0.00	300.00	0.66
Total	0.00	0.00	3,947.60	300.00	1,473.00	5,720.60	12.58
2.3 Small power producers (SPP)							
2.3.1 Firm							
- Natural gas	810.00	4,967.00	180.00	0.00	0.00	5,957.00	13.10
- Coal	0.00	369.50	0.00	0.00	0.00	369.50	0.81
- Renewable energy (bagasse, rice chaff, biomass, palm bunch, black liquor, rubber wood chips)	0.00	177.80	159.30	29.00	25.00	391.10	0.86
Total	810.00	5,514.30	339.30	29.00	25.00	6,717.60	14.77
2.3.2 Non-Firm							
- Natural gas	65.00	205.00	0.00	0.00	0.00	270.00	0.59
- Coal	8.00	0.00	0.00	0.00	0.00	8.00	0.02
- Renewable energy (bagasse, natural gas from crude oil production, waste gas, waste, wind power, solar energy and hydropower from large dams)	30.00	641.00	1,148.00	167.62	491.72	2,478.35	5.45
Total	103.00	846.00	1,148.00	167.62	491.72	2,756.35	6.06
Total net energy output produced by small power producers	913.00	6,360.30	1,487.30	196.62	516.72	9,473.95	20.83
Total net energy output produced by private power producers	913.00	19,678.80	5,434.90	1,426.62	1,989.72	29,443.05	64.74
Contracted capacity (total capacity)	4,903.00	24,088.64	7,358.17	3,569.10	5,561.46	45,480.37	100.00



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About This Report

This EGAT Sustainability Report 2020 is the twelfth edition of the sustainability report series, which has been published by EGAT every year since 2009. It discloses information on management and the results of economic, environmental, and social performances during the period from 1 January to 31 December 2020. The reporting scope covers the performance of EGAT and does not include operating activities conducted by its suppliers, business partners, contractors, or the five affiliated companies that include Ratch Group Public Company Limited, Electricity Generating Public Company Limited, EGAT International Company Limited, District Cooling System and Power Plant Company Limited, and EGAT Diamond Service Company Limited.

This report has been prepared in accordance with the GRI Standards: Comprehensive option and Electric Utilities Sector Disclosure. Furthermore, EGAT sought external assurance to perform a limited assurance engagement on the sustainability information and key performance indicators, as described on pages 114-115 of this report.

As part of our efforts to care for society and the environment, this report is printed with soy ink on eco-friendly paper, and also published in electronic format which can be downloaded at EGAT's website. If you have any questions or suggestions, please contact:

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Material Topics of Sustainability

The steps EGAT has followed to identify and select the material topics of sustainability are in accordance with the GRI Sustainability Reporting Standards as follows:



1. Identification

Material topics in the Sustainability Report 2019 are reviewed and compared with international and national sustainability guidelines and topics concerned by leading organizations in similar industries, in order to adjust EGAT's material topics to be more inclusive and up-to-date.



2. Prioritization

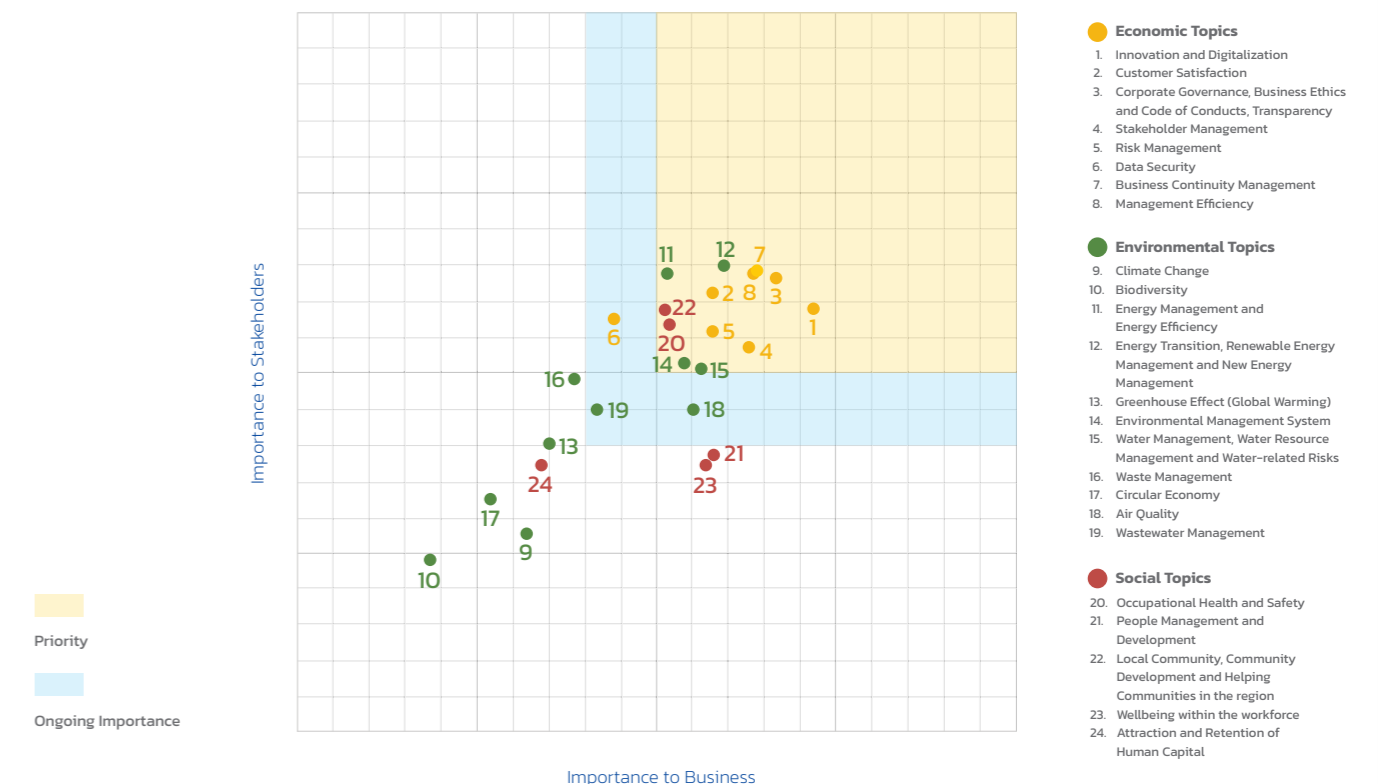
The identified material topics are prioritized from the perspectives of both stakeholders and the organization. Topics material to EGAT take into account the impacts, opportunities, and risks that may occur to EGAT, and topics material to stakeholders are considered based on the level and significance of each impact that may be caused by EGAT that affects stakeholder decision about the organization. To clarify, the identified material topics are selected and prioritized by executives at the assistant governor level or higher and EGAT's stakeholders by means of an opinion survey.



3. Validation and Review

The inclusiveness and completeness of the identified material topics are then validated and reviewed before being submitted to the Corporate Governance and Social Responsibility Committee for approval.

EGAT 2020 materiality comprises 16 topics, including: 8 economic topics, 6 environmental topics and 2 social topics.



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No.	Material Topics	Information Disclosure			Topic Boundary	
		GRI Topic	GRI Standard Disclosures	Sector Disclosures (Electric Utilities)	Inside of Organization	Outside of Organization
Economic						
1	Innovation and Digitalization	EU: Research and development	-	DMA (former EU8)	EGAT	Major customers/ Electricity users and overall society
2	Customer Satisfaction	-	-	-	EGAT	Major customers/ Electricity users and overall society
3	Corporate Governance, Business Ethics and Code of Conducts, Transparency	GRI 205: Anti-corruption	102-16 - 102-37 205-1, 205-2, 205-3	-	EGAT	Public sector and regulators/ Communities around power plants and transmission systems/Scholars, NGOs, and Civil Society Sector/ Major customers/ Electricity users and overall society/ Business partners and allies/ Financial institutions/ Mass media
4	Stakeholder Management	-	102-40 - 102-44	-	EGAT	Public sector and regulators/ Communities around power plants and transmission systems/ Scholars, NGOs, and Civil Society Sector/ Major customers/ Electricity users and overall society/ Business partners and allies/ Financial institutions/ Mass media
5	Risk Management	-	102-11, 102-15	-	EGAT	Public sector and regulators/ Major customers/ Electricity users and overall society
6	Business Continuity Management	EU: Disaster/ emergency planning and response	-	DMA (former EU21)	EGAT	Public sector and regulators/ Major customers/ Electricity users and overall society/ Communities around power plants and transmission systems
7	Data Security	GRI 418: Customer Privacy	418-1	-	EGAT	Major customers/ Electricity users and overall society
8	Management Efficiency	EU: Availability and reliability EU: System efficiency EU: Demand-side management	-	DMA (former EU6), EU10 EU11, EU12 DMA (former EU7)	EGAT	Public sector and regulators/ Major customers/ Electricity users and overall society/ Business partners and allies

No.	Material Topics	Information Disclosure			Topic Boundary	
		GRI Topic	GRI Standard Disclosures	Sector Disclosures (Electric Utilities)	Inside of Organization	Outside of Organization
Environmental						
1	Energy Management and Energy Efficiency	GRI 302: Energy	302-1, 302-3, 302-4,	-	EGAT	Public sector and regulators/ Major customers/ Electricity users and overall society/ Business partners and allies
2	Energy Transition, Renewable Energy Management and New Energy Management	GRI 301: Materials GRI 302: Energy	301-1, 301-2, 301-3 302-1, 302-3, 302-4,	-	EGAT	Public sector and regulators/ Major customers/ Electricity users and overall society/ Business partners and allies
3	Environmental Management System	-	-	-	EGAT	Public sector and regulators/ Communities around power plants and transmission systems
4	Water Management, Water Resource Management and Water-related Risks	GRI 303: Water and Effluents	303-1 - 303-5	-	EGAT	Public sector and regulators/ Communities around power plants and transmission systems
5	Wastewater Management	GRI 303: Water and Effluents	303-2, 303-4	-	EGAT	Public sector and regulators/ Communities around power plants and transmission systems
6	Air Quality	GRI 305: Emissions	305-1, 305-2, 305-3, 305-4, 305-5, 305-6, 305-7	EU5	EGAT	Public sector and regulators/ Communities around power plants and transmission systems/ Electricity users and overall society
Social						
1	Occupational Health and Safety	GRI 403: Occupational health and safety	403-1 - 403-9	-	EGAT	Public sector and regulators/ Employees and labor union
2	Local Community, Community Development and Helping Communities in the region	GRI 413: Local communities	413-1, 413-2	EU22	EGAT	Public sector and regulators/ Communities around power plants and transmission systems

Remark: Disclosures 305-1, 305-2, 305-3, 305-4 and EU5 are also covered in topics No. 9 Climate Change and No. 13 Greenhouse Effect (Global Warming) (see Matrix on page 13) which were not considered as material topics in 2020.

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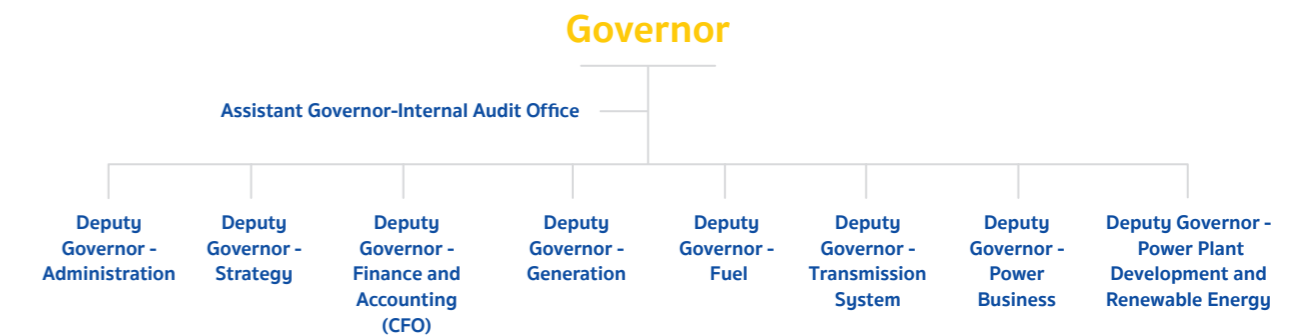
Corporate Governance

Corporate Governance Structure

The EGAT Board of Directors appointed by the Cabinet is responsible for developing policies and ensuring compliance with the principles of corporate governance. To ensure effective management and supervision of key operations, the Board has established 12 committees, including nine scrutinizing committees and three ad hoc committees, in addition to one ad hoc working group, as shown in the corporate governance structure chart below.



Remark: Digital Technology, Knowledge Management, and Innovation Committee was established in 2020.



EGAT's Executive Committee consists of the EGAT Governor as the chairman of the committee and Deputy Governors as directors. It is responsible for managing the day-to-day activities of the organization and making decisions on administrative matters in line with the policies of regulators, the Board of Directors' policies and directives, and EGAT's strategies, as well as addressing the social, economic, and environmental impacts caused by EGAT's activities.

Composition of the Board of Directors

The Board of Directors consists of the Chairman of the Board and not more than 10 directors, including the EGAT Governor, who serves as an ex officio member. The board members are appointed for a three-year term. In 2020, there were six outside independent directors capable of making independent decisions and expressing independent views, among whom, two were selected from seven candidates listed in the Director's Pool. This procedure is in accordance with the Guidelines on Corporate Governance of State Enterprises 2019, published by the State Enterprise Policy Office, Standard Qualifications of State Enterprise Directors and Officials Act (No. 6) B.E. 2550, and Cabinet Resolution dated 18 July 2017, which require that at least one-third of the board of a state enterprise shall possess work experience in the business sector.

To ensure a separation of duties and transparency, the Chairman of the Board does not hold a management position in EGAT. While the Chairman of the Board acts as a chief supervisory officer, the EGAT Governor serves as a chief executive officer. However, to connect the supervisory function and management function, the Board of Directors has appointed the Governor to serve as the Secretary to the Board, in accordance with Article 6 of the EGAT Rule No. 373 on Meetings and Performances of the EGAT Board of Directors, which requires the Chairman of the Board to appoint a secretary with approval of the board members.

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Nomination and Selection

Nomination and selection processes for the Board of Directors and Committees are in accordance with the Guidelines on Appointment of State Enterprise Directors set by the State Enterprise Policy Office, which was approved by the Cabinet on 18 July 2017. The Guidelines require that:

- Directors of a state enterprise shall possess a skill matrix in four areas, including finance, accounting, law, and information technology to make sure that the EGAT Board of Directors possess the knowledge and expertise needed to manage and supervise EGAT's activities. However, the Board of Directors, in Meeting No. 13/2559, held on 28 November 2016, has added seven additional areas in the skill matrix required for the EGAT Board of Directors, including energy business, business administration, science, engineering, economics, treasury, and innovation. Having been approved by the State Enterprise Policy Office, the EGAT Board of Directors is now required to possess a skill matrix in a total of 11 areas.
- At least one-third of the board of a state enterprise shall be non-ex officio directors selected from qualified candidates with work experience in the business sector listed in the Director's Pool.
- No member of the National Legislative Assembly of Thailand, political official, or political office holder shall be appointed as a member of the board of a state enterprise.
- A representative from the Ministry of Finance who is a full-time official in the Ministry of Finance shall be appointed as a member of the board of a state enterprise to protect the interests of the ministry as a shareholder of

a state enterprise and to comply with the Regulation of the Office of the Prime Minister on the Policy and Supervision of State Enterprises B.E. 2557 and as amended.

- A representative from the affiliated ministry of a state enterprise who is a full-time official in that ministry but not a regulator of that state enterprise shall be appointed as a member of the board of that state enterprise.

The candidates nominated for the EGAT Board of Directors must be a Thai national with adequate knowledge and proficiency in business administration, sciences, engineering, economics, finance, or law. Furthermore, they must possess the relevant qualifications and have no prohibited characteristics as required by the Standard Qualifications of State Enterprise Directors and Officials Act (No. 6) B.E. 2550.



Members of the Board of Directors

No.	Name	Position in the Board / Working Position	Independent Member	DP	Experience in Business Sector
1	Mr. Kulit Sombatsiri	Chairman / Permanent Secretary, Ministry of Energy		•	
2	General Somsak Roongsita	Director / Secretary General, Office of the National Security Council	•		
3	Ms. Nantika Thangsuphanich	Director (Representative of Ministry of Energy) / Director General, Department of Energy Business		•	
4	Mr. Suthon Boonprasong	Director / Former EGAT Deputy Governor - Transmission System	•	•	•
5	Mr. Pornpoth Penpas	Director / Director General, Department of Public Works and Town & Country Planning, Ministry of Interior	•		
6	Professor Pisut Painmanakul	Director / Associate Dean, Innovation Strategy and Sustainability, Faculty of Engineering, Chulalongkorn University	•		•
7	Mr. Pakorn Apaphant	Director / Executive Director, Geo-Informatics and Space Technology Development Agency (Public Organization)	•	•	•
8	Ms. Niramarn Laisathit	Director / Senior Executive Vice President, Bangkok Bank Public Company Limited	•		•
9	Mr. Pornchai Thiravet	Director (Representative of Ministry of Finance) / Fiscal Policy Advisor, Ministry of Finance		•	
10	Mr. Viboon Rerksirathai	Director (Ex-Officio) and Secretary / EGAT Governor		•	
11	Mr. Boonyanit Wongrukmit	Director (Ex-Officio) and Secretary / EGAT Governor		•	

Remark :

No.7 resigned on November 1, 2020.

No.10 retired as having completed the term of EGAT Governor on December 3, 2020

No.11 was appointed as a director on 4 December 2020 and as a secretary on 23 December 2020.

Prevention of Conflicts of Interest

EGAT attaches great importance to prevention of conflicts of interest. It requires that members of the EGAT Board of Directors shall not have material interests, whether directly or indirectly, in contracts with EGAT or activities carried out for EGAT. Moreover, directors shall disclose their interests to stakeholders and the public in the EGAT annual report and website.

As per the EGAT Regulation No. 402 on Corporate Governance, the EGAT Board of Directors is also required to monitor and manage conflicts of interest that may occur between management, directors, and employees, as well as investigating the improper use of EGAT's assets.

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Roles of the Board of Directors and Senior Executives

The EGAT Board of Directors and executives, as well as chief executives of affiliated companies, hold the Top Team Meeting (TTM) annually to review EGAT's vision, missions, and strategies. Another important responsibility of the Board is to develop the EGAT Enterprise Plan that takes into consideration government and regulator's policies, the needs and expectations of customers and stakeholders, and internal and external factors encompassing economic, social, and environmental areas. Additionally, it also conducts a review of strategies and operational guidelines every time significant changes in external factors take place.

In 2020, the Board identified factors critical to EGAT's operations, which included government policies, disruptive technology, and implementation of plans and activities to support the EGAT Transformation Roadmap. After confirming EGAT's vision-Innovate Power Solutions for a Better Life, it determined four strategies needed to achieve the vision: 1) Energy Solutions for a Better Life (E), 2) Green Innovation for Sustainability (G), 3) Agile EGAT to the Next Chapter (A), and 4) Trust & Pride by Delivering Values to Regional People (T), or E.G.A.T. for short.

Furthermore, having recognized the importance of fostering values to build a strong corporate culture, the Executive Committee reviewed the SPEED core values defined in 2017 and concluded that they were still appropriate and consistent with the current situation.

Development and Promotion of Knowledge

EGAT strives to develop and enhance the Board of Directors' collective knowledge of economic, environmental, and social topics by continually providing board members with training courses, seminars, and other educational activities, such as study trips, site visits to observe actual operations, and meetings of Independent Directors to improve their competencies. Moreover, EGAT has organized the Introduction Program to brief relevant activities and internal systems for newly-appointed directors, as well as preparing the EGAT Directors' Handbook, which contains important legal and regulatory information necessary to enable directors to perform their duties efficiently and effectively.

Performance Evaluation

The Board of Directors is required to conduct a self-assessment annually in accordance with the Guidelines on Corporate Governance of State Enterprises established by the State Enterprise Policy Office. In 2020, the Board passed a resolution to use two types of self-assessments, including a board assessment and an individual director assessment. The questions in the assessment forms covered the social, economic, and environmental roles of the Board of Directors. The board members jointly considered and discussed their individual assessment results to determine how to improve the efficiency and effectiveness of their performance. As for its performance as a whole, the results indicated that the Board of Directors achieved 'excellent efficiency' in its annual performance evaluation.

Management of Economic, Environmental, and Social Impacts

EGAT takes feedback and comments from stakeholders on economic, environmental, and social impacts caused by its operations as input for developing the organization's strategic plans and objectives that align with enterprise risk management. EGAT Risk Management and Internal Control Committee is established by the Board of Directors to review internal control policies and systems, assess risks and internal controls, evaluate audit and reporting processes and supervise to ensure compliance with the risk management framework. Moreover, it is responsible for reviewing disclosure of risk information to regulators and the public, approving risk appetite and risk tolerance, and ensuring that enterprise risks are managed within the risk appetite.

EGAT has also established the Strategy Steering Committee, an executive body which is composed of Deputy Governor-Strategy as the Chairman of the Committee, Deputy Governors-Administration, Generation, and Transmission System as the Vice Chairmen, and Assistant Governors as committee members. It is responsible for reporting risk management and internal control performance to the Board of Directors every quarter for comments and suggestions about risk impacts and their economic, environmental, and social opportunities.

When a critical concern arises, the responsible unit will communicate the concern to the Executive Committee for consideration before reporting it to the subcommittee in charge and the Board of Directors, respectively. In an unforeseen event that could have

a serious impact on society and the nation, the EGAT Governor will communicate the incident and report the actions taken to resolve the situation to the Board of Directors without delay via communication channels such as telephone and Line application.

EGAT management reported critical concerns raised by the Ministry of Finance after the state enterprise assessment to the Board of Directors at the EGAT Board Meeting No. 6/2563 on 22 May 2020. Specifically, the Ministry of Finance was concerned about various factors that may greatly affect the role of EGAT in the future. These factors include changes in the global energy industry due to energy innovation and technology development, the limitations of power generation and supply in Thailand, and the possibility of restructuring the country's energy industry to allow for more competition, such as direct power purchase between power producers and consumers. The Ministry suggested that to reduce impact and maintain its status as the country's main power producer and supplier, EGAT should determine its business directions and models and improve its internal structures and processes so as to be ready for these changes, as well as timely addressing the impact and creating new opportunities.

The Board of Directors has advised and commented on mechanisms for addressing and resolving these concerns to respond to changes in the global energy industry in the next 5, 10, and 20 years, as follows:

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1. Power System Security	Use natural gases and clean coals from smart mining as fuels and improve existing power plants to achieve high efficiency and low cost.
2. Power Transmission System	Expand power transmission systems to support grid connectivity and modernization, energy trading with neighboring countries, and mass transit systems, such as electric trains and double-track railways. Develop battery energy storage systems for use with solar cells and electric vehicles in response to changes in the global energy industry and disruptive technology.
3. Smart Grid	Improve the smart grid for two-way communication to sell electricity to prosumers and independent power supplies (IPS). Integrate artificial intelligence in the RE Control Center. Develop the National Energy Trading Platform.
4. Renewable Energy	Research and develop a community power plant model that uses biomass fuel, biogas, and solar energy to generate electricity and the energy regulatory commission sandbox (ERC Sandbox).
5. Electric Vehicles (EV) and Energy Storage System	Support prosumers and IPS. Develop and promote EV charging stations and energy storage systems (ESS).

In addition, EGAT will use big data analytic to support smart grid development and AI and the Internet of Things (IoT) to support the organization's activities in various areas.

Remuneration

Determining the remuneration, including the salary and meeting allowance of the Board of Directors, is in compliance with the Cabinet Resolution and guidelines of the Ministry of Finance. Best Practices for State Enterprise Directors set by the State Enterprise Policy Office, Ministry of Finance, and the Cabinet Resolutions dated 2 July 2013 and 24 April 2019 Concerning Meeting Allowance for State Enterprise Directors require that a director of the board of a large state enterprise shall receive a monthly remuneration of not more than 10,000 baht, and a chairman of the board shall receive a monthly remuneration of 20,000 baht. Furthermore, a director shall receive a meeting allowance of not more than 20,000 baht per month in the month in which a meeting is held. With reasonable causes, a director may receive a meeting allowance more than once per month but not more than 15 times per year. A director appointed to serve on more than one committee shall receive a total meeting allowance for not more than two committees and not more than one

allowance per month per committee. A chairman of the board shall receive a meeting allowance that is 25 percent more than other directors. Directors shall be responsible for paying their own income tax.

The Governor Remuneration Committee has been established to determine the remuneration of the EGAT Governor and remuneration payment rules, draft a governor contract, and negotiate salary and other compensations and submit them to the Board for consideration. EGAT also has the Governor Performance Assessment Committee, which is responsible for considering the action plan and performance evaluation criteria for the EGAT Governor, evaluating the EGAT Governor's performance, and reporting the results to the Board of Directors EGAT.

Senior executives (division directors, equivalent, or higher) shall receive remuneration in accordance with EGAT's salary structure and a bonus at the same rate across the organization, depending on the operating and performance results of the state enterprise in compliance with the rule set by the Ministry of Finance.

The Board of Directors is responsible for developing policies and supervising business operations to ensure that the economic, environmental, and social objectives set in the EGAT Enterprise Plan are achieved. Nevertheless, the success in achieving these objectives will be evaluated, which is then used to support the determination of remuneration and incentives of the Board of Directors and other senior management.

EGAT studies and analyzes opinions of stakeholders, government laws and policies, management policy, opinions of employees through the Labor Union, and employee engagement survey results in a remuneration determination process, in order to propose guidelines for determining remuneration to the Executive Committee and Board of Directors. However, collective bargaining beyond the existing financial limit must be proposed to the State Enterprise Labor Relations Committee and the Cabinet for approval. However, EGAT does not require votes of stakeholders to determine the remuneration.

	2020	2019	2018
Ratio of annual total compensation for the organization's highest paid individual to the median annual total compensation for all employee	3.80 : 1	3.96 : 1	3.96 : 1
Ratio of the percentage increase in annual total compensation for the organization's highest paid individual to the median percentage increase in annual total compensation for all employee	0.41 : 1	1.07 : 1	1.06 : 1

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Ethics and Code of Conduct

EGAT attaches great importance to corporate governance and business ethics. EGAT Ethics Manual, which contains ethical standards, proper practices, and guidelines on acceptable behaviors for the Board of Directors and employees at all levels to comply with in performing their duties, was published and communicated to all employees through various channels such as email and the corporate governance website. Moreover, EGAT has established the Compliance Division to offer advice about compliance with the code of conduct, rules, and regulations, as well as penalties, appeals, and complaints related to violation of codes of conduct, rules, and regulations. In addition to preparing to support the Ethical Standards Act B.E. 2562 and Rules for Developing Code of Ethics, Ethical Requirements, and Ethical Assurance Procedures for Government Agencies and Officials B.E. 2563, EGAT has followed up on newly enacted or revised laws to improve and update its rules and regulations and communicated them to all employees throughout the organization to ensure compliance.

EGAT encourages employees, workers, and stakeholders to file complaints and provide suggestions on matters related to EGAT's employees and business activities via a comment and complaint management system. The Complaint Management Center is responsible for handling comments and complaints, including those related to corruption and breach of discipline. It will resolve the issue and report back to the complainant within the time required by the law. The Complaint Management Center will report its performance results to senior executives, the EGAT Anti-Corruption Operations Center, and the Corporate Governance and Social Responsibility Committee every quarter.

Anti-corruption

EGAT has signed the Memorandum of Cooperation on Driving the National Strategy on Corruption Prevention and Suppression Phase 3 (2017-2021) between the Office of the National Anti-Corruption Commission (NACC), State Enterprise Policy Office, and 54 state-owned enterprises to build an anti-corruption culture, improve corporate governance, and reform corruption prevention and suppression in the organization. Employees at all levels play a part in preventing corruption in the organization. For instance, the EGAT Governor acts as a role model in upholding corporate governance, declaring his intention to perform administration with honesty, integrity, and transparency. EGAT executives and employees comply with the corporate governance and anti-corruption policies to build immunity against corruption, promote a culture of honesty in the organization, and develop transparent, fair, and accountable work processes, and are ready to take responsibility to stakeholders for any impacts caused by EGAT's management or activities.

Fraud Risk Assessment

EGAT has conducted a fraud risk assessment by analyzing every operational activity that may cause corruption, or have a negative impact on the organization's image, and has specified preventive and corrective measures. In 2020, a total of 73 operational activities were included in the annual audit plan. All of these activities, accounting for 100 percent, were assessed for fraud risks.

An analysis of fraud risk factors covered the following seven aspects.

- F1 Fraud policy
- F2 Conflict of interest
- F3 Corruption
- F4 Non compliance
- F5 Reporting manipulation
- F6 Misappropriation of assets
- F7 Information technology fraud

Anti-Corruption Communication

Anti-corruption policies, rules, and regulations have been regularly communicated through various channels such as email, the LINE application, the EGAT website, and the information board. A meeting is also held to provide information to promote proper behavior and prevent misconduct, such as giving or receiving bribes, CG & ITA delivery, the No Gift Policy, how to work from home without breaking organization rules, and audit alert, which contained information about work-related matters that should be treated with caution. In addition, a video is played before the beginning of an in-house training session to raise anti-corruption awareness among participating executives and employees.

In addition, EGAT has organized anti-corruption trainings such as the 'Train the Trainer' course which aims to develop participants to drive EGAT into a moral organization model, and a mindset training course about differentiating between self-interest and collective interest and zero tolerance for corruption. EGAT also organizes and participates in anti-corruption activities regularly.

- EGAT set moral goals in four areas, including discipline, sufficiency, honesty, and volunteer spirit, and declared their intentions or agreements between division-level executives and employees to drive a moral organization.
- EGAT organized the Clean Organization 2020 under the theme 'EGAT Upholding Corporate Governance and Business Ethics' on 30 November 2020 at the Auditorium Room, 3rd Floor, Tor 103 Building. Activities in the event included 1) a symbolic declaration of commitment by the EGAT Board of Directors, executives, and employees, 2) a panel discussion on the topic 'Ethic Conduct for Transparent Workplace' 3) the Honor Pin Award Ceremony 2019, 4) the Outstanding Corporate Governance Project Award Ceremony 2019, and 5) the Corporate Governance Role Model Award Ceremony 2020.

- EGAT participated in the Online Anti-Corruption Day 2020 on 15 September 2020 organized by the Anti-Corruption Organization of Thailand under the theme 'Power of Data.' The event encouraged organizations to adopt big data and modern technology to monitor and prevent acts of corruption, urging them to recognize the importance of anti-corruption.
- EGAT attended the International Anti-Corruption Day (Thailand) 2020 on 9 December 2020 at Nonthaburi Room 1, Building 4, Office of the NACC. The hybrid event, combining regular and online formats, was co-organized by the Offices of the NACC and ACT under the theme 'Zero Tolerance' to declare the intention to join force against corruption.

EGAT communicates anti-corruption policies and procedures to the Board of Directors, employees, and business partners, accounting for 100 percent of the governance body members, employees, and business partners. All of employees have received e-learning on anti-corruption.

In 2020, there were no employees for malfeasance, no legal case filed against EGAT over corruption and no incidents of corruption causing business partners to terminate or refuse to renew contracts. However, a legal case was filed against an employee over a bidding process with the Criminal Court for Corruption and Misconduct Cases, Region 1. The accused has been acquitted by the court of first instance. The case is now with the appeal court. EGAT also had no legal cases, significant fines, non-monetary sanctions, or cases brought to the dispute mechanisms for non-compliance with environment or other socioeconomic laws and regulations.

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Risk Management and Internal Control

Recognizing that changes brought about by internal and external factors may affect operations, EGAT continuously manages risks and internal controls in accordance with COSO's principles and guidelines. The current approach to risk management and internal control is consistent with the State Enterprise Assessment Model (SE-AM) developed by the State Enterprise Policy Office (SEPO). Moreover, EGAT has applied the 2017 COSO Framework (Enterprise Risk Management—Integrating with Strategy and Performance), which emphasizes value addition to the organization, alignment of strategic plan with the risk management process, and creation of corporate culture that integrates risk management in every process at all levels and requires all employees to comply with the risk management and internal control policy.

The EGAT Board of Directors has established the Risk Management and Internal Control Committee to oversee the organization's risk management and internal control systems while the Strategy Steering Committee, appointed by the EGAT Governor, is responsible for ensuring effective enterprise-wide risk management.

COSO 2017

emphasizes value addition to the organization and the alignment of strategic plan

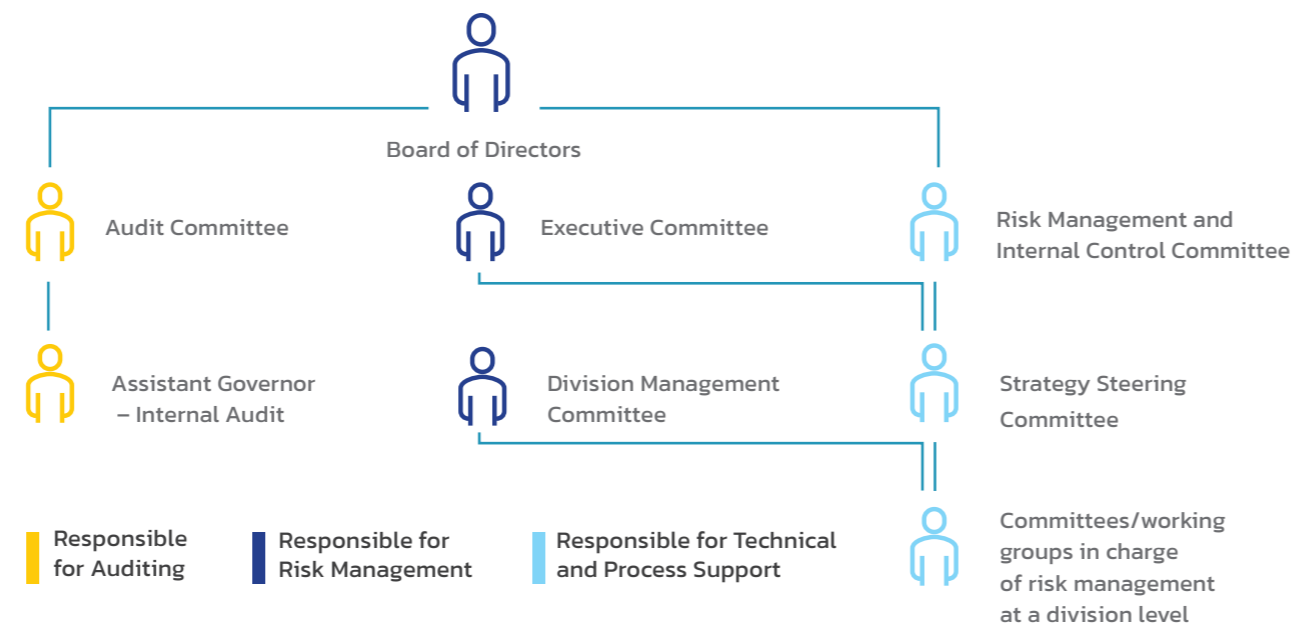
Enterprise risks are managed systematically through steering committees and integrated into strategy planning to ensure that the risk management plan is implemented effectively and efficiently in alignment with corporate objectives and strategies. Operational risks are under the supervision of division executives and persons in charge, and it is the responsibility of every unit to manage and control risks within the defined risk tolerance.



Risk Management and Internal Control in 2020

In 2020, EGAT managed risks in accordance with the guidelines set by the State Enterprise Policy Office (SEPO) and COSO Enterprise Risk Management—Integrating with Strategy and Performance 2017 (COSO-ERM 2017), which consist of five components including:

Risk Management and Internal Control Structure



- 1 Governance and Culture**
 - Establish risk management structure
 - Determine rules for defining risk appetite
- 2 Strategy and Objective Setting**
 - Formulate business objectives
 - Define risk appetite and risk tolerance
- 3 Performance**
 - Identify risks
 - Assess risk severity
 - Develop risk management plans/measures
- 4 Review and Revision**
 - Conduct risk management result review and revision
 - Set plans to improve risk management
- 5 Information, Communication and Reporting**
 - Communicate risk management information
 - Monitor, assess, and report risk management performance
 - Improve support systems

1. Governance and Culture

The Risk Management and Internal Control Committee set policies that integrate corporate governance, risk management, and internal control and encourage employees at all levels to participate in the implementation of the risk management framework. Moreover, executives are required to use risk-related information in their decision-making and management.

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2. Strategy and Objective Setting

EGAT manages risks to achieve its vision and mission and align risk management with the strategic objective and operational directions. EGAT risk management plan is formulated and reviewed on an annual basis to reflect the changing circumstances, analyzing and assessing both internal and external factors that may affect our EGAT's operations. Furthermore, key risk indicators (KRIs) are identified for all major risks, whereas risk appetite and risk tolerance are determined at the organization and risk factor levels, which are then submitted to the Risk Management and Internal Control Committee for approval and implementation.

3. Performance

EGAT identifies risks and assesses their probability of occurrence based on accumulated past data and the prediction model, as well as considering their potential impacts or severity levels. The comprehensive risk management plan is developed to reduce the probability of risk occurrence and/or risk impact, which will help EGAT to accomplish its defined mission and goals. A risk map is used to analyze risk correlation and a cause-effect tree of enterprise risks to ensure that risks can be managed in a timely manner.

4. Review and Revision

EGAT makes a risk management plan every year to be submitted to the Risk Management and Internal Control Committee for approval and uses it as the organization's risk management guideline. The result of risk management is monitored on a quarterly basis and the risk management plan or measures are adjusted to reflect changing internal and external factors. All units responsible for each risk factor are informed of the annual risk management plan.

5. Information, Communication, and Reporting

To ensure that employees apply risk management in their daily work, EGAT has published the EGAT Risk Management Manual on the risk management and internal control website within the intranet system. The implementation of the risk management plan, measures, and activities are continuously monitored and reported to the Risk Management and Internal Control Committee and Board of Directors every quarter. The comments and suggestions from the Committee will be used to improve the risk management and internal control plan and performance. In addition, to increase the efficiency of the risk management process, EGAT has developed a risk management system (RMS) to collect risk management and internal control data, analyze, monitor, and report risk management performance at the organization and division levels.

EGAT classifies risks into four areas as follows:

1. Strategic and Corporate Risk

EGAT develops strategies to respond to economic, social, energy, technological and consumer behavioral changes caused by global trends. EGAT reviews its vision, strategies, and future business directions and make strategic and action plans every year at the seminar of executives and Board of Directors. In addition, the high-ranking executives also hold a meeting to discuss and exchange ideas to revise strategic plans.

2. Operational Risk

EGAT is aware of operational risks arising from power system availability improvement, information technology system security, use of innovations and technologies to improve competitiveness, human resources development employee management, and social, community, and environmental management. In addition, due to the global spread of COVID-19, which

could pose economic risks and change consumer behavior and the supply chain system, EGAT may have to review its future business model to reflect these changes. Other factors that may affect EGAT include unreliable electricity bills and corruption.

3. Financial Risk

EGAT manages financial risks to maintain financial stability and ensure adequate capital investment or return on investment. Capital management has been carried out in order to achieve maximum efficiency with reasonable costs. Moreover, EGAT has a capital structure that can maintain appropriate financial ratios comparable to leading corporations in the same industry and manage operating budgets to ensure effective cost and spending control.

4. Compliance Risk

EGAT adopts the 'Corporate Governance Policy' and monitors policy, legislation, rule, and regulation changes within the regulatory ministry to ensure that operations are in compliance with the new laws. EGAT directs its internal units to adhere to the principles of good corporate governance and internal control, as well as monitoring their compliance with policies, laws, rules, and regulations and reporting the results to relevant committees.

EGAT has developed a COVID-19 Response Plan, which breaks down the crisis-response cycle into five stages: Resolve, Resilience, Return, Re-Imagination, and Reform as shown in the figure below.



Resolve

Put emergency measures in place to resolve issues.



Resilience

Build operational resilience, make an emergency response plan, and consider a business continuity plan.



Return

Create a plan to quickly return to scale.



Re-Imagination

Envision the next scenario and make appropriate management and resource allocation plans.



Reform

Review organizational strategies to respond to the new normal in the electricity industry.

EGAT's COVID-19 Response Plan in 2020 integrated the 5-R strategy

(Resolve, Resilience, Return, Re-Imagination, and Reform) to effectively drive EGAT forward.

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Internal Control System

EGAT implements internal control in accordance with the Rule of the Ministry of Finance on Internal Control Standards and Rules for Government Agencies B.E. 2561. An EGAT internal control assessment report is prepared annually, which is reviewed by the Audit Committee before being submitted to the Board of Directors and Ministry of Energy. EGAT strives to integrate risk management and internal control to establish a state enterprise internal control system that aligns with risk management. Internal control is a process for ensuring the achievement of an organization's objectives in operational effectiveness and efficiency, reliable financial reporting, and compliance with laws, regulations, and policies.

EGAT has assessed the internal control system in accordance with the rules of the Ministry of Finance to ensure that its objectives are achieved efficiently and effectively. The internal control assessment covers all five components as follows:

1. Control Environment

To achieve the organization's objectives in an efficient, effective, transparent, fair, and accountable manner and maintain a positive attitude towards internal control, EGAT promotes an appropriate internal control environment in which its management adheres to the principles of good corporate governance. EGAT also promotes honesty, integrity and responsibility among employees by adopting the corporate governance and anti-corruption policies. Moreover, EGAT code of ethics and code of conduct manual are also established and communicated to the Board of Directors, management, and employees to ensure compliance.

The Board of Directors, which is independent from EGAT executives, supervises and develops internal control,

vision, mission, corporate plan, strategic objectives and measurable indicators and action plans, to guide executives and employees in performing their duties. The Board also assigns specific tasks and responsibilities to subcommittees to help the organization achieve its objectives.

EGAT promotes SPEED core values to build a strong corporate value and culture, encouraging all employees to put them into practice and integrating them into other organizational processes. Approval authority and responsibilities at each hierarchical level are clearly defined. Moreover, key performance indicators (KPIs) are established to guide and follow up on employee performance toward the organization's goals, in addition to recruiting, developing, and retaining talents to lead EGAT toward sustainable growth.

2. Risk Management

EGAT manages risks in accordance with the 2017 COSO Framework, aligning risk management with organizational strategies. Risk management activities are monitored and reviewed on a quarterly basis. The Risk Management and Internal Control Committee is responsible for overseeing enterprise risk management, defining a risk management framework, risk appetite, and risk tolerance, and setting a risk management policy in writing.

Moreover, EGAT analyzes and assesses both internal and external factors that may prevent the organization from achieving its objectives, covering four risk areas. To formulate appropriate risk management plans and measures, EGAT has conducted a corruption risk assessment covering different kinds of corruption and evaluating the level of risk significance based on their likelihood of occurrence and potential impact.

3. Control Activities

To ensure achievement of internal control objectives, EGAT implements effective and efficient control activities to prevent or mitigate potential damages and errors. EGAT also sets up policies, rules, regulations, and procedures covering all areas of operations, as well as establishes several necessary control activities, such as the separation of powers, hierarchy of approval authority, and automated and manual controls, in addition to using information technology to develop control activities like General Controls and Application Controls.

4. Information and Communication

EGAT has financial and non-financial information systems and a database management system. EGAT Digital Committee is responsible for managing, overseeing, and supplying digital systems and scrutinizing the digital development plan to transform EGAT into a digital organization. EGAT also has the Enterprise Performance Management (EPM) System, which is an information system that allows executives to evaluate and analyze data for improvement and planning.

In addition, EGAT has established the communication system to help executives and people within and outside the organization communicate and exchange information in a systematic and timely manner during normal and crisis times.

5. Monitoring Activities

EGAT has established a regular and continuous performance monitoring system and clear guidelines to follow when the objectives are not met, as well as monitoring and reporting improvement progress, and reviewing the adequacy of the internal control system. In addition, the risk management system (RMS) is also

developed to support risk management and internal control activities and an early warning system to help employees prepare for rapidly changing situations.

Assistant Governor - Internal Audit has established an audit plan to ensure checks and balances and transparency, covering important managerial and operational processes. The person is also responsible for evaluating the adequacy and implementation of the internal control system and reporting the audit results and rectification progress to the Audit Committee and Board of Directors on a regular basis.

The internal control assessment found that EGAT's internal control system consists of five components as required by Rule of the Ministry of Finance on Internal Control Standards and Rules for Government Agencies B.E. 2561. EGAT's internal control system is effective and sufficient for achieving the organization's internal control objectives.



EGAT's internal control system consists of five components in line with the Rule of the Ministry of Finance.

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Business Continuity Management

EGAT's operations are constantly exposed to unforeseen risks and crises caused by either natural disasters or human activities. To ensure resilient energy services can respond to any situation, EGAT has implemented a business continuity management system in accordance with the ISO 22301 standard. The EGAT Governor has the duty to approve policies and drive operations, while the Business Continuity Management Subcommittee is responsible for business impact analysis (BIA), risk assessment, and crisis management, together with process owners. The Subcommittee also makes business continuity plans to enable EGAT to carry out its core mission of generating and transmitting electricity during the maximum tolerable period of disruption (MTPD) and restore its business process to meet the recovery time objective (RTO).

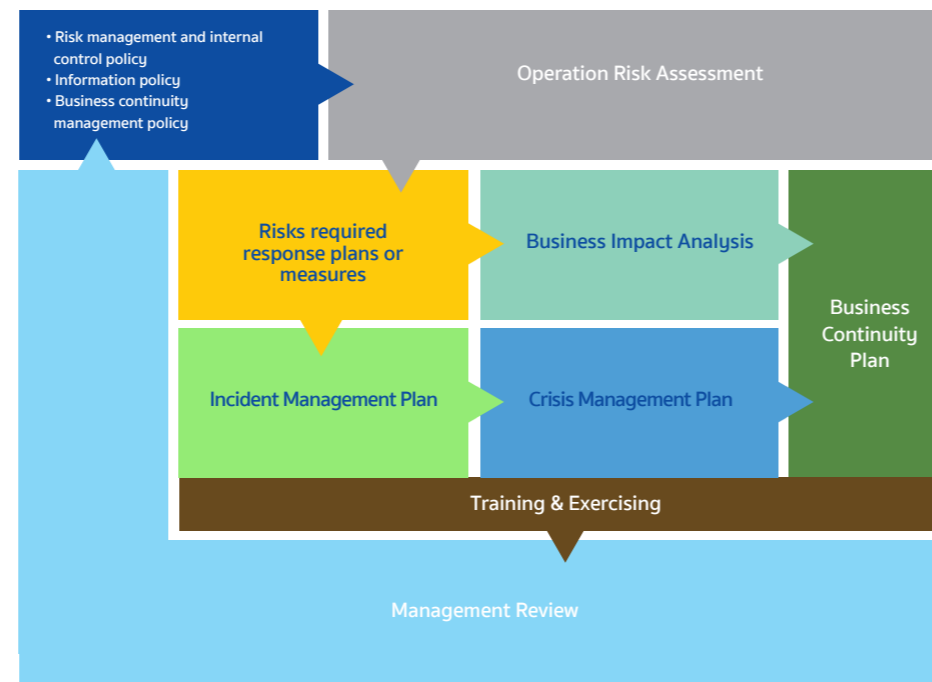
EGAT analyzes risks according to the COSO-ERM framework in relation to the assumptions of stakeholder

EGAT business continuity management is in accordance with the ISO 22301 standard.

needs and expectations against internal factors, such as information policy and business continuity management policy and external factors, such as relevant laws and regulations and natural disasters that may affect operations. The results of risk analysis will be used by the highest-ranking officers in each area to set up a working group to develop relevant response plans or measures.

EGAT defines the scope of business continuity management and prepares for disaster response to ensure that systems and workplaces can continue functioning, as shown in the figure below.

Disaster Preparedness and Business Continuity Management Process



In 2020, EGAT prepared the EGAT Business Continuity Management Manual, which includes topics such as planning, monitoring, reviewing, drilling, maintaining, and improving the business continuity management system in the electric power supply process. Furthermore, representatives from various units take part in the Business Continuity Management Subcommittee, to ensure crisis preparedness and efficient management of EGAT operations through the below.

- Determining and formulating the framework for business continuity management framework, business continuity management policy, business continuity management handbook and business continuity management guidelines for relevant units
- Developing and revising EGAT's business continuity management system to ensure it is up to date and in alignment with international standards
- Reviewing critical processes, conducting a business impact analysis and risk assessment in regard to risks that may affect EGAT's business operations and determining a business continuity strategy
- Gathering plans, measures or other relevant documents from functional units, monitoring crisis drills and summarizing results annually
- Integrating crisis drills, crisis management and crisis communications of all EGAT functional units by conducting annual drills
- Appointing working groups where necessary
- Conducting other work as assigned by the Strategic Steering Committee

Business Continuity Management Process

1. Analyze business impacts and assess risks.
2. Determine strategies and actions to be taken during a crisis.
3. Develop a pre-incident plan (including alarm device inspection, maintenance, and preparedness plans).
4. Develop incident action procedures and business continuity plan/measures.
5. Develop a post-incident plan (survey and recovery). Every plan/measure must clearly identify activities and responsible persons.

Crisis management and communication

EGAT requires each functional unit to prepare its own crisis management and communication manual using the EGAT Crisis Management Manual as a guideline. Crisis severity is divided into four levels, as follows:

- Level 1 low (green): communication with concerned parties, according to an emergency response plan in each local unit.
- Level 2 moderate (yellow): communication with concerned parties, according to an emergency response plan in each local unit.
- Level 3 high (orange): communication with concerned parties, according to crisis management and/or communication plan in each function.
- Level 4 critical (red): communication with concerned parties, according to the Crisis Management Manual.

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Business Continuity Exercises

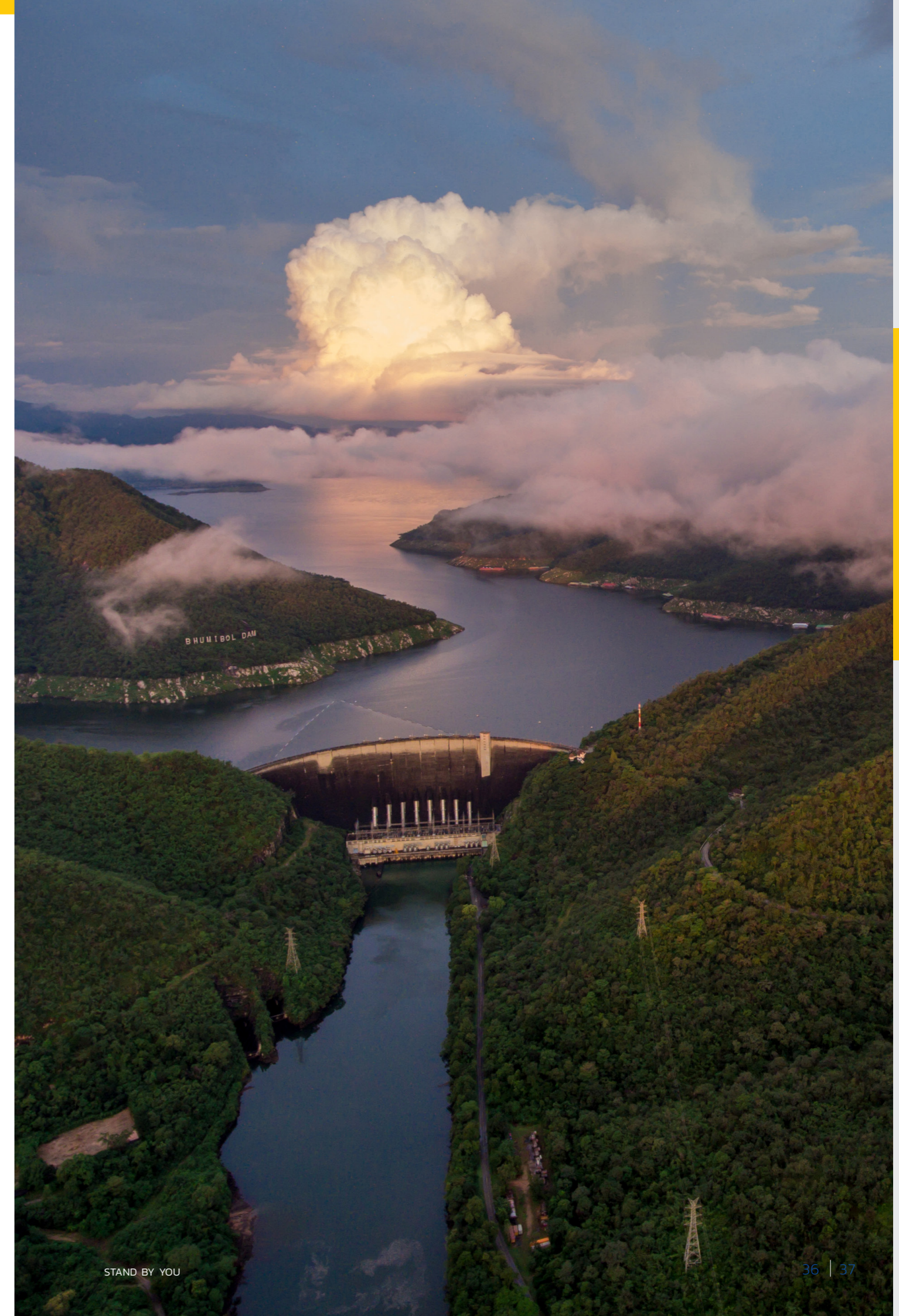
EGAT conducts drills to test business continuity processes at a unit-level for the functional units that has devised business continuity plans or measures. At the organization level (EGAT crisis level), the Business Continuity Management Subcommittee, with the safety division acting as secretary, will be in charge of the drills, which will go over crisis management and communications as well as the business continuity context. The relevant sector or division will also take part in the drills (depending on the scenario determined by the Subcommittee) based on the process and chain of demand prescribed in the EGAT Crisis Management Manual. Crisis management and communications drills are required to be held at least once annually, so personnel will be familiar and review the roles in crisis management and improve their performance. For functional units with a business continuity plan within their own context, such drills are also required at least once annually.

Important disaster and emergency response exercises conducted in 2020 include:

- A level three fire disaster and evacuation drill on 15 October 2020 at the Mae Moh Power Plant, Mae Moh District, Lampang Province in compliance with the law on fire prevention and suppression and power plant crisis management policy. The drill aimed to prepare employees and equipment to ensure that they were ready to respond effectively to a real incident.
- A seminar organized by EGAT and Rayong Province Office of Disaster Prevention and Mitigation on 24 November 2020 at the Holiday

Inn & Suites, Rayong City Center, to provide 70 participants with information about preparedness measures to respond to power outages caused by natural disasters or emergencies. A functional exercise was conducted to test and evaluate individual performance and roles in responding to emergency scenarios. The seminar also informed the relevant agencies of measures and actions in the event of natural disasters or transmission system emergencies.

- A seminar organized by EGAT and Lopburi Province Office of Disaster Prevention and Mitigation on 2 December 2020 at the Monnipha Convention Center, Mueang Lopburi District Lopburi Province. Participants, including local government agencies, military units, and private organizations, participated in a functional exercise to respond to a scenario of a tropical depression causing a high-voltage tower on a main road to collapse, resulting in a blackout in the Muang Lopburi District. Before and during the incident, emergency response procedures were drilled and rehearsed to resolve problems within the required time.



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Information System Management

EGAT places great importance on information system security and has thus adopted innovative technologies to keep the organization's data, including financial and non-financial information, safe and secure. EGAT Digital Committee is established to manage, acquire, and supervise digital systems, as well as considering the digital development plan to transform EGAT into a digital organization. EGAT also puts in place the Executive Information System (EIS) to support managerial decision-making and modern communication systems to enable executives and people within and outside the organization to communicate and exchange information in a systematic and timely manner during normal and crisis times.

In compliance with the Official Information Act B.E. 2540, EGAT has set up mechanisms to provide information to and receive complaints or protests from the public and concerned parties. While the Information Management Committee is responsible for developing policies and measures, considering complaints, and coordinating several departments, the EGAT Information Center is in charge of providing information services to the general public through the internet and call center.

Internet Information Services

EGAT provides information about its operations and performance on its website (www.egat.co.th) and website of the Office of the Official Information Commission (in the electronic official information system: www.oic.go.th). The general public can access EGAT's information on a 24-hour basis. EGAT also makes information publicly available on its social media channels which are Facebook: EGAT1416 and Twitter: EGAT1416.

Facebook: EGAT1416 Twitter: EGAT1416

EGAT Call Center

EGAT Call Center 1416 answers enquiries and provides information and assistance to consumers by telephone. It also provides a channel to receive emergency reports or reports of transmission system failures. EGAT Call Center offers a convenient and fast method for consumers across the country to contact EGAT 24/7.

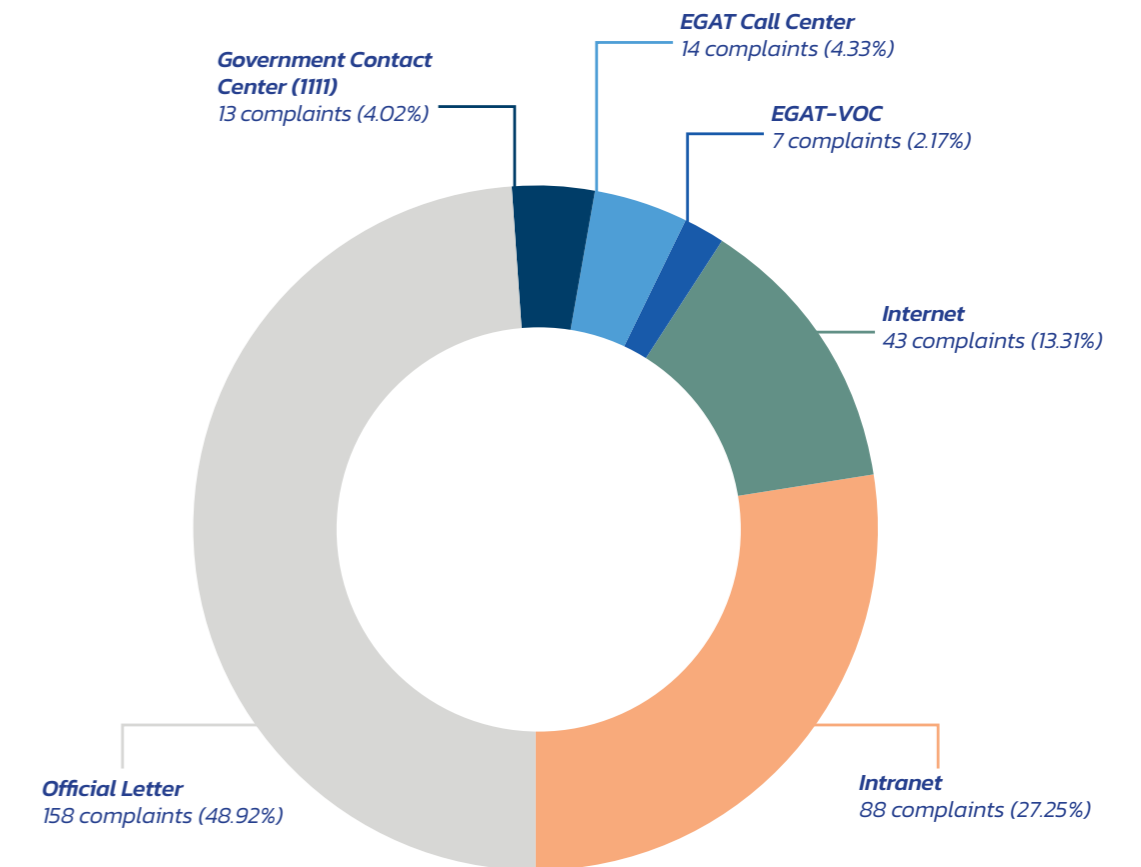


Performances of the EGAT Information Center in 2020

1. Provided information by telephone, answered enquiries on the EGAT website, and provided in-person services for information retrieval at the EGAT Information Center during office hours.
2. Provided services through EGAT Call Center 1416. In 2020, there were 7,224 inbound calls enquiring about information such as power generation and transmission, EGAT's CSR activities, and power purchasing.
3. Provided information through the official electronic information system (www.oic.go.th/infocenter6/623/) in accordance with the policy of the Office of the Official Information Commission (OIC).

Comment and Complaint Management

Comments and Complaints in 2020 by Receiving Channel



In 2020, the EGAT Complaint Management Center forwarded 323 comments and complaints received through six channels to responsible units for further handling. All had been settled and the results were reported to complainants. No complaints related to information security were received from stakeholders (e.g., customer data loss or breach, failure to keep customer information confidential, or violation or misuse of customer data).

In 2020,
EGAT had no information security complaints from stakeholders.

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Stakeholder Management



EGAT's stakeholder management process is in line with **AA 1000 Stakeholder Engagement Standard 2015** and the State Enterprise Assessment Model (SE-AM)

EGAT has systematic and clearly-defined processes put in place to engage and manage stakeholders in order to meet their needs and expectations and to help the organization achieve sustainable success. Our stakeholder management processes cover the Plan-Do-Check-Act cycle, in line with AA1000 Stakeholder Engagement Standard 2015 and the State Enterprise Assessment Model (SE-AM) – Stakeholder and Customer Management (SCM) developed by the State Enterprise Policy Office, Ministry of Finance. The processes consist of the following six stages.



EGAT has developed the 'Stakeholder Management Master Plan' systematically incorporating input provided by stakeholders to serve as a framework that units responsible for coordinating with stakeholders can use to appropriately and effectively engage stakeholders and respond to their needs, expectations, and concerns. The impacts of plans and projects on stakeholders are assessed to determine impact mitigation measures and indicators for monitoring performance. Stakeholder management performance will be reported to the Corporate Governance and Social Responsibility Committee assigned by the Board of Directors to review and improve stakeholder management strategies and methods.

In 2020, EGAT undertook a review and revision of stakeholders to reflect its ongoing and future missions and role as Thailand's key electric power organization that strives to achieve sustainable growth together with stakeholders. Three additional stakeholder groups were identified, adding up to a total of 11 groups, which include the public sector and regulators, communities, scholars and the civil society sector, mass media, customers and electricity users, business partners, employees and labor union, financial institutions, EGAT Board of Directors, affiliated companies, and competitors.

To ensure effective implementation of the Stakeholder Management Master Plan, a set of templates has been designed as a guide to be used by departments and divisions to identify and review key stakeholders and to develop stakeholder profiles to manage stakeholder

data more systematically. These templates were first applied in processes related to the public sector and regulators and the EGAT Board of Directors. They will be used to collect data from other key stakeholders at the department/division levels in 2021.

Despite the COVID-19 pandemic in the previous year, EGAT continued to engage stakeholders while caring about the safety of employees. Social distancing measures was adopted in our stakeholder engagement, such as using video conferencing to communicate with Assistant Governors to obtain advice to improve stakeholder management, collecting relevant information from departments and divisions, and interviewing significant stakeholders to our core missions, such as the public sector and regulators, the EGAT Board of Directors, and affiliated companies. Moreover, EGAT listened to the voice of stakeholders and the voice of customers to improve our engagement with stakeholders in accordance with the State Enterprise Assessment Model (SE-AM) – Stakeholder and Customer Management.

In addition to the Stakeholder Management Master Plan, other activities carried out in response to issues important to stakeholders included improving supplier relationship management, launching making work from home and work from anywhere arrangements, providing co-working spaces for employees, and setting up more communication channels between employees and management. Our approach to stakeholder engagement is summarized in the table below.

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Approach to Stakeholder Engagement

Stakeholder	Stakeholder Engagement Channel	Issues Important to Stakeholders	EGAT's Response
Public Sector and Regulators	<ul style="list-style-type: none"> • Meetings, discussions, and joint activities (at least 1-2 times a month). • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Call Center 1416. 	<ul style="list-style-type: none"> • Accurate, complete, and timely information about power generation. • Compliance with laws and acts. • Support and cooperate in the public sector's activities, and pay required taxes and fees. • The public sector's policies to promote electricity generation by power producers (IPPs and SPPs). • Account officer (AO) who serves as the lead point of contact and answers inquiries. 	<ul style="list-style-type: none"> • Set up a unit to integrate strategic policies, acts, and laws into corporate strategies. • Communicate regularly to build an understanding of EGAT's missions. • Organize projects together with public agencies and regulators. • Promote compliance with standards to achieve sustainability. • EIA/EHIA reports. • Develop a stakeholder management master plan and stakeholder profile.
Mass Media	<ul style="list-style-type: none"> • Meetings, discussions, and joint activities (at least 5-10 times a month). • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Call Center 1416. 	<ul style="list-style-type: none"> • Accurate, up-to-date, transparent, and verifiable news and information. • Improve protocol and process for presenting news and information. • Reliable sources of information. 	<ul style="list-style-type: none"> • Communicate regularly to build an understanding of EGAT's missions. • Engagement activities. • Develop a stakeholder management master plan and stakeholder profile.
Communities	<ul style="list-style-type: none"> • Meetings, discussions, and engagement activities (at least 10-12 times a month). • CSR projects to promote public participation. • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations boards and local media. • Call Center 1416. 	<ul style="list-style-type: none"> • Effective environmental, occupational health, safety, and resource management. • Improve the quality of life, respect community rights, and promote public domains and simple technologies in communities. • Feedback, two-way communication, discussion, and information disclosure. 	<ul style="list-style-type: none"> • CSR projects and community engagement activities to improve quality of life. • Set up a working group to promote power plants as a tourist attraction and develop community products. • Develop a stakeholder management master plan and stakeholder profile.
Scholars, NGOs, and Civil Society Sector	<ul style="list-style-type: none"> • Exchange views and opinions through forums, research, and collaboration (at least once a month). • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Call Center 1416. 	<ul style="list-style-type: none"> • Disclose information truthfully and timely. • Effective environmental and resource management. • The public is concerned about power supply security and availability, e.g., stable power system and no power outages. 	<ul style="list-style-type: none"> • Communicate regularly to build an understanding of EGAT's missions. • Discussions and public forums. • Provide appropriate access to information on EGAT's operations such as EIA/EHIA reports. • Develop a stakeholder management master plan and stakeholder profile.
Major Customers, Electricity Users, and Society at Large	<ul style="list-style-type: none"> • Meetings, discussions, and joint activities (at least 2-4 times a year). • Visit or meet with customers and inquire about their needs and expectations (at least once a quarter). • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Sustainability report. • Call Center 1416. 	<ul style="list-style-type: none"> • Fair, transparent, and verifiable contracts. • Provide quality and eco-friendly services, accurate and complete service information, and good after-sales services. • Measures to keep customer information confidential and respond to complaints. • Build sustainable consumption awareness. • Personnel possesses coordination and communication skills. • Handling complaints effectively. 	<ul style="list-style-type: none"> • Develop quality and safe products and services that meet the market needs. • Product and service cost management. • Complaint response measures. • Communicate to build an understanding of EGAT's missions and promote energy efficiency awareness. • Develop a stakeholder management master plan and stakeholder profile.

Stakeholder	Stakeholder Engagement Channel	Issues Important to Stakeholders	EGAT's Response
Suppliers/Business Partners	<ul style="list-style-type: none"> • Seminar, visit or meet with suppliers and inquire about their needs and expectations at seminars (at least once a year). • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Sustainability report. • Call Center 1416. 	<ul style="list-style-type: none"> • Fair selection process and contract management. • Sustainability issues in supply chain, such as human rights. • Ability to deliver fair procurement contracts/conditions, and transparency/equitability in procurement and bidding. • Procurement rules, audit, and assessment that take society, community and the environment into consideration. • Participate in product/service development, resource management, and skills development, and respect intellectual property rights. 	<ul style="list-style-type: none"> • Develop a green procurement policy and supplier code of conduct. • Streamline practices and processes to make it easier to work with suppliers, such as holding a meeting with suppliers to help them understand EGAT's procedures and set up payment transfer channels. • EGAT code of conduct and supplier ethics assessment form. • Encourage suppliers to recognize social responsibility. • Support local businesses (community products) so they can become suppliers. • Develop a stakeholder management master plan and stakeholder profile.
Employees and Labor Union	<ul style="list-style-type: none"> • Executive-employee meetings (at least 2-4 times a year). • Synergy activities (at least once a year) at division/functional unit level. • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Sustainability report. • Call Center 1416. 	<ul style="list-style-type: none"> • Employment security and compliance with labor laws. • Fair compensation and welfare benefits beyond legal requirements. • Provide skills development opportunities. • Anti-corruption promotion both inside and outside the organization, responsible political participation, protection for groups with special needs, collective bargaining, access to management, and complaint channels and responses. 	<ul style="list-style-type: none"> • Integrate human rights and international standards such as ISO 26000 into employee treatment practices. • Two-way communication between superiors and subordinates. • Personnel development plan that is open for all. • Improve employee welfare so it is relevant to the current situation. • Encourage employees to take part in volunteer activities and social responsibility. • Develop a stakeholder management master plan and stakeholder profile. • Provide co-working spaces for employees. • Work from home (WFH) and work from anywhere (WFA) policies to keep employees safe during the pandemic. • Set up more social media to support communication between management and employees.
Financial Institutions	<ul style="list-style-type: none"> • Meetings and joint activities (at least once a year). • Annual report/sustainability report. • Annual satisfaction and engagement survey. • Comment and complaint channels. • Communication through public relations and social media. • Call Center 1416. 	<ul style="list-style-type: none"> • Pay debt on time. • Operational transparency and accountability. • Appropriate risk management. • Compliance with financial transaction agreements between EGAT and financial institutions. 	<ul style="list-style-type: none"> • Prepare and review financial report, submit a financial statement on time, determine KPIs, and hold a meeting with relevant agencies. • Develop a stakeholder management master plan and stakeholder profile.

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Customer Satisfaction

An electricity customer and stakeholder satisfaction survey was conducted by the Deputy Governor – Transmission unit in 2020 to ensure that EGAT’s operations for electricity customers achieved the organization’s strategic objective of T: Trust and Pride of the Nation. The results of the survey will be used as input to improve our engagement processes.

The ACSI Model (American Customer Satisfaction Index) and Net Promoter Score (NPS) theories were used to analyze customer satisfaction, engagement and loyalty. The survey results were compared with the results obtained over the past five years, as well as from other energy and utility service providers in Thailand and abroad.

Customers on whom a survey was conducted include PEA, MEA and direct customer. The survey focused on five specific areas, namely quality, credibility, service provision, communications and personnel. Results of the survey, compared to those conducted in the past, are as below.

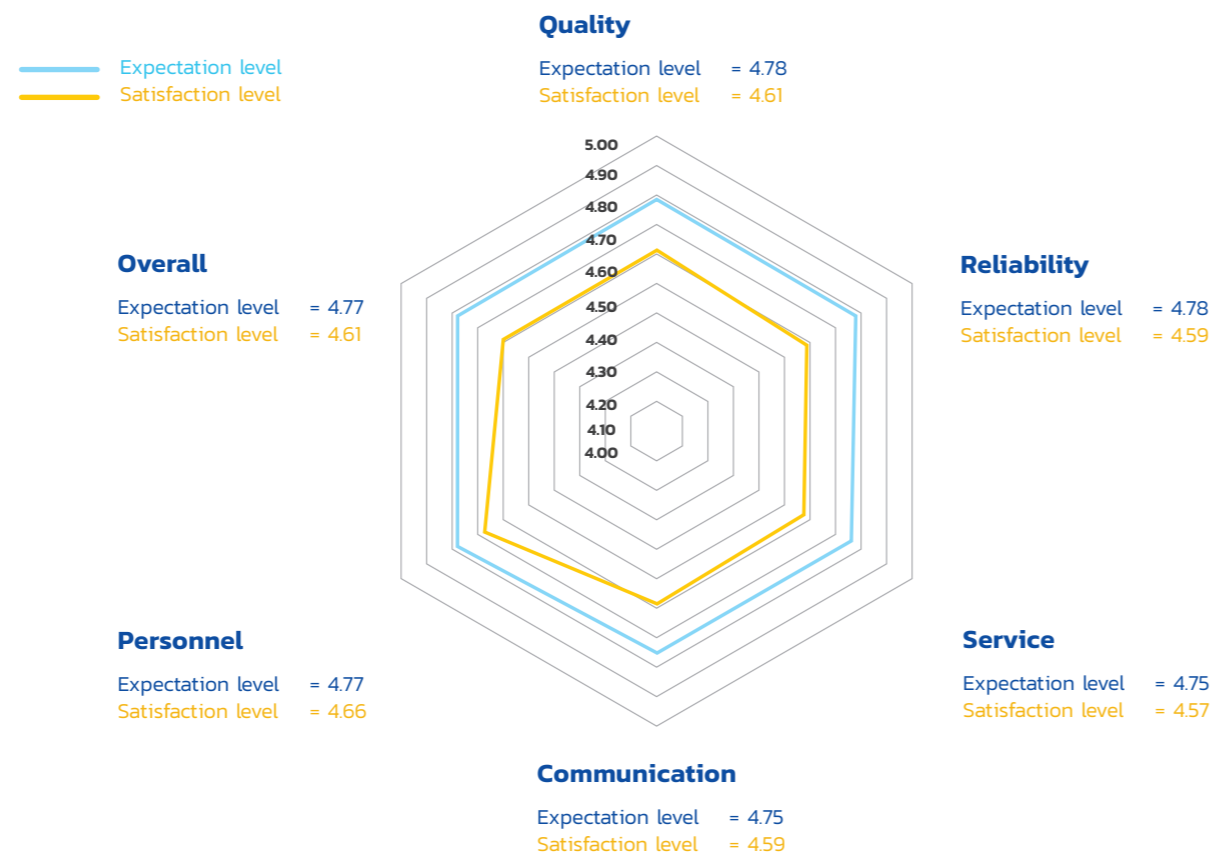


ACSI Model (American Customer Satisfaction Index) and Net Promoter Score (NPS)

were used to analyze customer satisfaction

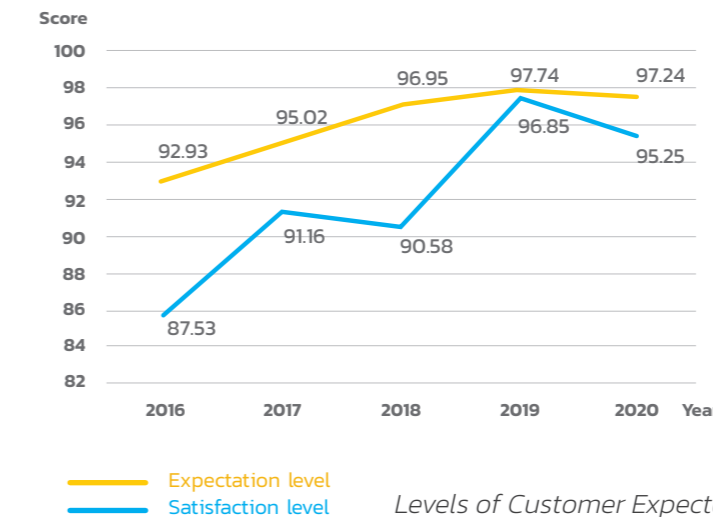
The survey focused on five specific areas, namely

- Quality
- Reliability
- Service
- Communication
- Personnel

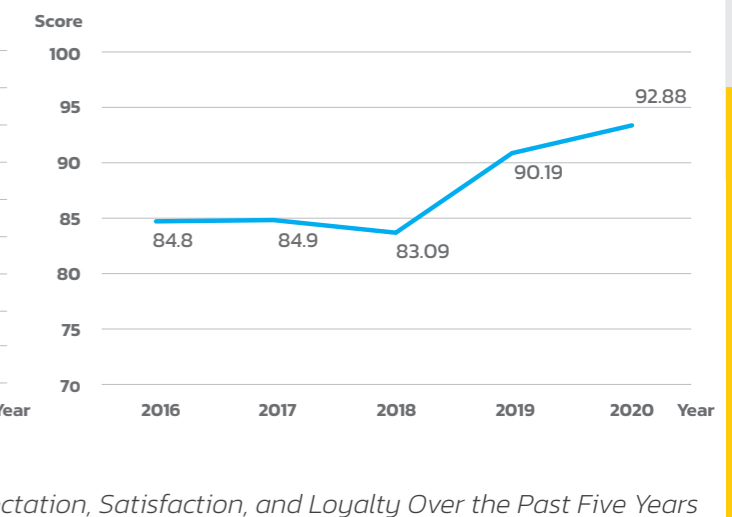


Levels of Customer Satisfaction and Expectations in 2020

Customer Expectation and Satisfaction



Customer Loyalty



Levels of Customer Expectation, Satisfaction, and Loyalty Over the Past Five Years

In terms of customer attitude towards EGAT in various matters in line with the organization’s vision and mission, it was found that in 2020, customer attitude towards EGAT was excellent. The most positive response was in regard to EGAT strengthening energy security for the country and EGAT’s reputation and high standard of operations. The least positive response was in regard to EGAT’s expertise in renewable/clean energy. In addition, customers found EGAT services reliable and their loyalty for EGAT increased compared to 2019 and was exceptionally high. The level of brand engagement stood at 92.63%, up from 89.50% in 2019.

Further EGAT conducted additional qualitative research by interviewing PEA and MEA’s top management on issues related to collaboration between EGAT and their respective organization, e.g., interorganizational relations, exchange of information

and future cooperation. Additional surveys were conducted on customers of electric power by doing an in-depth interview of the focus group to learn more about issues that they found highly satisfactory and unsatisfactory or areas where EGAT could improve in terms of meeting customer demand and how to address any problems that occurred. Some of the findings from the interview included: over voltage and unbalanced currents, new distribution buses following station construction or station renovation unable to tribute power, maintenance not carried out as planned, frequent issues with communications of key messages, communications devices not working, proactive engagement and other areas of cooperation in the future. EGAT has brought these issues noted from the surveys to the attention of relevant teams in order to improve their operations.

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Management Efficiency

Availability and Reliability

In 2020, EGAT developed power generation system

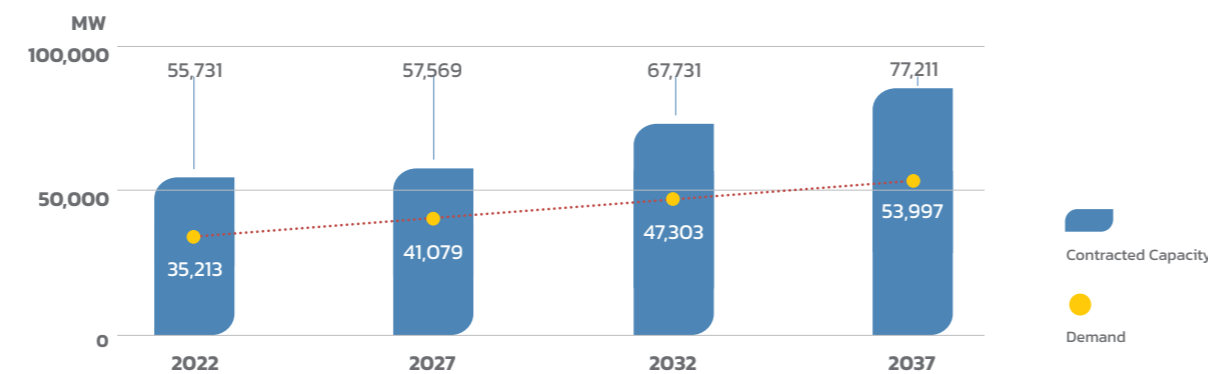
in line with the PDP2018 Revision 1.

EGAT strives to ensure the reliability and security of the country's electric power system to achieve its mission to 'be the main organization to secure power reliability and enhance the competitiveness of the country through innovation for the happiness of Thai people.' In addition to playing a part in developing the Thailand Power and Transmission Development Plans, EGAT has enhanced cross-border power grid

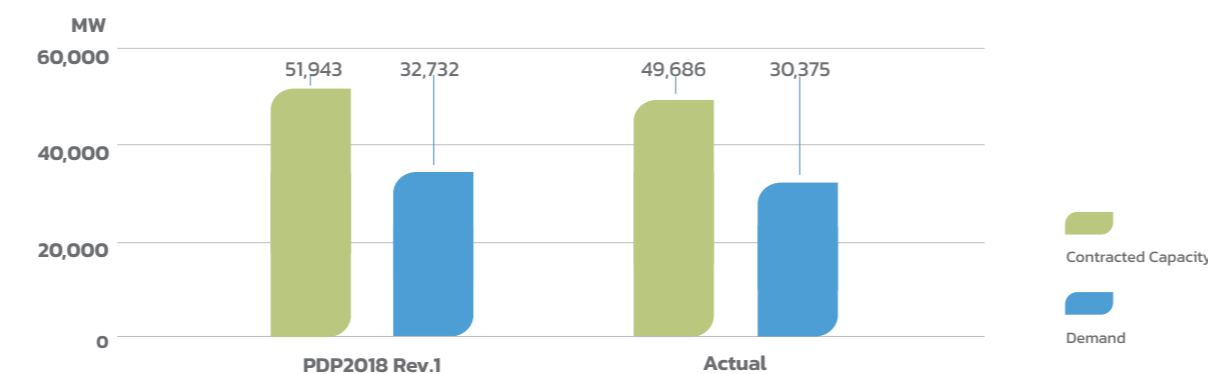
connectivity to guarantee an efficient, secure, and reliable power supply for the country in accordance with economic and engineering principles.

As the national body responsible for power generation and transmission, EGAT takes part in developing and implementing the Thailand Power Development Plan 2018-2037 (PDP2018 Revision 1). In 2020, EGAT developed the power generation system under the PDP2018 Revision 1, which was approved by the National Energy Policy Council (NEPC) on 19 March 2020 and the Cabinet on 20 October 2020. The actions taken to ensure the availability and reliability of the power system are as follows:

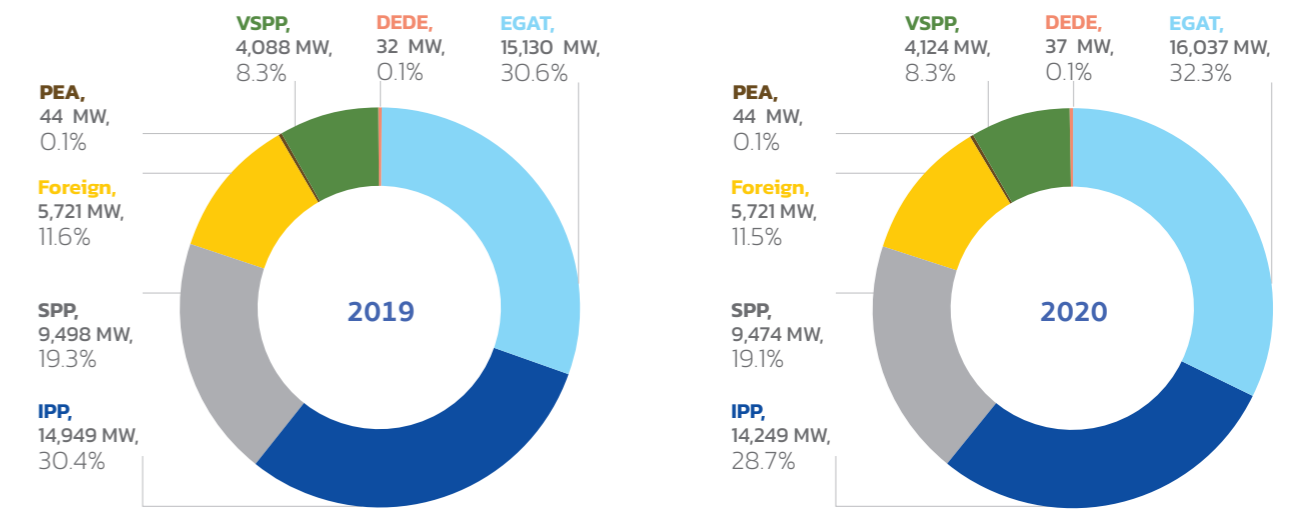
Generation Capacity and Electricity Demand



Comparison of PDP2018 Revision1 and Actual Generation Capacity in 2020



Contracted Capacity in 2019 and 2020 by Power Producer



Power Generation and Purchase

The highest net peak demand was 28,636.70 MW on Thursday 12 March 2020 at 20.30 hour, down from the previous year by 2,216.50 MW or 7.18 percent (30,853.20 MW on Thursday 2 May 2019 at 22.27 hour).

Net energy generated and purchased in 2020 was 191,934.55 million kWh, down from the previous year (197,873.00 million kWh) by 5,938.45 million kWh or 3 percent. Net energy generated and purchased per day was 524.41 million kWh, down from the previous year (542.12 million kWh) by 17.71 million kWh or 3.27 percent.

Power Sales

In 2020, EGAT transmitted a total of 187,489.39 million kWh of electricity to customers. Of this, 52,343.73 million kWh was sold to the Metropolitan Electricity Authority (MEA), 131,558.55 million kWh to the Provincial Electricity Authority (PEA), and 1,205.07 million kWh to direct customers. A total of 2,001.74 million kWh was sold to neighboring countries (Lao PDR, Malaysia, and Cambodia) and 380.30 million kWh to UPS customers, temporary users, and other customers.

The highest net peak demand was

28,636.70
MW

EGAT's energy sales totaled

187,489.39
million kWh

Available to customers as follows:

- Metropolitan Electricity Authority (MEA)
- Provincial Electricity Authority (PEA)
- Direct customers
- Lao PDR
- Malaysia
- Cambodia
- Temporary users and other customers

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EGAT Power Plants

Type of Power Plants	Capacity (MW)	Percentage
Combined Cycle	8,262.00	51.52
Thermal	3,687.00	22.99
Renewable Energy (Hydropower)	2,972.40	18.53
Renewable Energy (Others)	85.525	0.53
Diesel	30.40	0.19
Other	1,000.00	6.24
Total	16,037.325	100.00

Remark: Data as of 31 December 2020

Commercial Operation and Decommissioning of Power Plants in 2020

Commercial Operation

EGAT Power Plants

1. South Bangkok Combined-Cycle Power Plant Block 4 Unit 1	610 MW	29 February 2020
2. South Bangkok Combined-Cycle Power Plant Block 4 Unit 2	610 MW	18 April 2020
3. Khlong Tron Hydropower Plant	2.5 MW	16 December 2020

Small Power Producers (SPP) - Firm

1. Bangkok Cogeneration Co., Ltd. (renewed)	60 MW	3 February 2020
2. Buayai Bio Power Co., Ltd.	25 MW	2 June 2020
3. Amata B.Grimm Power 1 Co., Ltd. (renewed)	60 MW	15 June 2020
4. Glow Energy PCL (Project 1) (renewed)	60 MW	15 June 2020
5. Uthong Green Power Co., Ltd.	24 MW	16 December 2020

Small Power Producers (SPP) - Non-Firm

1. Ruamphol Bio Power Co., Ltd. (Project 2)	13 MW	15 January 2020
2. Gulf Chana Green Co., Ltd.	20.662 MW	1 March 2020
3. Pattani Green Power Co., Ltd.	21 MW	19 May 2020
4. TPI Polene Power Co., Ltd. (Project 1) (renewed)	55 MW	1 August 2020
5. Ruamkamlarp Power Co., Ltd. (renewed)	18 MW	1 August 2020

Decommission

EGAT Power Plants

1. South Bangkok Combined-Cycle Power Plant Block 1	316 MW	1 January 2020
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Independent Power Producers (companies under EGAT Group)

1. Ratchaburi Electricity Generating Co., Ltd. Tri-Energy Power Plant Block 1	700 MW	30 June 2020
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Small Power Producers (SPP) - Firm

1. National Power Plant 2 Co., Ltd.	8 MW	6 May 2020
2. Samutprakarn Cogeneration Co., Ltd.	90 MW	23 August 2020

Power Generation and Transmission Systems Development

New Power Plant Projects

- **South Bangkok Power Plant Replacement Project Phase 1** is a combined-cycle power plant with a contracted capacity of 1,220 MW. It uses natural gas as a primary fuel and diesel as a secondary fuel and is intended to maintain power system stability in Bangkok. The project has been completed and has already started supplying electricity to the grid. Generator Unit 1 (610 MW) began commercial operation on 29 February 2020 and Generator Unit 2 (610 MW) started on 18 April 2020.
- **The Bang Pakong Power Plant Project (Units 1-2 Replacement)** is a combined-cycle power plant with a contracted capacity of 1,386 MW. It uses natural gas as a primary fuel and diesel as a secondary fuel and aims to improve the power system security and stability in the eastern Bangkok area. The power plant is expected to begin commercial operation in 2020.



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Renewable Energy Power Plant Projects

- **Khlong Tron Downstream Hydropower Plant** is a small hydropower plant with a contracted capacity of 2.50 MW, located downstream of the Khlong Tron Dam in Uttaradit Province. It is scheduled to begin commercial operation on 16 December 2020.
- **Pha Chuk Downstream Hydropower Plant** is a small hydropower plant located in Pha Chuk Subdistrict, Mueang District, Uttaradit Province. It has a generation capacity of 14 MW (2 x 7) and average output of 91.256 million units per year. As of December 31, 2020, progress is at 48.26 percent, 2.44 percent faster than planned. It is expected to begin commercial operation in 2021.
- **Hydro Floating Solar Hybrid Projects** with a combined capacity of 2,725 MW aim to increase renewable energy stability, which will, in turn, indirectly strengthen the grid system. They will use an integrated renewable firm power system to manage and optimize resources without affecting communities and the environment. EGAT has initiated two pilot projects. One is located at Sirindhorn Dam in Ubon Ratchathani and has a contracted capacity of 45 MW (project approved by the Cabinet on 29 October 2019). The construction was 82.04 percent complete as of 31 December 2020. Another project is located at Ubol Ratana Dam in Khon Kaen and has a contracted capacity of 24 MW. The project proposal is being submitted to the Ministry of Energy and the commercial operation date is scheduled for 2023.

Power Purchase Projects

- **Independent Power Producers (IPP)** Between 2019 and 2025, several projects, totaling 5,000 MW of contracted capacity, have signed power purchase agreements with EGAT under the IPP Power Purchase Policy Phase 3. In addition, Hin Kong Power Plant (Western Region Power Plant Replacement) Blocks 1 and 2, with a combined capacity of 2x700 MW, are scheduled for commercial operation in 2024 and 2025 respectively.
- **Small Power Producers (SPP)** At the end of 2020, the total purchased capacity from small power producers was 9,474 MW, of which 6,605 MW was from producers using a cogeneration system and 2,869 MW from producers using renewable energy. As per PDP2018 Revision 1, EGAT will purchase from SPPs with a total contracted capacity of 3,545.46 MW between 2018 and 2025, divided into 1,391.5 MW from cogeneration system users, 704 MW from cogeneration system users under renewed contracts, 300 MW from SPP hybrid firms, and 1,149.96 MW from renewable energy users and projects under the government promotion policy
- **Neighboring countries** Currently, EGAT purchases a total of 5,716 MW of contracted capacity from neighboring countries. In 2022, we plan to purchase an additional 514 MW of capacity from the Nam Theun 1 Hydropower Project.

Transmission System Construction and Improvement

In 2020, EGAT implemented 17 transmission system construction and expansion projects across the country.

	Projects	Project Objectives	Progress (%)	Scheduled completion
1	Transmission System Development Project in Loei, Nong Bua Lam Phu, and Khon Kaen for Power Purchase from Lao PDR (LNKP)	Development of power transmission system to accommodate overseas power plants	96.61	December 2022
2	Transmission System Project for Power Purchase from Independent Power Producers Phase 3 (IPP3)	Development of power transmission system to accommodate domestic private power plants	12.19	March 2023
3	Transmission System Project for Power Purchase from Independent Power Producers (IPPP)		76.84	October 2026
4	Main Transmission System Expansion Project for Power Purchase from Small Cogeneration Power Plants, Based on Request for Proposal 2010 (SPPC)		91.96	June 2022
5	Transmission System Development Project for South Bangkok Power Plant Replacement Phase 1 (SBR1)	Development of power transmission system to accommodate EGAT power plants	74.88	June 2022
6	Transmission System Development Project for Pha Chuk Hydropower Plant (PCHP)		52.69	July 2021
7	Transmission System Expansion Project in the Bangkok Metropolitan Region Phase 2 (GBAS2)	Development of power transmission system to accommodate rising demand for electricity	89.84	December 2022
8	Transmission System Expansion Project in the Bangkok Metropolitan Region Phase 3 (GBA3)		58.71	December 2024
9	Transmission System Expansion Project Phase 12 (TS12)		52.50	March 2025
10	Transmission System Improvement Project in Eastern Region for System Security Enhancement (TIPE)	Development of power transmission system to strengthen security of supply in the future	38.30	September 2023
11	Transmission System Improvement Project in Western and Southern Regions for System Security Enhancement (TIWS)		47.08	July 2024
12	Transmission System Improvement Project in Northeastern Region, Lower Northern Region, Central Region, and Bangkok for System Security Enhancement (TIEC)		23.27	October 2030
13	Transmission System Improvement Project in Lower Southern Region for System Security Enhancement (TILS)		5.62	December 2024
14	Transmission System Improvement Project in Upper Northern Region for System Security Enhancement (TIPN)		6.01	November 2024
15	Transmission System Expansion and Improvement Project Phase 1: High Voltage Substations	Improvement and expansion of power transmission lines that are deteriorating	85.60	February 2023
16	Transmission System Expansion and Improvement Project Phase 1: High Voltage Transmission Lines		90.70	May 2026
17	Transmission System Expansion and Improvement Project Phase 2		61.26	July 2025

Remark: Progress as of December 2020

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Grid Connectivity

As per the resolution passed at the Meeting of National Energy Policy Council No. 1/2562 (No. 16), EGAT is assigned to study and develop the Thailand Power Transmission Development Plan to strengthen national grid security and improve the efficiency of the national power transmission system, which will help drive the country toward a regional grid connection center, making EGAT a regional power market manager. We have conducted a feasibility study of grid interconnections with neighboring countries to accommodate the development of cross-border energy trading in the future. In addition, the Cross-Border Power Purchase Policy under the Thailand Power Development Plan 2018-2037 (PDP2018 Revision 1) requires EGAT to procure power supply by purchasing electricity from neighboring countries in order to enhance access to electricity in the country, accommodate renewable energy in the grid system, reduce investment in power plant construction in the country, and promote efficient cross-border resource allocation. We have also developed the East-West Economic Corridor Grid Connection Plan to connect a network of newly-constructed transmission lines to the existing grid, from the Thai-Lao border in Mukdahan Province to the Thai-Myanmar border in Tak Province. This project will make it possible to deliver electric power across national borders to facilitate energy trading from Lao PDR to Myanmar and to make the most use of EGAT's grid system.

The power purchase from neighboring countries is a bilateral cooperation between the governments of the two countries under the framework set forth in the Memorandum of Understanding on Energy Cooperation (MOU). At present, Thailand has signed the MOU on Energy Cooperation with three neighboring countries, including Lao PDR, Myanmar, and Cambodia

Grid Modernization

EGAT's goal for grid modernization is to ensure a secure and reliable supply of electric power at both national and regional levels through cutting-edge grid technologies. Such modernization will make Thailand's power generation and transmission systems more resilient, able to accommodate power generation from renewable energy and build sustainable relationships with electricity consumers, ultimately leading the country to become a global energy leader and energy trading center in the Asia-Pacific region.

Currently, EGAT is implementing various grid modernization projects and efforts as follows:

Smart Grid

At present, there is no clear or internationally acceptable definition of a smart grid. However, according to the broad definition provided by EGAT, a smart grid is a grid that applies and integrates information and communication technologies to make two-way communication possible. This two-way communication enables feedback from users of electricity supplied through the distribution and transmission systems to be sent back to the grid control center, which helps improve the efficiency and reliability of the power system.

- **Mae Hong Son Smart Grid Pilot Project**

This project was initiated under the Thailand Smart Grid Short-Term Development Plan 2017-2021. It aims to transform Mae Hong Son into a place for demonstration, research, and development, and to build a body of knowledge to be applied in other areas of Thailand. The investment in this project amounts to 720 million baht. The project was originally scheduled to be completed in 2019, but the completion period has now been extended to 2022. It is currently X percent complete.

- **Eureka Project** The Eureka Project is a microgrid and energy trading platform research and development project, initiated to serve as a model for further research and knowledge building. The model systems in the Eureka Project include an energy management system and microgrid load management system. The project will develop a peer-to-peer energy trading platform to build upon the existing knowledge to develop a microgrid service solutions provider business for EGAT Micro-EMS, RE Forecasting System, ENGY Load Aggregator, and ENGY Peer-to-Peer Energy Trading Platform.
- **A Study and Assessment of Distribution Automation System at Sattahip Electricity Authority, Royal Thai Navy Welfare Concession, Sattahip District, Chonburi Province** The project which is a cooperation between EGAT and Sattahip Electricity Authority, Royal Thai Navy Welfare Concession, aims to study and assess the installation of a distribution automation system to improve power distribution and enhance power system security in the area under the responsibility of Sattahip Electricity Authority. A distribution automation system will allow the power distribution system to be remotely operated through optical fiber communication, thus reducing power outage duration and wide-scale blackout impact. It will also make the distribution system more secure and better meet the growing demand for electricity due to urban expansion in the Eastern Economic Corridor.

Energy Storage System Development Project in Chaiyaphum and Lopburi Provinces

The project was initiated under the Thailand Smart Grid Short-Term Development Plan 2017-2021. The project will install a 16-MWh energy storage system at Bamnet Narong High Voltage Substation in Chaiyaphum, and

a 21-MWh energy storage system at Chai Badan High Voltage Substation in Lopburi. It aims to store a large amount of electric power from the wind and solar energy power plants. The project will also test the effectiveness of the energy storage system in dealing with unstable renewable energy. The investment in this project amounts to 1,982.7 million baht. The project was 42.29 percent complete as of December 2020 and is scheduled for completion in 2021.

Research on Conceptual Design of Integrated Renewable Storage under EGAT's New Energy Power Development Plan

Clean energy is booming, as is evident from the PDP2018 Revision 1, which requires that 18,833 MW of the nation's electricity generation be from renewable energy. Under PDP2018 Revision 1, EGAT has developed hydro-floating solar hybrid power plant projects with a combined capacity of 2,725 MW. These hybrid projects require simultaneous management of renewable energy and water resources, with focus on optimizing the existing grid system and power costs. EGAT provided research funding to Chulalongkorn University and King Mongkut's Institute of Technology Ladkrabang to jointly conduct research on 'Conceptual Design of Integrated Renewable Storage under EGAT's New Energy Power Development Plan.' The research found that a hybrid power system combining a hydro-floating solar hybrid power plant and an energy storage system (ESS) of appropriate size will make the power generation more stable and efficient. The initial research at Sirindhorn and Ubol Ratana Dams has been completed and additional studies are being conducted at Srinagarind Dam.

EGAT - Energy Excellence Center

This project was initiated under the EGAT Long-Term Strategic Plan as part of Bang Krui Green Community Project. The EGAT-Energy Excellence Center (EGAT-EEC) aims to be a learning center where the general

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public can visit to learn about the history and evolution of power generation and energy efficiency, as well as a place that can manage its own electric power. Currently, we are conducting a feasibility study of the project and preparing the Term of Reference (TOR), both of which are expected to be completed in 2021.

The EGAT-EEC will use a renewable energy power generation system integrated with energy storage technology, controlled through a Micro EMS. It is a micro grid system that does not rely on electric power from the main grid. The power generation system will consist of the main solar PV panels installed on the rooftops of office and parking lot buildings and an auxiliary gas engine power generation system that uses hydrogen gas and biogas produced from the fermentation and decomposition of bio-waste from the EGAT headquarters. The energy storage system consists of hydrogen energy storage and a battery energy storage system (BESS), designed to store excess electricity generated during daytime. Both energy storage systems will (1) supply electric power during nighttime or when needed and (2) help reduce fluctuations in power generation from renewable energy sources.

Digital Substation Development Project

To transform the organization into a digital utility, EGAT has used ICT and smart grid technologies in the development of digital substations. The digital substation development is part of EGAT's Power Transmission System Improvement Plan to improve substation equipment to meet the communication requirements of IEC61850 standard and support automated systems for measuring performance, and monitoring and evaluating useful life of equipment in production and transmission systems to manage EGAT's

assets to achieve maximum efficiency. At present, the Chatuchak High Voltage Substation has been transformed into a digital substation. We are planning to develop four more fully digital substations at the Trat High Voltage Substation, Kantharalak High Voltage Substation, Satun High Voltage Substation, and Mae Moh High Voltage Substation 2, which are scheduled for completion in 2022.

National Energy Trading Platform Research and Development

EGAT, MEA, and PEA have collaborated on the Nation Energy Trading Platform Research and Development Project (NETP) and Nation Digital Utility Platform (NDUP) Roadmap Development to study the impacts and provide technical, supervisory, and policy recommendations for Thailand's electricity industry structure of the future. The three Electricity Authorities submitted the NETP study report to the State Enterprise Policy Office, which was approved in 2018. In 2019, a pilot project was carried out to test the NETP study results on the testing grounds of each of the electricity authorities. Currently, the project is at the stage of system commissioning, which is expected to be completed in 2022.

RE Control Center

The project aims to study the establishment of a renewable energy control center (RE Control Center) to forecast electricity production in renewable energy power plants to help system operators plan plant operations more efficiently. Day-ahead forecasting of power generation in a renewable energy power plant can help make daily operation planning and backup capacity allocation more accurate, while intraday forecasting can help system operators predict fluctuations in power generation in renewable energy

power plants in advance, and, in a timely manner, maintain backup capacity, control frequency, and manage power voltage within appropriate levels. At present, the project has developed solar and wind power generation forecasting models for all SPP power plants, which include 7 solar power plants and 22 wind power plants. It has also designed and developed a forecasting display system to make it easy for the operator to view and understand the forecast results and for use in the RE Control Center, which is scheduled for completion in 2021.

Demand Response Control Center

In line with the Thailand Smart Grid Action Plan 2017-2021 under Pillar 1: Demand Response (DR) and Energy Management System (EMS), EGAT is establishing the Demand Response Control Center (DRCC) to serve as a focal point for nationwide demand-side management (DSM), order demand responses, and reduce peak demand during crises. The hardware and software designs for the project have been completed. The hardware and software systems are expected to be installed and commissioned in the fourth quarter of 2021.

System Efficiency

Performance of EGAT's Power Plants

No.	Performance	2018	2019	2020
1	Heat Rate (kJ/kWh)	8,247	8,028	7,987
2	GWEAF (%)	92.46	93.73	92.19
3	POF (%)	3.20	3.00	5.29
4	UOF (%)	3.40	2.71	2.02
5	UDF (%)	0.94	0.56	0.50

To deliver quality, secure, and reliable electric power, EGAT has continued to make efforts to enhance the efficiency of power system, including improving generation and maintenance, switching to efficient equipment and accessories, using modern technologies to increase the reliability of the national power system, solving power outages, and developing a system to prevent power outages. In 2020, EGAT's power plants

had a higher generation efficiency factor than the previous year thanks to South Bangkok Power Plant Block 4, which began its commercial operation early last year.

Generating weighted equivalent availability factor (GWEAF) decreased by 1.54 percent compared to the previous year, while planned outage factor (POF) increased by 2.29 percent due to the COVID-19 pandemic that caused power plants to extend the shutdown maintenance to reflect the changed situation. However, unplanned outage factor (UOF) decreased by 0.69 percent and unit derating factor (UDF) decreased by 0.06 percent as EGAT has been able to control UOF and UDF below 5 percent since 2008.

EGAT has been able to control unplanned outage factor and unit derating factor below

5 percent since 2008.

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Transmission System

High voltage substation, transformer capacity and transmission line length

Voltage	High voltage substation (Station)	Transformer capacity (Mega-volt ampere)	Transmission line length (circuit-kilometers)
500kV	22	41,949.69	6,912.29
230kV	83	66,400.01	15,697.87
115kV	126	15,223.16	14,423.19
132kV	-	133.40	8.71
69kV	-	-	18.80
300kV	-	388.02	23.07
Total	231	124,094.28	37,083.92

Transmission loss

2018 (%)	2019 (%)	2020 (%)
1.60	1.61	1.55

There were 53 failures resulting in power outages, including 9 transmission line failures and 44 high-voltage substation failures. Twenty-three cases were caused by substation and transmission equipment defects and control system equipment malfunction. Thirteen cases were caused by animals, five by environmental conditions, four by human actions (including both EGAT employees and outsiders), three by weather conditions, four by unidentified reasons, and one by other cause.

A significant failure case affecting EGAT's power system occurred on Friday 14 February 2020 at 05.35 at Nakhon Si Thammarat High Voltage Substation. A distribution system failure caused an outage at Nakhon Si Thammarat and Ranot High Voltage Substations, affecting seven delivery points. Total interruption duration was 347 minutes and total electricity supply cut off was 7,960.98 MW-minutes. Bulk system disturbance indices (BDI) were 1.214 system-minutes.

EGAT's 2020 performance index and availability

Performance index and availability	2020 Performance
System Average Interruption Frequency Index (SAIFI) (number of occurrence/delivery point)	0.12649
System Average Interruption Duration Index (SAIDI) (minutes/delivery point)	1.69265
Service Availability (SA) (%)	99.80704
Transmission Circuit Availability (%)	99.98778
Transformer Availability (%)	99.24645
Voltage Deviation (VD) (ppm)	0.053
Frequency Deviation (FD) (%)	0.00003

Remark: The index of standard service quality of EGAT takes into account the number of unplanned outages which is used in the performance evaluation of EGAT.

Demand Side Management

EGAT has implemented various demand side management programs under the 3A Strategy, aiming to improve energy efficiency in three aspects, including appliance, architecture, and attitude. These programs seek collaboration from the government sector, private sector, and general public to use energy more efficiently and reduce unnecessary electricity consumption. Moreover, they build energy efficient awareness and attitudes and promote carbon dioxide emissions reduction. DSM activities conducted in 2020 are as follows:

A1 – Energy Efficient Appliance

The Energy Efficiency Label No. 5 Scheme initiated by EGAT has promoted energy efficiency labeling for 31 types of products. In 2020, a total of 28.33 million Energy Efficiency No. 5 Labels were used. In addition, EGAT planned to add two more products, including air purifiers and horizontal drum washing machines to the Label No. 5 Scheme in 2021 and held a meeting with entrepreneurs and testing bodies to set energy efficiency standards for the appliances. These appliances will be labelled and placed on the market from 1 January 2021 onwards.

Outcome of distributing the Energy Efficiency No. 5 Label in 2020

- Reduce up to 281 MW of electricity demand
- Reduce up to 1,865 million kWh of electricity consumption
- Reduce 908.61 thousand tons of carbon

The above outcome was evaluated from the distribution of No.5 Label in 2020 to 18 products with a total number of 26.98 million labels, not including products that cannot be evaluated and products with no energy-saving outcome.

From 1993 to 2020, the Label No. 5 Scheme has reduced 5,309 MW of electricity demand,

31,880 million kWh of electricity consumption,

and 17,871 thousand tons of carbon dioxide equivalent emissions.

EGAT has also promoted the circular economy (reduce, reuse, and recycle) through the Energy Efficiency Label No. 5 Scheme to properly separate product waste to recover and reuse resources and while reducing waste. In 2020, EGAT collaborated with the Electrical and Electronics Institute and partners to support the Roleplay Simulation of Waste from Electrical and Electronic Equipment Project, aiming to develop a waste electrical and electronic equipment management process in response to the Waste Electrical and Electronic Equipment Act. The project has identified five types of e-waste including 1) computers, 2) cordless phones, 3) air conditioners, 4) television receivers, and 5) refrigerators and determined the scope of study in the municipal areas of Nonthaburi and Buriram Provinces. Furthermore, EGAT held a meeting with entrepreneurs participating in the Energy Efficiency Label No. 5 Scheme to propose guidelines for setting circular economy criteria and waste electrical and electronic equipment management.

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Result of Demand-side management project (from Energy Efficient Appliance Strategy)

Year	Peak Demand (MW)	Electricity Reduced (million kWh)	Carbon Dioxide Emissions Reduced (Ton CO _{2e})
2010	267.08	1,706.02	937,888
2011	298.28	1,808.20	994,379
2012	430.20	2,574.54	1,414,637
2013	385.84	2,348.06	1,200,563
2014	345.60	2,069.35	1,058,061
2015	443.48	2,529.63	1,292,990
2016	210.64	1,324.25	677,091
2017	261.39	1,530.44	798,074
2018	278.68	1,664.34	885,593
2019	273.41	1,789.06	902,758
2020	281.00	1,865.00	908,609

Remark:

1. Since 2016, EGAT has changed the assessment method and variables as recommended by its research consultant (Enconlab, King Mongkut's University of Technology Thonburi) in 2014, from using only Minimum Energy Performance Standards (MEPS) required by law to establish a baseline according to the nature of buyers as follows; 1) For buyers buying new electric appliances to replace the non-expired one, the baseline is the MEPS required by law 2) For buyers buying new electric appliances to replace the expired or dilapidated one, the baseline is the MEPS of the Label No. 5 Scheme 3) For buyers buying new electric appliances, the baseline is the MEPS of the Label No. 5 Scheme. This change has resulted in a 40-60 percent drop in energy efficiency but more reliability since it better reflects consumer behavior and the energy efficiency of electric appliances.
2. Annual performance data may be subject to backdated adjustment because the energy efficiency of certain newly labelled products has not yet been assessed due to pending study results of relevant variables.

A2 – Energy Efficient Architecture

EGAT promotes the efficient use of electricity in all residential, commercial, and industrial buildings. It has attempted to build energy awareness, encourage investment in improving energy efficiency in old buildings, and promote the use of high-performance design and construction materials in new buildings as follows:

- Implemented the Energy Efficiency Resources Standard (EERS) in collaboration with MEA and PEA to help target consumers achieve more energy savings through consulting services and financial incentives, which were able to save 27.68 million kWh of electricity consumption.

- Implemented the House and Building Energy Efficiency Label No. 5 Project in collaboration with the government, private, and education sectors to promote energy efficient home and building design. In 2020, there were seven home and building designs that met the energy efficiency criteria, ready to be developed into the Smart and Sustainable Community for better well-being (SSC) by the National Housing Authority under the Baan Eua Arthorn Bang Chalong Project in Samut Prakan Province.

A3 – Energy Efficient Attitude

EGAT has collaborated with the Office of the Basic Education Commission (OBEC) to implement the Green Classroom Project since 1998. The project aims to integrate energy and environmental conservation knowledge into the classroom through curricular teaching and extracurricular activities to build a knowledge-based society. It fosters energy efficient attitudes among young people and educates them about environmental conservation and further expands the results to the homes and communities of the students.

In 2020, there were 464 primary and secondary schools across the country participating in the Green Classroom Project. EGAT also built upon green classroom activities to develop and implement various energy-saving projects and programs, including the Green School Program (model schools for energy and environmental conservation), Low Carbon School Program (reduce energy consumption in schools), Low Carbon School to Community Program (reduce energy consumption in students' homes), Energy Efficient School Building Label No. 5, Energy and Environmental Conservation Learning Center, and Energy Efficient Community Label No. 5.

- **The Green School Program (model schools for energy and environmental conservation)** encourages schools to integrate energy and environmental conservation principles into every school system and process, including energy management, classroom teaching, extracurricular activities, and learning environment management. Since 2009, 209 schools have achieved the green school standard.
- **The Low Carbon School Program (reduce energy use in schools)** encourages schools to develop an energy management system, reduce CO₂ emissions from day-to-day activities, calculate carbon footprint, implement environmental conservation activities, and drive low carbon society in schools. The program has run since 2014.

In 2020, 129 schools under the program were able to reduce 1.87 million kWh of electricity consumption, 8.76 million baht on electricity bills, and 1,062 tons of carbon dioxide equivalent emissions from electrical appliances.

- **The Low Carbon School to Community Program (reduce energy use in students' homes)** encourages schools to expand energy-saving activities to students' homes to enable their families to reduce household electricity consumption by at least five percent. The program has been continued since 2016. In 2020, 33,769 families were able to reduce up to 4.91 million kWh of electricity consumption, 17.79 million baht on electricity bills, and 2,783 tons of carbon dioxide equivalent emissions from electrical appliances.
- **Energy Efficient School Building Label No. 5** aims to promote energy efficiency in school buildings in three aspects, including architecture, appliance, and attitude to help schools reduce their electricity costs in a more concrete manner and create a positive learning environment. For example, it encourages the use of construction materials that can keep buildings cool and electrical appliances with Energy Efficiency Label No. 5, as well as regularly maintaining electrical appliances. The program has run since 2018. To date, there are 23 schools that have achieved the Energy Efficient School Building Label No. 5 Standard.
 - Established green classrooms in 10 schools under the royal patronage of King Vajiralongkorn on the auspicious occasion of the coronation of King Rama X. This was part of the activities to enhance energy efficiency in schools in collaboration with the Ministry of Energy.
 - Initiated the Green Classroom 2020 in collaboration with the Office of

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the Basic Education Commission, Secondary Educational Service Area Office District 34, and San Patong Wittayakhom School, Chiang Mai Province. It aims to expand the green classroom network, create a knowledge-based society, promote understanding of energy efficiency and environmental conservation among young people, and enhance interactive learning. The project also supports the improvement of energy efficiency in the Intellectual Promotion Center (Phra Phrom Mongkhon Wi.) at San Patong Wittayakhom School, Chiang

Mai Province to help it achieve the Energy Efficient Building Label No. 5 Standard.

- Promoted greenhouse gas reduction through energy-saving activities at schools, such as switching to energy efficient bulbs and low carbon school activities to reduce electricity consumption in schools and students' homes as part of the Low Emission Support Scheme (LESS) certified by the Thailand Greenhouse Gas Management Organization (Public Organization).

Demand-side Management Activities by Target Groups

Project	Electricity users			Related Institutions
	Residential	Commercial	Industrial	
1. Energy Efficient Appliance includes; Energy efficiency labeling (Label No.5)	•	•	•	•
2. Energy Efficient Architecture (Buildings) includes; Energy Efficiency Label No. 5 for New Buildings, Energy Efficient Housing (Label No.5 Housing), and Energy Efficiency Resources Standards (EERS)	•	•	•	•
3. Energy Efficient Attitude includes; Green classroom project to homes of communities of students, and other Energy Conservation Promotion measures.	•	•	•	•

Innovative Development of Energy Conservation Promotion Measures

- **Refrigeration and Air Conditioning Nationally Appropriate Mitigation Actions (RAC NAMA)**

EGAT has collaborated with the German International Cooperation (GIZ) to implement the Refrigeration and Air Conditioning Nationally Appropriate Mitigation Actions (RAC NAMA). The project will provide financial

support to promote the manufacture and use of energy-efficient and climate-friendly cooling technologies in refrigerators, freezers, air-conditioners, and chillers. EGAT has been managing the RAC NAMA Fund of 8.3 million euros or 300 million baht since 2017 to promote the use of natural refrigerant

technology in the production, consumption, and service sectors. Over the past two years, EGAT has provided support through various financial measures, including:

- 1) Consumer sales promotion grant in the amount of 10 million baht to stimulate a purchase of products already on the market. As a result, over 15,000 refrigerators using natural refrigerants have been sold, saving about 1.1 million units of electricity per year.
- 2) One-year interest-free loan in the amount of 52 million baht for manufacturers in the refrigeration industry to use as liquid investment to transform their production lines to ones that use natural refrigerant technology.
- 3) Unconditional grant in the amount of 90 million baht for manufacturers in the refrigeration industry to help them transform their production lines to ones that use natural refrigerant technology.
- 4) Grant in the amount of 15 million baht for purchasing training equipment and establishing eight training centers nationwide.
- 5) Interest-free loan in the amount of 155 million baht to implement marketing measures to increase refrigeration and air conditioning sales.

On 17 February 2020, EGAT, the Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Ministry of Natural Resources and Environment, and German International Cooperation (GIZ) celebrated the success of the RAC NAMA Fund. The fund has successfully helped drive nine

manufacturers toward green refrigeration and air conditioning production and established eight technician training centers across the country with more than 150 trainees to date.

- **Promoting the Use of Electric Vehicles in EGAT**

EGAT has promoted the use of electric motorcycles in EGAT and CSR activities to set an example for energy efficiency, reduce CO₂ emissions (decarbonization), and create an environmentally friendly image for the organization. In addition to developing and improving electric motorcycles to meet the needs and expectations of users, it has spread awareness about the benefits of electric motorcycles, implemented the Energy Efficient e-Motorcycle Label No. 5 Project, and promoted the improvement of electric motorcycle performance.

In 2020, EGAT developed 51 electric motorcycles under the brand 'ENGY' with swappable batteries for use in our CSR activities in 19 areas of EGAT's operations across the country. Furthermore, it set up three battery swapping stations at the EGAT Learning Center Headquarters in Nonthaburi Province, Mae Moh Power Plant in Lampang Province, and EGAT Learning Center Lamtakong in Nakhon Ratchasima Province. These swapping stations are equipped with a RFID access control system to manage and facilitate battery swapping.

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Innovation, Research and Development

In today's fast-paced digital world, failure to adapt to changes could affect the sustainability of businesses. Recognizing the importance of this issue, EGAT has strived to develop technology and innovation and supported research and development to enhance the organization's capacity to meet the needs of customers and stakeholders and promote sustainable development. EGAT Research & Development, Innovation, and Invention Policy Committee, chaired by the EGAT Governor, is responsible for determining guidelines for researching and developing energy

technologies and innovations, focusing on three areas of research and development.

1. Research and development of innovations to enhance grid competitiveness, stability, and productivity from upstream to downstream.
2. Research and development of business innovations to create business opportunities and support future energy systems.
3. Research and development of social and environmental innovations.

5-Year Research and Development Master Plan (2018-2022)

The plan is intended to serve as a roadmap to ensure that research and development are moving in the same direction and in a systematic and efficient manner. It consists of two key strategies: 1) research and innovation and 2) support and promotion of research and innovation.

Strategy 1: Implement research and development projects, according to five research directions, which determine the nature of research and innovation EGAT plans to focus on.

Budget Allocation for Five Research Directions



(Each year, EGAT allocates 3% or around 1,200 million baht of its profit to research.)

Strategy 2: Support and promotion of research and innovation

- Develop infrastructures, such as co-working spaces, laboratories, and research institutes.
- Develop managerial processes, such as research and development funding and incentive system.
- Build innovation partnerships and networks.
- Promote commercialization, such as intellectual property management and commercialization through innovation companies.

Moreover, EGAT has initiated various processes and activities to encourage employees to develop an innovation mindset and entrepreneurship, and promote innovation development and culture within the organization.

Research and Development

EGAT provided funding to 79 internal and external research projects, totaling **1,074.95 million baht.**

In 2020, EGAT funded a total of 79 internal and external research projects, totaling 1,074.95 million baht. The total cumulative return increased by 2,331.7 million baht. Twenty-eight projects have been completed.

	Direction	Number of Projects	Approved Funding (Million Baht)
1	National Grid Innovation	16	122.75
2	Problem Solving, Efficiency Improvement, Cost Reduction	28	63.52
3	Solving Environmental Problems	13	38.77
4	Sustainable Co-existence with Communities	15	90.98
5	New Business	7	758.93
Total		79	1,074.95

Some of the outstanding projects in the areas of digital technology and innovations to create business models of the future, improve grid stability and reliability, and promote sustainable development are:

Machine Learning System Model Project for the Digital Power Plant

This project is a collaboration between EGAT and the Biomedical Engineering Institute, Chiang Mai University, to use digital technology and data science to improve the efficiency of the Mae Moh Power Plant, predict failures in boiler and FGD units, and recommend solutions to minimize loss. It aims to design and prototype a machine learning system using a decision tree model that is easy to understand, accurate and can deal with previously encountered problems.

The research found that the machine learning system can learn from past incident data to detect events of boiler leakage. It can even identify new problems that may be caused by similar incidents previously encountered. Moreover, different models are created based on different types of incidents to improve the efficiency of boiler leakage incident identification. The research also found the machine learning system can predict fan vibration in the FGD system 24 hours in advance using the mean absolute error.

Virtual Power Plant Model Development

This project is a collaboration between EGAT and the King Mongkut's University of Technology Thonburi to study the virtual power plant technology (VPP) to efficiently manage distributed generation. A virtual power plant is

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a central platform that aggregates the capacities of heterogeneous distributed energy resources to enhance the national grid stability and provide a reliable overall power supply.

The project conducted an analysis of cost, distributed generation efficiency, and management prior to developing a virtual power plant model. It was found that a 133 MW virtual power plant model is the most suitable model for the several types of power sources connected to the system in northeastern Thailand while maintaining low power generation cost. The model consists of two 40 MW thermal power generation units (maximum 45 MW capacity), one 15 MW solar power generation unit, and one 38 MW wind power plant. It has two types of energy storage units: two 20 MW pumped hydroelectric energy storage units and 80 MWh batteries.

Moreover, an inquiry was conducted to gather information on whether power producers would be interested in participating in virtual power plant contracts. EGAT also analyzed its technical readiness and recommended the IEC 61850 standard for communication in power generation facilities to ensure system safety and stability, as well as supporting a VPP data center and power trading on the electricity market in the future.

Business Model Research for the Thap Sakae Community Power Plant, Thap Sakae District, Prachuap Khiri Khan Province and the Mae Chaem Community Power Plant, Mae Chaem District, Chiang Mai Province

This research applies the Bioeconomy, Circular Economy, and Green Economy (BCG) to the development of a community power plant business model, which will promote energy for all, optimal use of local resources, and energy community prosumers in Thailand. The research aims to achieve energy, economic, and social and environmental goals to develop the quality of life of the Thap Sakae community in a sustainable manner.

In addition, EGAT has also developed four transportation projects, especially those related to electric vehicles, that will play an important role in addressing environmental problems in the future under the concept of ‘EGAT’s E-Mobility for a smart life.’

EV Kit & Blueprint Project

This project is a cooperation between EGAT and the National Electronics and Computer Technology Center (NECTEC) under the National Science and Technology Development Agency (NSTDA) to build upon Honda Jazz, the first modified electric vehicle developed by the i-EV Project Phase 1 between EGAT and NSTDA. The i-EV Project Phase 2 aims to develop four more modified electric vehicles, including two Nissan Almera and two Toyota Altis, with better performance. These electric vehicles can run at a maximum speed of 160 kilometers per hour, and can travel more than 200 kilometers on a single charge at an average speed of 90 kilometers per hour.

Moreover, the project will develop an EV kit that utilizes components and parts available in the country, making it easier to modify vehicles into electric vehicles, costing no more than two hundred thousand baht per vehicle, excluding the battery. Not only are these modified electric vehicles cheaper than electric vehicles made by manufacturers, but they are also registrable. In 2020, EGAT organized two EV modification theoretical training courses for the public and selected entrepreneurs to participate in practical training. This commercialization of research results will allow consumers to have access to affordable electric vehicles.

City Transit E-buses Project

This project aims to modify the Bangkok Mass Transit Authority’s old buses with expired combustion engines into registrable electric buses to promote the development of the electric vehicle industry in Thailand and upgrade city transit buses. Phanthong Machinery Co., Ltd. has

been selected by EGAT, Metropolitan Electricity Authority (MEA), Provincial Electricity Authority (PEA), Bangkok Mass Transit Authority (BMTA), and the National Science and Technology Development Agency (NSTDA) to modify old 12-meter buses into electric buses for EGAT. The electric buses will use a 370-kW permanent magnet motor powered by a 195-kWh lithium nickel-manganese-cobalt-oxide (NMC) battery. Their body and cabin will be overhauled using domestically manufactured components and parts. The bus can travel more than 180 kilometers on a single charge at a maximum speed of at least 80 kilometers per hour. The electric buses modified are required to pass a user acceptance test on the route specified by BMTA. Currently, the project is conducting a feasibility and cost-benefit study of replacing city transit buses with modified electric buses.

A Pilot Study for Public Electric Boats and ‘Road-Rail-Water’ Transit Point Development

Electric boats are clean energy innovation. EGAT has collaborated with Kasetsart University to design and develop electric boats for transporting employees and/or use in organization’s missions, and two charging stations as part of the pilot study for public electric boats and ‘road-rail-water’ transit point development. Two types of electric boats will be designed and developed: a monohull and a catamaran. The boat will use two 55-kW motors powered by a 214-kWh lithium battery and a 175-kW DC charger, while the hull is made of aluminum. The maximum gross load is 23,000 kg for the monohull and 25,000 kg for the catamaran. Both types of boats can accommodate up to 80 passengers and travel up to 60 kilometers on a single charge at a speed of 20 kilometers per hour. In the first phase of the study, a test will be conducted to study and evaluate the boat’s performance in EGAT’s missions before introducing the electric boat in public transport.

Electric Motorcycle Research: A Case Study of the Public Motorbike Taxi in Bang Krui District, Nonthaburi Province

This research project aims to study the use of the electric motorbike taxi in Bang Krui District, Nonthaburi Province and develop a mobile application to support services. A total of 51 electric motorcycles are involved in this study. Data be automatically collected via cloud include: 1) GPS data of the electric motorcycle, 2) data from a swapping station, such as battery status, 3) charging data from a smart meter at home, 4) analytical data, such as motorbike usage and air emissions, and 5) data from the application, such as application usage and user satisfaction. This research project will help EGAT understand public electric motorbike taxi services, motorbike user behavior, power consumption, and driver and service user satisfaction, as well as economic and environmental impacts.

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Environmental Performance

EGAT complies strictly with environmental laws, regulations, standards and requirements. The ISO 14001 environmental management system is also adopted by EGAT functional units involved in electricity generation, to create confidence in communities and society regarding environmental management. In 2020, a total of 22 EGAT units were certified by ISO 14001. These include seven power plants, 14 dams and one coal mine. In addition, EGAT's high-voltage electricity stations have also adopted ISO 14001 in their operations to ensure comprehensive environmental management in accordance with international standards, from electricity generation to distribution.

EGAT has conducted an environmental impact assessment in order to evaluate the likely impacts of its project development on natural resources, economy, society, and health, as well as to find ways to prevent

potential impact from the project, and to propose environmental impact preventive and corrective measures, environmental impact monitoring measures, and environmental action plans during the construction and operation phases.

In 2020, EGAT conducted 5 types of environmental impact studies and reporting, including

- Environmental and Health Impact Assessment (EHIA)
- Environmental Impact Assessment (EIA)
- Initial Environmental Examination (IEE)
- Code of Practice (CoP)
- Environmental and Safety Assessment (ESA)

Projects Approved by Approving Agency or Project Permitting Agency

1. EIA for the Replacement Project of Wang Noi Combined Cycle Power Plant (Replacement of Blocks 1 and 2): approved by the National Environment Board on February 19, 2020
2. EIA for the project of Floating Storage Regasification Unit (FSRU) pipelines to South Bangkok Power Plant: approved by the National Environment Board on July 20, 2020
3. IEE for the project of electricity network of 500 kV of Thung Song - Songkhla 3 (the part over additional protected forest area): approved by the Expert Committee on Environmental Impact Assessment on August 6, 2020
4. IEE for the project of electricity network of 230 kV (Junction) (electricity network of 230 kV of Yasothorn - Ubon Ratchathani 1) - Ubon Ratchathani 1 (the part over additional protected forest area) (approved by the Expert Committee on Environmental Impact Assessment on August 13, 2020)
5. CoP and ESA for the project of Hydro-Floating Solar Hybrid of Sirindhorn Dam: The Energy Regulatory Commission of Thailand approved the issuance of factory license (Factory 4) of the sequential number 88 (1) to EGAT on 5 June 2020, and approved the change of the installed generating capacity of the hydro turbine generator in the electricity generation license and the increase of installed generating capacity of hydro-floating solar hybrid in the electricity generation license on 19 August 2020.

Projects under Consideration

1. EHIA for the Replacement Project of Mae Moh Thermal Power Plant (Units 8-9)
2. EIA for the project of Floating Storage Regasification Unit (FSRU) in the upper Gulf of Thailand
3. EIA for the project of Floating Jetty for Anchoring FSRU
4. EIA for the Replacement Project of Nam Phong Combined Cycle Power Plant
5. EIA for the project of Surat Thani Combined Cycle Power Plant, Blocks 1-2
6. EIA for the project of electricity network of 230 kV of Tak 2 - Mae Sot (the part over the watershed class 1)
7. IEE for the project of electricity network of 500 kV of Mae Moh 3 - Lamphun 3 (the part over additional protected forest area)
8. IEE for the project of electricity network of 230 kV of Tak 2 - Mae Sot (the part over additional protected forest area)

Projects in Study and Report Preparation Process

1. EHIA for the project of South Bangkok Combined Cycle Power Plant (Addition)
2. EIA for the project of North Bangkok Combined Cycle Power Plant (Addition) Phase 1
3. EIA for the project of electricity network of 230 kV of Lamphun 3 - Sop Moei (the part over the watershed class 1)
4. EIA for the project of electricity network of 230 kV, connection point of the project of hydro-floating solar power plant - Bhumibol Dam (the part over the watershed class 1)
5. EIA for the project of electricity network of 230 kV, connection point of the project of hydro-floating solar power plant - Vajiralongkorn Dam (the part over the watershed class 1)
6. IEE for the project of electricity network of 230 kV of Phayao - Chiang Rai (the part over additional protected forest area)
7. IEE for the project of electricity network of 500 kV of Bang Saphan 2 - Surat Thani 2 (the 3rd and 4th circuits) (the part over additional protected forest area)
8. IEE for the project of electricity network of 230 kV of Klong Ngae - Satun (the part over additional protected forest area)
9. IEE for the project of submarine cable of 230 kV of Khanom - Samui Island

Moreover, EGAT conducts environmental assessments and monitors any possible impact that may occur as a result of EGAT projects, including in terms of air pollution, noise levels, water quality, aquatic ecosystem, quality of life as well as waste management. It also reports outcomes of compliance with prevention measures and corrective action regarding the environment and monitoring of environmental impacts for a total of 31 projects to the Energy Regulatory Commission and relevant regulatory bodies regularly every six months.

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Energy Management

The global spread of COVID-19 in 2020 severely affected Thailand's economy, causing economic activities in the industrial sector to come to an abrupt halt, forcing people to embrace the new normal. As a result, the net electricity demand in 2020 dropped from 2019. However, EGAT recognizes how power supply is vital for medical facilities, economic activity, transportation, etc., and so has put rigorous measures in place to ensure security of supply in the country and crisis preparedness at all times.

Energy Consumption within the Organization for Electricity Generation

At EGAT, the functional unit under the Deputy Governor – Fuel is in charge of fuel management, to ensure sufficient generation and supply to power plants and support the development of fuel business and other relevant businesses for EGAT Group. The unit under the Deputy Governor – Generation is in charge of power generation.

EGAT has chosen a range of fuels for electricity generation, including renewable and non-renewable fuels, in order to provide stable, reliable, and affordable electric power for all. In 2020, we consumed fuels from the following sources:



Natural Gas

EGAT uses natural gas from the Gulf of Thailand, onshore sources (Nam Phong and Sinphuhorm), and imported from other countries (Myanmar and liquefied natural gas). In 2020, up to 324,543.52 million cubic feet of natural gas was used in EGAT-operated power plants.



Lignite

Mae Moh Power Plant uses lignite coals from Mae Moh mine to generate electricity. In 2020, a total of 13.23 million tons of lignite were used, slightly down from 2019 because the amount of electricity generated by Mae Moh Power Plant was less than that specified in the annual generation plan.



Oil

EGAT used oil as a primary energy source to generate electricity at Krabi Power Plant (fuel oil) and as a secondary fuel in many power plants such as Chana Power Plant (diesel oil) for when the Malaysia-Thailand Joint Development Area (JDA-A18) stops natural gas supply due to annual maintenance. Moreover, diesel oil was used to restart Mae Moh Power Plant after planned and unplanned maintenance and when commissioning the South Bangkok Power Plant Replacement (SBRP1). In 2020, EGAT used 28.86 million liters of fuel oil, and 32.24 million liters Diesel.



Crude Palm Oil

EGAT uses crude palm oil to generate electricity at Bang Pakong Power Plant in line with the government's crude palm oil market balancing measures. In 2020, we used up to 144.36 million liters of crude palm oil.

Fuel type	2020	2019	2018
Natural Gas (million cubic feet)	324,543.52	303,583.20	297,001.05
Fuel oil (million liters)	28.86	25.35	7.85
Coal (million tons)	13.24	13.76	14.22
Diesel (million liters)	32.23	28.28	27.36
Crude Palm Oil (million liters)	144.36	257.12	0

In addition, EGAT produces electricity from other renewable sources, such as hydropower, geothermal energy, solar power, and wind power. In 2020, 4,139.33 GWh of renewable energy generated electricity were supplied to the grid.

Energy Consumption within the Organization for Electricity Generation and Energy Output in 2020

Energy Source	Energy Consumed within the Organization for Electricity Generation (GWh)	Energy Output (GWh)
Renewable Sources		
Hydropower	-	4,056.54
Geothermal Energy	-	1.01
Solar Power	-	9.98
Wind Power	-	71.8
Palm Oil	1,441.89	486.32
Non-Renewable Sources		
Natural Gas	86,133.94	41,739.00
Fuel Oil	327.29	97.97
Diesel Oil	341.00	154.09
Lignite	47,057.50	16,550.45
Total	135,301.62	63,167.17

Remark: Not include electricity purchased from PEA and MEA

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Energy Consumption outside of EGAT

In addition to generating electricity, EGAT also purchases electricity from external power producers. In 2020, total contracted capacity of all power plants in the system was 45,476.37 MW. EGAT had a total contracted capacity of 16,037.32 MW or 35.26 percent, and purchased from other power producers which include IPPs 14,248.50 MW or 31.33 percent, SPPs 9,473.95 MW or 20.84 percent and neighboring countries 5,716.60 MW or 12.57 percent of the country's total capacity, as shown in the table below.

External Power Producer	Electricity Purchased (GWh)
Independent Power Producers (IPP)	45,269.12
Small Power Producers (SPP)	53,468.44
Neighboring Countries	29,572.69
Total	128,310.25

Intensity of Electricity Consumption within the Office

EGAT also gives importance to in-house energy management. It has adopted the energy efficiency policy, established the Working Group on EGAT Control Building Management and Energy Management Audit Committee, and put in place the electric power conservation measures.

In addition to implementing the energy efficiency policy and energy conservation measures, EGAT has established the Working Group on EGAT Control Building and Energy Management Audit Committee to verify energy efficiency and audit the electric power management system within its headquarters.

In 2020, EGAT replaced 14,900 fluorescent lamps in the Tor 100, Tor 082, and Tor 083 buildings at EGAT Headquarters with LED lamps, resulting in a decrease in energy consumption of up to 472,032 kWh/year. Furthermore, it adjusted the on-off times of the centralized air conditioning system in the Tor 100, Tor 101, and Tor 102 buildings, which was able to save up to 846,225 kWh in energy consumption. In 2020, the EGAT's headquarters consumed a total of 34,846,982 kWh of electricity, accounting for electricity intensity of 5,377.62 kWh per capita per year.

Year	Intensity of Electricity Consumption within the EGAT Headquarters (kWh/capita/year)
2018	3,908.90
2019	4,405.16
2020	5,377.62



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Water Management

EGAT recognizes the importance of effective and comprehensive water management, including controlling the amount of water withdrawal from a water source and effluent discharge, to reduce the impact of EGAT's activities on the environment and surrounding communities.

Water withdrawal

EGAT used water from various sources which include surface water, ground water and municipal water, for its power generation process and general consumption.

EGAT's large portion of water consumption is at its eight thermal power plants where water is withdrawn from near-by natural sources including Chao Phraya River, Bang Pakong River, Pakasai Canal and Phoma Canal, and reservoirs such as Mae Kham Dam and Mae Chang reservoirs. None of these water sources are located in national or international conserved and protected areas, and have no preserved and protected species. However, EGAT is aware of possible impacts on ecology, water sources and biodiversity and has installed juvenile excluder devices at water intake structures of power plants. Fish release activities are also held annually to increase fishery resources and restore diversity among fishes.

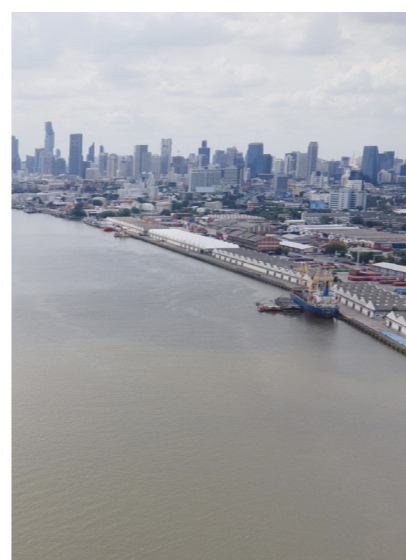
EGAT evaluates impacts from the use of water resource by power plants before commencing a project. Use of water resource, which has been approved by the Cabinet, is described in detail in environmental impact assessment reports of power plants. Every one of EGAT's power plants has been authorized by local regulatory bodies before water resource is used while a project is in progress. In addition, a working group has been set up at some power plants to monitor use of water resources and the request to use water resources by these power plants must be approved by the working group. It has been found, based on past operations, that every water source has been able to accommodate use of water resource by power plants, including in the dry and rainy seasons, without causing a shortage of water for local communities.

EGAT has prepared measures for drought conditions, to ensure stable power generation without having to pump additional water for a sustained period of time. It has adjusted annual maintenance plans according to water volume and communicated with communities for better understanding regarding shared use of water.

Water Use

Water is used in two main activities. One is production and consumption activities within the organization, including power generation, equipment and machinery maintenance, and office consumption. The other is cooling processes in thermal power plants (in cooling towers) which is reused before being discharged to receiving waters.

In addition, we conduct an environmental impact assessment (EIA) or environmental health impact assessment (EHIA) for each of our projects to assess the impact of water use and wastewater management.



Wastewater Treatment

EGAT's thermal power plants have wastewater treatment systems to treat wastewater to the standard required by law. Treated wastewater is delivered to a retention pond within a power plant before being discharged into nearby approved receiving waters, such as Khlong Pakasai (water discharged from Krabi Power Plant) and Khlong 26 (water discharged from Wang Noi Power Plant). Many power plants use treated wastewater stored in the retention pond to water lawns and trees within the power plants, instead of discharging it to natural water resources. Wastewater produced by the cooling process is controlled to ensure that the temperature is appropriate and does not affect aquatic animals, and meets the quality standard required by law before being discharged into nearby approved receiving waters. All water resources used are not located in national and international conservation or protected areas and have no preserved and protected species.

In addition to managing water used within the organization, EGAT takes part in public-public partnerships in the management of regional waters. For example, the EGAT Governor has joined the Thai National Mekong Committee (TNMC) established by the Mekong River Commission (MRC). The MRC is an inter-governmental organization that works directly with the governments of Cambodia, Lao PDR, Thailand, and Vietnam to jointly manage shared water resources and the sustainable development of the Mekong River. It has developed five sets of procedural rules to guide cooperation. They include the procedures for information exchange and sharing; water use monitoring; notification, prior consultation and agreement; maintenance of flows on the main stream, and water quality.

Water	Units	2019		2020 ⁴	
		All Areas	Areas with water stress	All Areas	Areas with water stress
Water withdrawal by source					
Total water withdrawal	Megaliters	616,291.77	N/A	29,523,898.58	2,498,472.94
Surface water (including rain water)	Megaliters	615,214.03	N/A	29,523,155.68	2,498,294.01
- Freshwater ¹	Megaliters	N/A	N/A	29,213,556.58	2,225,967.97
- Other water ²	Megaliters	N/A	N/A	309,599.11	272,326.03
Groundwater	Megaliters	133.63	N/A	126.51	45.00
- Freshwater ¹	Megaliters	N/A	N/A	126.51	45.00
- Other water ²	Megaliters	N/A	N/A	-	-
Third-party water	Megaliters	944.11	N/A	616.38	133.94
- Freshwater ¹	Megaliters	944.11	N/A	616.38	133.94
- Other water ²	Megaliters	-	-	-	-
Seawater	Megaliters	-	-	-	-
Water discharge by destination					
Total water discharge	Megaliters	112,395.21	N/A	29,086,578.04	2,442,897.39
- Surface water	Megaliters	110,985.21	N/A	29,084,888.04	2,441,207.39
- Groundwater	Megaliters	1,410.00	N/A	1,690.00	1,690.00
- Seawater	Megaliters	-	-	-	-
- Third-party water	Megaliters	-	-	-	-
- Freshwater ¹	Megaliters	N/A	N/A	29,062,485.25	2,421,236.61
- Other water ²	Megaliters	N/A	N/A	24,092.78	21,660.78
Water consumption					
Total water consumption ³	Megaliters	503,896.56	N/A	437,320.54	55,575.55

Remark: ¹ Freshwater (≤1,000 mg/L Total Dissolved Solids)
² Other water (>1,000 mg/L Total Dissolved Solids)
³ Amount of water consumed = Amount of water withdrawn - Amount of water discharged
⁴ Water withdrawal and water discharge in 2020 increased significantly, as this was the first year to include the total amount of water used in power generation by hydropower plants, which withdraw water from and discharge it back to natural water

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Air Quality Management

Greenhouse Gas Emissions

EGAT supports the United Nations Framework Convention on Climate Change (UNFCCC) to mitigate climate change, which causes direct and indirect impact on its business operations. For example, changes in electricity user behavior, rainfall, velocity, and solar output can affect power generation from renewable energy sources. EGAT is taking part in Thailand's Nationally Appropriate Mitigation Action (NAMA) to reduce greenhouse gases by 7 to 20 percent by 2020 and the Nationally Determined Contribution (NDC) to reduce 20 to 25 percent of emissions by 2030 with the hopes of keeping greenhouse gas intensity to a level that is not harmful to human life. EGAT greenhouse gas management is overseen by the Greenhouse Gas Management Committee, which consists of high-ranking executives from all administrative areas. The Committee is responsible for communicating policies and monitoring greenhouse gas management activities while the Greenhouse Gas Management Division is assigned to collaborate with other internal units to achieve organization-wide greenhouse gas reductions.

EGAT adopted the organization-wide greenhouse gas management policy in 2007, which was most recently revised in 2018. The policy sets the following goals for EGAT: to become a leader in greenhouse gas emissions reduction in the electricity sector by using clean and efficient technologies; to develop a greenhouse gas management network in the electricity sector; to promote research and development of greenhouse gas reduction technology and innovation; to implement greenhouse gas emissions reduction measures or projects; and to support the development of a carbon market in Thailand. EGAT greenhouse gas management plan consists of the following four long-term strategies: achieve the required greenhouse gas emission reduction targets; build understanding, awareness, and participation among stakeholders; become a focal organization for greenhouse gas emissions reduction in the electricity sector; and research and development. The plan sets both short-term and long-term greenhouse gas reduction targets as follows:

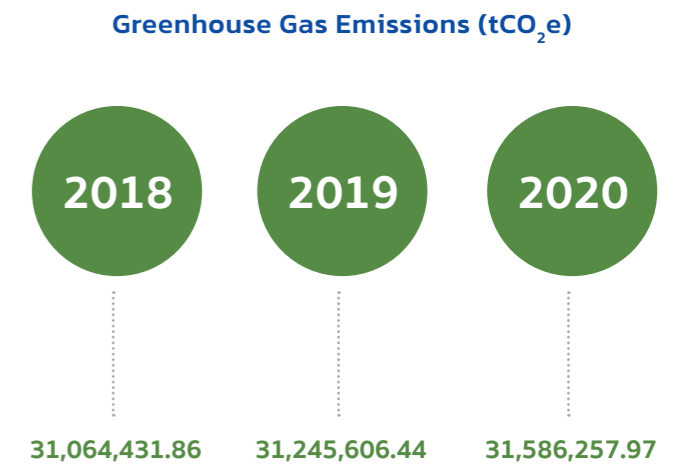
Indicator	Target	
	Short-Term (2020)	Long-Term (2030)
Greenhouse gas reduction at the policy level	4 million tons of carbon dioxide equivalent	10 million tons of carbon dioxide equivalent

Direct and Indirect Greenhouse Gas Emissions

EGAT prepared a greenhouse gas emissions and removal inventory in accordance with ISO 14064-1 Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals. It has measured, quantified and reported greenhouse gas emissions within the organizational boundary established under the control approach,

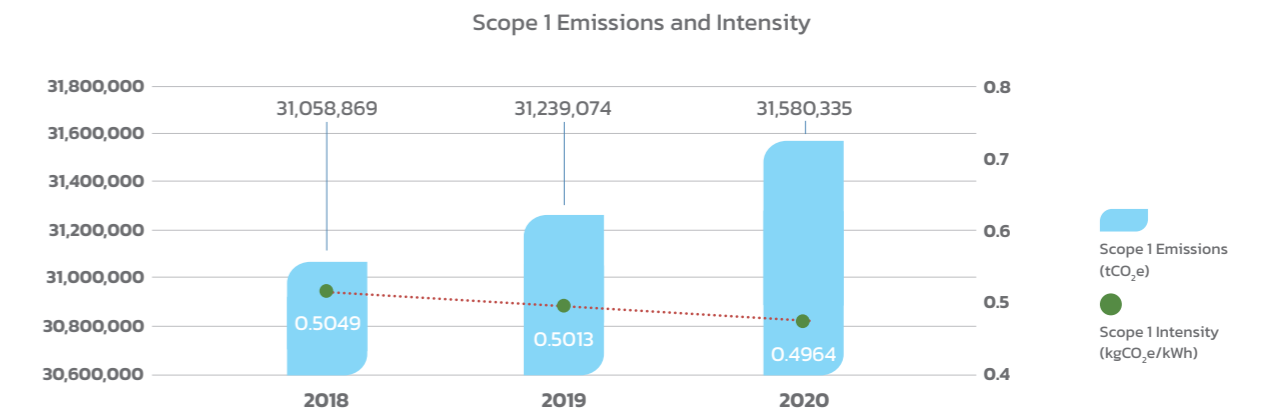
covering the power plants, mines, dams, offices, and transmission systems that EGAT has operational control over. However, the quantification does not include greenhouse gas emissions by plants or companies co-owned but not controlled by EGAT. The greenhouse gases chosen for measurement are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbon

(PFCs), hydrofluorocarbon (HFCs), and sulfur hexafluoride (SF₆) using the Global Warming Potential Values 100 Years from the IPCC's Fifth Assessment Report (AR₅). Nitrogen trifluoride (NF₃) is not related to EGAT's operations. The base year is 2018, as it was the first year in which the greenhouse gas emissions were reported at the organization level. The emission factors, assumptions, and reporting of greenhouse gas emissions and removals used in the assessment are in accordance with the requirements of ISO 14064-1. In 2020, the total direct (Scope 1), indirect (Scope 2), and other indirect (Scope 3) greenhouse gases emitted by EGAT was 31,586,257.97 tons of carbon dioxide equivalent (tCO₂e).



Direct and Indirect Greenhouse Gas Intensity

EGAT calculates the intensity of greenhouse gas emissions per electricity generation every year for greenhouse gas management planning and monitoring. In 2020, EGAT generated up to 63,624,302.133 MWh of net electricity and emitted 31,586,257.97 tCO₂e of greenhouse gases, equivalent to 0.4964 kgCO₂e/kWh greenhouse gas emissions intensity per electricity generation. The intensity of direct greenhouse gas emissions (Scope 1) was 0.4964 kgCO₂e/kWh, indirect greenhouse gas emissions (Scope 2) was 0.00007776 kgCO₂e/kWh, and other indirect greenhouse gas emissions (Scope 3) was 0.00001533 kgCO₂e/kWh.



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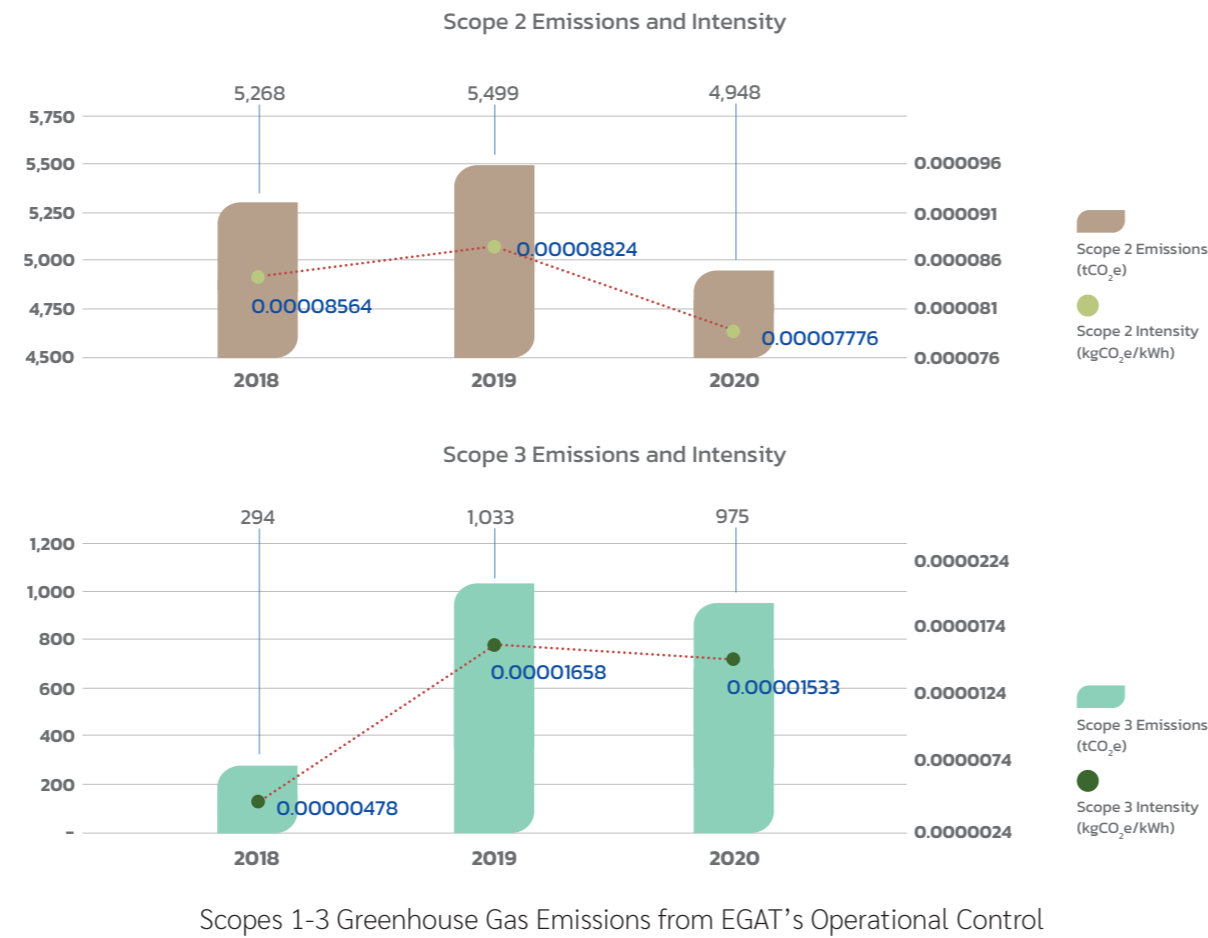
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Scopes 1-3 Greenhouse Gas Emissions from EGAT's Operational Control

Remark:

- Scope 1 emissions from fuel combustion in power generation process, organization vehicles, coal mining, CO₂ emissions from SO₂ (FGD) removal process, and use of SF₆ to quench the arc.
- Scope 2 emissions from consuming purchased electricity (PEA and MEA).
- Scope 3 emissions from paper and tap water consumption. No tap water use data is available for 2018 since EGAT began collecting tap water data in 2019.

In 2020,
the intensity of direct and indirect greenhouse gas emissions decreased from the previous year in all scopes.



more information



Scope 2 indirect greenhouse gas emissions are calculated from the consumption of electricity purchased from the Provincial Electricity Authority (PEA) and Metropolitan Electricity Authority (MEA). In 2020, EGAT's consumption of purchased electricity compared with the base year 2018 as follows:

Source of Purchased Electricity	Electricity Consumption (MWh)		
	2020	2019	2018 (Base Year)
Metropolitan Electricity Authority (MEA)	3,546.298	3,320.931	3,046.920
Provincial Electricity Authority (PEA)	6,351.781	6,126.037	6,003.595
Total	9,898.079	9,446.968	9,050.515

Greenhouse Gas Mitigation

EGAT is one of the key organizations taking part in the efforts to reduce greenhouse gas emissions in the electricity sector to help Thailand achieve its reduction targets. EGAT has implemented three measures to reduce greenhouse gas emissions within the organization, which are assessed against the baseline scenario and policy scenario as follows:

Measures	Baseline Scenario	Policy Scenario
1. Renewable Energy Power Generation	Greenhouse gas emissions from fossil fuel power generation and power purchase from other countries.	Power generation from renewable energy, which emits no greenhouse gases.
2. Power Generation Efficiency Improvement	Power generation by fossil fuel power plants in 2010.	Power generation by fossil fuel power plants in the year of policy implementation.
3. Label No. 5 Standard and Labeling Scheme	Greenhouse gas emissions from low energy-efficient electrical appliances.	Greenhouse gas emissions from electrical appliances with Label No. 5.

EGAT has a measurement, reporting, and verification process (MRV) that is certified by the Greenhouse Gas Management Committee and submits the results of greenhouse gas reduction to the Energy Policy and Planning Office (EPPO) every year for use in preparing a national greenhouse gas inventory report.

In 2020, EGAT reduced greenhouse gas emissions by up to 8,758,780 tons of carbon dioxide equivalent (tCO₂e), surpassing the reduction target of 4,000,000 tCO₂e.

In 2020, EGAT was able to reduce greenhouse gas emissions by up to 8.7 million tCO₂e, surpassing the reduction target of 4 million tCO₂e.

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Results of Greenhouse Gas Reduction at the Measure Level

Measures	Greenhouse Gas Reduction (tCO ₂ e)		
	2020	2019	2018
1. Renewable Energy Power Generation	2,363,965	3,317,418	4,004,926
2. Power Generation Efficiency Improvement	5,567,363	4,262,443	3,514,222
3. Label No. 5 Standard and Labeling Scheme	827,452	796,972	757,269
Total	8,758,780	8,376,833	8,276,417

Remark: EGAT set the greenhouse gas reduction target for 2020 at 4 million tCO₂e.

EGAT has registered its greenhouse gas mitigation projects and quantified the greenhouse gas emissions reduction as required by emissions trading mechanisms for carbon credit certification. In 2020, EGAT implemented the Thailand Voluntary Emission Reduction Program (T-VER), initiated by the Thailand Greenhouse Gas Management Organization (Public Organization), and successfully registered the Khlong Tron Hydropower Plant in Uttaradit and certified the amount of greenhouse gas reduction by the Khwae Noi Dam Bamrungdan Hydropower Plant in Phitsanulok. To date, EGAT has a total of nine T-VER projects and accumulated carbon credits for 308,872 tCO₂e.

To date, EGAT has a total of nine T-VER projects registered with TGO and accumulated carbon credits for 308,872 tCO₂e.

Certified Greenhouse Gas Emission Reduction from T-VER Program in 2020

Project	Crediting Period	Emission Reduction (tCO ₂ e)
Khwae Noi Dam Bamrungdan Hydropower Plant, Phitsanulok	1 January 2018 -31 December 2019	110,266

Greenhouse Gas Emissions Trading

Thailand is currently preparing its Climate Change Act, which aims to promote greenhouse gas reduction within the country. It will also set emissions trading mechanisms and guidelines for relevant sectors to implement greenhouse gas reduction in a concrete manner.

EGAT is paying close attention to this matter and is prepared to support the implementation of the Climate Change Act.

In 2020, we cooperated with the Thailand Greenhouse Gas Management Organization (TGO), which is the body responsible for the Thailand Voluntary Emission Trading Scheme (Thailand V-ETS), to study the development of an ETS system for the electricity sector in Thailand. At present, TGO is gathering expert opinions and the study report is expected to be published by 2021.

Renewable Energy Certificate Program

In 2020, Thailand's Nationally Appropriate Mitigation Action (NAMA) came to an end and the Nationally Determined Contribution (NDC) will launch in 2021 with an even higher greenhouse gas reduction target. As demand for electricity from renewable energy is increasing, especially in the private sector, companies face limitations as they do not have enough capital or space to invest in building their own power generation systems. Recognizing this problem, EGAT has developed and promoted the renewable energy certificate program (REC) in Thailand to support the transition from NAMA to NDC.

The Renewable Energy Certificate, or REC, is an instrument that supports power producers of renewable energy in selling the rights to the environmental attributes of renewable power generation, which have been verified and certified by the issuer, to purchasers to allow them to claim the environmental benefits of renewable electricity generation. One megawatt-hour (MWh) of electricity generated from a renewable energy resource is equal to one REC. As the REC process is verifiable, it is transparent and reliable. EGAT was chosen by the International REC Standard Foundation (I-REC) to serve as the only local issuer in Thailand. In addition to being an issuer, we also sell RECs earned from power generated by our renewable energy power plants.

Emissions of Ozone Depleting Substances

In 1998, the Department of Industrial Works set forth measures to control ozone depleting substances by prohibiting the use of CFC-11 and CFC-12, regulating the import of ozone depleting substances, and abolishing the use of CFC-13, CFC-14, CFC-15, methyl chloroform, and halon. EGAT therefore does not engage in the production, importation, or exportation of any ozone depleting substances.

Other Significant Air Emissions

To keep the stack emissions intensity within the level required in the EIA or EHIA, stack emissions data for oxides of nitrogen (NO_x), sulfur dioxide (SO₂), and particulate matter (PM) is collected at EGAT's eight power plants. The data collected is used to calculate total annual emissions in ton/year and pollutant intensity in kilogram/MWh. EGAT collects two types of site-specific data, including 1) power plant service hour data and net generation from the Electricity Generation Asset Management Department and 2) pollutants emission quantity data, from the following two sources:

1. CEMS system installed at power plant stacks monitors continuous emissions from stacks during power plant service hours. The monitoring results are more reliable than those obtained from other sampling methods because the data is collected during power plant service hours. At present, Mae Moh is the only EGAT's power plant using CEM data due to the completeness of the system. The sampling method complies with the standard of US EPA. The intensity reported is based on the reference condition at 1 atm, dry basis, 25 °C, 7% excess oxygen

2. Stack sampling collects emission data, which is collected from stacks twice a year to be a representative of year-round emissions. The concentration and flow rate data of NO_x, SO₂, PM, and O₂ will be collected at the power plant service of at least 80% of full load according to US EPA Code 40 App F. O₂ samples are collected according to Method 6C, SO₂ samples are

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collected according to Method 7E, PM samples are collected according to Method 5/5i, O₂ is collected according to Method 3A, and flow rate is measured according to Method 2. The intensity reported is based on the reference condition at 1 atm, dry basis, 25 °C, 7% excess oxygen.

EGAT has reported the intensity of NO_x, SO₂, and PM from stack sampling and CEMS, compared against the emission standards for air contaminants from power

generation, transmission, and distribution plants under the Notification of Ministry of Industry B.E 2547 and the emission control standards for new power plants under the Notification of Ministry of Natural Resources and Environment B.E 2552. Based on the concentration data obtained from the CEMS system and stack sampling, the annual pollutant emissions (ton/year) can be calculated by multiplying the concentration by % oxygen, flue gas flow rate (m³/s) at the time of measurement, and power plant service hours.

$$E = C \times \frac{(20.9\% - \%O_2)}{(20.9\% - 7\%)} \times Q_s \times SH \text{ (hour/year)} \times 3,600 \text{ (sec/hr)} \times 10^{-6} \text{ (tonne/g)}$$

- E** Total Emissions (tonne/year)
- C** Pollutants concentration (mg/m³) @ 7% excess O₂, 25 °C, 760 mmHg, dry basis
- %O₂** Percentage of flue gas excess oxygen (%)
- Q_s** Flue gas flow rate (m³/sec) at actual O₂, 25 °C, 760 mmHg, dry basis
- SH** Power plant service hours (hour/year)

Air emissions from EGAT's power plants between 2018 and 2020 (ton/year) and pollutant intensity (kg/MWh) are shown below. Moreover, EGAT has inspected the continuous emission monitoring system (CEMS) of its

eight power plants twice a year to ensure the accuracy of the air quality measurement results. There is no POP, VOC or HAP in stack emissions since they are not the components of the fuels used in EGAT's power plants.

NO_x, SO₂, and PM Emissions from EGAT's Power Plants

Emissions	2018	2019	2020
SO ₂ emission (tonne)	19,527.09	16,555.63	11,650.19
SO ₂ intensity (kg/MWh)	0.32	0.27	0.18
NO _x emission (tonne)	49,958.37	44,950.90	42,913.68
NO _x intensity (kg/MWh)	0.81	0.72	0.67
PM emission (tonne)	1,185.69	873.48	694.98
PM intensity (kg/MWh)	0.02	0.01	0.01



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Biodiversity



All EGAT's projects are located outside natural conservation areas, except for the Lamtakong Wind Turbine Power Plant Project Phase 2. This project (consisting of 12 wind turbines covering an area of 160,256 square meters) is situated in Nakhon Ratchasima Province, extending over a mountain ridge in Ban Khao Yai Thiang Nuea, Klong Phai Subdistrict, Sikhiu District and a forest area in Nong Sarai Subdistrict, Pak Chong District. The project area encompasses a Class 1B watershed conserved area and two non-conserved national forest reserves of Khao Tian-Khao Khuean Lan and Pak Chong-Mu Si.

EGAT conducted a study of the project area and its surroundings to assess the ecological impact before implementing the project. It was found that the project area has moderate ecological value with no or slight disturbance. The plant species present are diverse and have the ability to reproduce and regenerate naturally. Because the Lamtakong Wind Turbine Power Plant Project Phase 2 uses wind energy to generate electricity, it does not emit pollutants into the environment. The study also found that the forest in the project area is being recovered from past land use. Wildlife resources mostly consist of endemic wild animals that can adapt to changing environments. However, birds and bats may be affected by collision with wind turbine blades. Large

and migratory birds have a higher risk of flying into turbine blades (although they have not been found in the project area). Bats use sound waves to hunt for prey at night, but they will not be affected by the project's sound frequency. To prevent and mitigate impacts, EGAT has implemented the following activities.

- A reforestation program to restore the forest and ecosystem in the project area, focusing on growing plants that provide food and habitat for wild animals.
- Focus reforestation efforts in the Class 1B watershed and degraded forest areas in the national forest reserves. After planting, tree survival rate is monitored, and replanting happens immediately after the trees die.
- Conduct a five-year participatory research project to study the project's impact on wildlife.

As the project covers a conserved area, EGAT has conducted a survey of plant and wildlife species to identify and understand the plants and animals present in the project area.

The survey has identified Class A forbidden tree species protected by the Royal Decree on Prescribing of Forbidden Trees B.E. 2530, including the lanete tree,

the Catechu tree, the Mempat tree, Indian Laurel, and velvet tamarind. However, no rare and endangered plant species listed in the Thailand Red Data have been found¹.

Two protected wild mammals under the Wildlife Preservation and Protection Act B.E. 2535² and the Announcement of Additional Protected Wildlife Species Permitted for Captive Breeding B.E. 2546 have been identified. They are the hill long-tongued fruit bat and the small Indian mongoose. The survey has also discovered 59 bird species (e.g. the Chinese pond heron, the crested serpent eagle, and the collared scops owl), four reptile species (the Oriental garden lizard,

the red-headed lizard, the Bengal monitor, and the Indochinese rat snake), and one amphibian species (the flat-headed toad). No wild animals listed in the Thailand Red Data have been found. However, the mammals and birds identified in the project area have been classified as Least Concern in the IUCN Red List of Threatened Species, while the reptile and amphibian species have not yet been evaluated against the IUCN Red List criteria.

Conservation and Restoration Area

Aware of the ecological impacts of mining, EGAT has continued to plant trees to restore and maintain the ecological balance of post lignite and limestone mining areas in the Mae Moh District in compliance with concession terms and conditions since 1982. Moreover, EGAT has continuously monitored plant community changes and bioproducts deriving from reforestation.

From 1982 to 2020, EGAT has planted 2,016,489 trees in a total of 12,024 rai of land to restore the ecosystem of post-mining areas in compliance with concession terms and conditions. In 2020, EGAT planted 35,180 trees in a total of 187 rai of land. EGAT's efforts to restore forest resources between 1982 and 2020 can be summarized in the table below:

Year	Reforest Area (rai)	Number of Trees Planted (tree)
1982-1986	637	150,350
1987-1991	365	52,100
1992-1996	2,360	290,925
1997-2001	3,020	542,998
2002-2006	1,929	375,406
2007-2011	1,909	353,582
2012-2016	1,221	136,340
2017-2020	583	114,788
Total	12,024	2,016,489

In 2020, EGAT monitored plant community changes and bioproducts deriving from reforestation in nine locations in four main areas.

- Concession area: soil samples and plant community data were collected in six locations, including NW Dump, Ash Dump, SW Dump, adjacent intact land, golf course, and NE Dump.
- Limestone mine restoration area.
- Natural forest area.
- Newly restored area (NE Dump): additional area monitored in 2020.

¹ Compiled by the Office of Natural Resources and Environmental Policy and Planning (ONEP 2006) and Red List of Endemic and Rare Plants in Thailand (Department of National Parks, Wildlife and Plant Conservation 2005) have been found in the project area.

² Based on past studies.

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To study the plant community, EGAT used 20 x 40 square meter sample plots to measure tree growth rate in post-mining areas, and studied carbon storage in the plant community by assessing the biomass content of trees in the sample plots using the allometric equation recommended by Ogawa et al. (1967) for deciduous mixed forests.

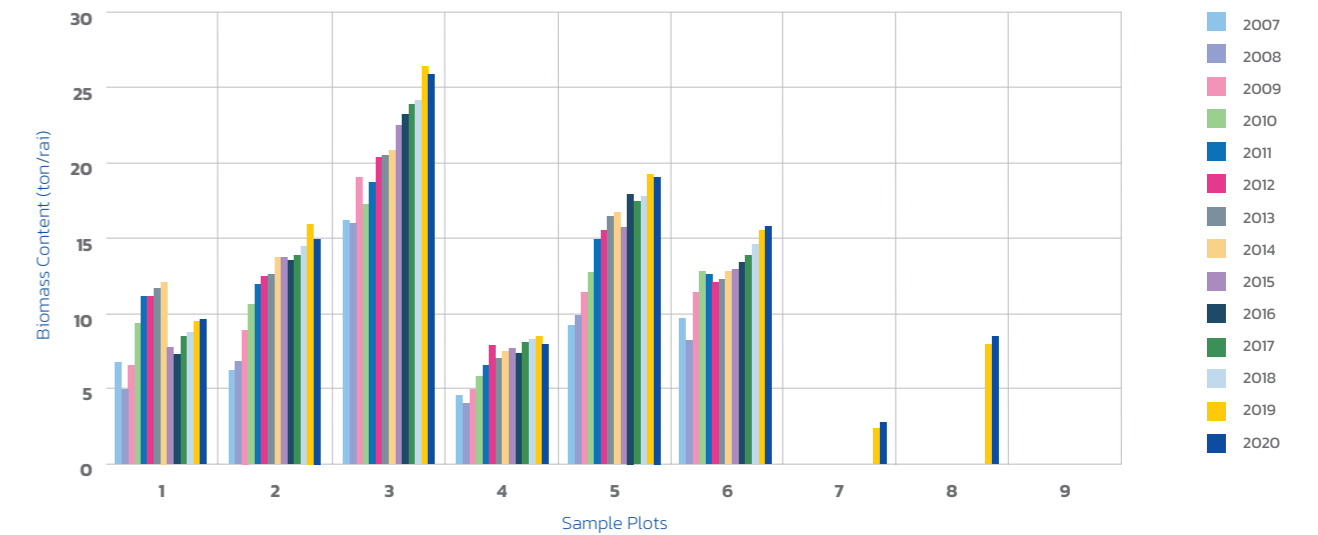
Notable plant species found in the study of the plant community in nine locations include teak, the monkey pod tree, and the Casuarina junghuhniana. There were little changes in the plant community in the adjacent intact area. Plant species found in the sample plots are listed in the table below.

Results of Plant Community Survey from Nine Sample Plots

Survey Area	Plant Species Identified	Notable Species
1. NW Dump	Monkey pod tree, Cassod tree, Lagerstroemia venusta Wall. ex C.B. Clarke, Teak, Combretum quadrangulare Kurz, Kalamona, Thai crape myrtle, Pride of India, and Jujube tree	Monkey pod tree
2. Ash Dump	Teak, Cassod tree, Tamarind tree, Neem tree, Lead tree, Earleaf acacia, Cutch tree, Madras Thorn, Combretum quadrangulare Kurz, and Indian elm	Teak
3. SW Dump	Casuarina junghuhniana, Cassod tree, Madras Thorn, Kalamona, and Thai crape myrtle	Casuarina junghuhniana
4. Adjacent Intact Area	Milletia leucantha, Harrisonia perforata (Blanco) Merr., Jackal jujube tree, Eriolaena candollei Wall., Thai crape myrtle, Creeping woodsorrel, Lagerstroemia cochinchinensis Pierre, Cratoxylum cochinchinense, Indian cork tree, Dolichandrone serrulata (Wall. ex DC.) Seem, Bhesa robusta (Roxb.) Ding Hou, Combretum punctatum Blume., Annonaceae, Bombax anceps Pierre, Canarium subulatum Guill., and Mitrephora vandaefflora Kurz.	Harrisonia perforata (Blanco) Merr.
5. Golf Course	Royal poinciana, Neem tree, Ebony tree, Orchid tree, and Lagerstroemia venusta Wall. ex C.B. Clarke.	Royal poinciana
6. NE Dump	Teak, Cassod tree, Madras Thorn, Lead tree, Golden shower tree, Indian elm, Combretum quadrangulare Kurz, and Cutch tree	Teak
7. Limestone Mine Rehabilitation Area	Java plum tree, Cassod tree, Cutch tree, Gamari, Calabura, Lead tree, Lebbek tree, Teak, Croton oblongifolius Roxb, and Indian elm	Java plum tree
8. Natural Forest Area	Cananga latifolia (Hook.f. & Thomson) Finet & Gagnep., Lagerstroemia venusta Wall. ex C. B. Clarke, Alangium salviifolium Wang., Holarrhena pubescens, Burma padauk, Jackal jujube tree, Indian trumpet flower, Vitex canescens Kurz, Terminalia bellirica, teak, Casearia grewiaefolia Vent., Ivru wood, Microcos tomentosa Sm., Annonaceae, Albizia odoratissima (L.f.) Benth., Golden shower tree, Morinda coreia Buch.-Ham., Eriolaena candollei Wall., Dolichandrone serrulata (Wall. ex DC.) Seem., Combretum punctatum Blume., Bastard teak, Cansjera rheedei J.F.Gmel., and Fagraea ceilanica Thunb.	Cananga latifolia (Hook.f. & Thomson) Finet & Gagnep.
9. Newly restored area (NE Dump)	Cutch tree, Madras Thorn, Teak, Hog plum, Tamarind tree, Indian trumpet flower, Combretum quadrangulare Kurz, Burma padauk, Jujube tree, Neem tree, Orchid tree, and lebbek Tree	Cutch tree

The study of carbon storage in the plant community by assessing the biomass content of trees in the sample plots shows a continuous increase in biomass content, with the highest biomass content in sample plots in the SW Dump area. Biomass and carbon content in trees are similar to those in 2019, although carbon content in organic matter increases from 2019, as shown in the biomass and carbon content chart below.

Biomass Contents in Sample Plots in Nine Study Areas from 2007 to 2020



Remark: Sample plots were placed in Areas 7 and 8 in 2019 and Area 9 in 2020 (0.06 tons/rai).

Biomass Content, Carbon Content, and Carbon Dioxide Content in Tree Biomass and Organic Matter Collected from Sample Plots in Nine Study Areas in 2019 and 2020



Remark: Sample plots in nine study areas, including (1) NW Dump, (2) Ash Dump, (3) SW Dump, (4) Adjacent Intact Area, (5) Golf Course, (6) NE Dump, (7) Limestone Mine Rehabilitation Area, (8) Natural Forest Area, and (9) Newly Restored Area (NE Dump)

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Waste Management

EGAT places importance on waste management. It categorizes and sorts waste produced from its operation activities to ensure that waste in each category is disposed of properly, according to the principles of sustainable waste management, or recovered or recycled in strict compliance with relevant laws, as follows:

Waste Category	Source	Disposal Method
 Hazardous waste Waste that has a hazardous component or is contaminated with hazardous substances or has dangerous properties.	Waste from plant operations	Sent to be disposed of by agencies authorized by the Department of Industrial Works, with a uniform hazardous waste manifest system.
	Infectious waste from medical facilities	Sent to qualified hospitals for safe disposal.
 General waste Waste that does not easily degrade naturally and it is not cost-effective to recover or recycle through industrial process.	Waste from plant operations	Sent to be disposed of by agencies authorized by the Department of Industrial Works.
	Waste from consumption activities	Transported by garbage truck to be disposed of in sanitary landfills by local authorities.
 Recycled waste Waste that can be recovered as new products through industrial recycling process. This type of waste includes metal, glass, plastic, paper, and wood scraps.	Waste from plant operations	Sent to be disposed of by agencies authorized by the Department of Industrial Works.
	Waste from consumption activities	Sorted and sent for recycling by local authorities or companies authorized by local authorities.
 Biodegradable waste Waste that degrades naturally and/or can be composted, such as food, vegetable, and fruit scraps, and leaves.	Waste from consumption activities	Collected in containers to be used as animal feed or to make compost.

In 2020, EGAT did not transport hazardous waste across borders, and no leakage of oil, fuel, waste, chemicals or other substances was reported.

Waste by Type and Disposal Method

Disposal Method	Volume	Unit
Total Waste	4,597,969.44	Tonnes
Hazardous Waste	2,712.26	Tonnes
- Reuse	0	Tonnes
- Recycling	97.65	Tonnes
- Composting	0	Tonnes
- Incineration (mass burn)	122.42	Tonnes
- Landfill	167.72	Tonnes
- On-site storage	224.06	Tonnes
- Other	2,100.41	Tonnes
Non-hazardous Waste (Ton)	4,595,257.18	Tonnes
- Reuse	81.30	Tonnes
- Recycling	558.31	Tonnes
- Composting	40.65	Tonnes
- Incineration (mass burn)	0	Tonnes
- Landfill	3,383,020.68	Tonnes
- On-site storage	405.31	Tonnes
- Other	1,211,150.94	Tonnes

Remark: Waste data from thermal and combined-cycle power plants, hydropower plants, Mae Moh Mine and headquarters, excluding high-voltage substations and transmission offices.

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Human Resource Management and Development

Human resources are an essential driving force towards an organization's sustainability. EGAT's approach for human resource management focuses on developing individuals to be kind, talented, happy and loyal to the organization as well as adhering to organizational values and culture. EGAT reviews its organizational structure, manpower plan, competency based on job responsibilities, as well as other human resource management systems that will enable EGAT to carry out its operations smoothly, by ensuring that the organizational structure is well suited to its operations, that there is sufficient manpower in terms of quantity and quality, and that its personnel have the necessary skills, knowledge and competency to handle changes and respond to EGAT's vision, strategy and mission at present in the future efficiently and effectively.

Total number of employees by type, age group and gender

Age group (year)	Permanent and Probationary Employee (person)						Contract Employee (person)						Total (person)
	Central			Provincial			Central			Provincial			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	
20-30	725	623	1,348	1,635	383	2,018	3	0	3	78	1	79	3,448
31-40	875	747	1,622	2,110	405	2,515	87	6	93	334	3	337	4,567
41-50	533	489	1,022	1,102	206	1,308	70	6	76	130	2	132	2,538
51-60	1,362	911	2,273	4,024	707	4,731	32	11	43	34	7	41	7,088
Total	3,495	2,770	6,265	8,871	1,701	10,572	192	23	215	576	13	589	17,641

Total number and rate of employees hires by age group, gender and region

Age group (year)	Permanent Employee (person)												Total (person)
	Central						Provincial						
	Male	%	Female	%	Total	%	Male	%	Female	%	Total	%	
20-30	31	0.18	21	0.12	52	0.29	113	0.64	51	0.29	164	0.93	216
31-40	1	0.01	1	0.01	2	0.01	4	0.02	3	0.02	7	0.04	9
41-50	0	0.00	0	0.00	0	0.00	1	0.01	1	0.01	2	0.01	2
Total	32	0.18	22	0.12	54	0.31	118	0.67	55	0.31	173	0.98	227

Remark: No contract employees hired in 2020

Total number and rate of employees turnover by age group, gender and region

Age group (year)	Permanent Employee (person)												Contract Employee (person)				Total (person)
	Central						Provincial						Central		Provincial		
	Male	%	Female	%	Total	%	Male	%	Female	%	Total	%	Male	%	Female	%	
20-30	9	0.05	4	0.02	13	0.07	4	0.02	3	0.02	7	0.04	1	0.01	1	0.01	22
31-40	2	0.01	1	0.01	3	0.02	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3
41-50	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01	1	0.01	0	0.00	0	0.00	1
51-60	1	0.01	3	0.02	4	0.02	1	0.01	0	0.00	1	0.01	0	0.00	0	0.00	5
Total	12	0.07	8	0.05	20	0.11	5	0.03	4	0.02	9	0.05	1	0.01	1	0.01	31

Welfare and Benefits

EGAT provides welfare benefits to all employees. While some benefits cover the employee's family, such as a medical allowance, some benefits are offered for employees with specific duties or tasks, such as a special allowance for machine operation, special allowance for work at height, and risk allowance for officials in the three southern border provinces. Some important welfare and benefits are as follows:

Welfare and Benefits		High-ranking executive	Executive	Practitioner
1	Travel allowance for work in the country	●	●	●
2	Accommodation allowance when travelling for work in the country	●	●	●
3	Loans, such as emergency loans and children's education loans	●	●	●
4	Housing allowance	●	●	●
5	Provident fund	●	●	●
6	Medical allowance in EGAT's medical facilities (*)	●	●	●
7	Overtime pay and holiday pay	●	●	●
8	Uniform	●	●	●
9	Allowance or reward for high-risk jobs (**)	●	●	●
10	Special allowance for specific duties or tasks such as underwater operations and welding craftsmanship	●	●	●
11	Risk allowance and accident insurance for officials in the southern border provinces (***)	●	●	●
12	Special reward/vacation leave for officials in the southern border provinces (***)	●	●	●

Remark: (*) Covers the employee's family; (**) For specific duties or tasks; (***) For high-risk areas
 ● means welfare and benefits provided ● means welfare and benefits not provided.



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EGAT regularly improve our welfare and benefit programs to ensure that employees are provided with fair and appropriate welfare benefits, safety, and quality of life. In 2020, the following improvements were made:

1. Revised the rules and regulations to better respond to the needs of employees by increasing the allowance rates in four areas, as follows:
 - (1) EGAT Regulation No. 401 on Funeral Allowance.
 - (2) EGAT Regulation No. 422 on Child Support (1st Revision).
 - (3) EGAT Regulation No. 434 on Uniforms for Certain Types of Work.
 - (4) EGAT Regulation No. 432 on Special Allowance for Preparation Work at High Voltage Substations.
2. To ensure the safety of employees during the COVID-19 outbreak, EGAT has had guidelines for work from home to avoid close contact and prevent the spread of virus since 20 March 2020. Employees using personal cell phones for work are eligible for mobile service compensation of not more than 400 baht per month under the EGAT Regulation No. 395 on Communication Devices, Telephones, and Mobile Service Bills. In addition, EGAT has provided accommodation and food for employees for whom working from home during the COVID-19 pandemic is not feasible, such as employees operating power generators, controlling power transmission, and working in high-voltage substations.

Furthermore, EGAT sets rules for welfare and benefits in the terms of reference and service contracts, requiring that outsourced contractors comply strictly with the labor protection law and Social Security Act.

EGAT also satisfies the social needs of employees through activities such as EGAT Family's Day and Sports Day. Various clubs have been established in response to the need for social contact. These clubs are managed by the Sports, Entertainment, and Hobby Management Committee, which provides locations and budgets to support club activities. There are four types of clubs: religious clubs, senior clubs, entertainment and hobby clubs, and sports clubs at both the EGAT central administration area and regional offices.

EGAT believes in the importance of social development and family institution and especially care about pregnant employees who need to take time off to give birth and care for their newborn child. As per EGAT Regulation No.99 on Leave, Day Off, and Absence from Work, EGAT's female employees are entitled to maternity leave of not more than 90 working days, with 75 days of paid leave and unpaid parental leave of up to 150 working days immediately after the end of maternity leave. EGAT has also given male employees the right to take parental leave of up to 15 working days for each confinement of his legal spouse.

Parental leave	Employee		
	Male	Female	Total
Total number of employees entitled to parental leave	13,134	4,507	17,641
Total number of employees took parental leave in 2019	0	2	2
Total number of employees returned to work after parental leave ended	0	2	2
Total number of employees returned to work after parental leave ended that were still employed 12 months after their return to work	0	0*	0*
Return to work rate	0	100%	100%
Retention rate	0	0.00%	0.00%

Remark: *Unable to determine because employees were still employed less than 12 months after their return to work after the leave ended.

Collective Bargaining

EGAT promotes employee participation and engagement. Because EGAT is a large corporation with a large number of employees working in the central administration and regional areas, it places importance on the principles of human rights and promotes the establishment of employee organizations to collectively bargain in accordance with the State Enterprise Labor Relations Act B.E. 2543. One such organization is the Labor Union of the Electricity Generating Authority of Thailand (EGAT Labor Union), which aims to promote good relationships between employees and executives, protect employee interests relating to collective bargaining, and collaborate with EGAT to create efficiency and protect the organization's interests. At present, the EGAT Labor Union has 11,143 members or 63.17 percent of the total number of employees. Another organization is the EGAT Relations Committee, a bilateral committee consisting of nine representatives from management, and nine from the EGAT Labor Union. It was established to promote mutual understanding between employees and management, monitor collective bargaining, employee benefits, and complaints, and consider the appropriateness of the organization's welfare program. It also supports and develops labor relations activities to create a harmonious workplace, and improves work regulations.

The collective bargaining agreement between EGAT and the EGAT Labor Union is generally made when the EGAT Labor Union files a specific claim. Then, a negotiation takes place until a mutual agreement is reached. In general, the collective bargaining agreement applies to all employees (100%) in the organization. In the event of a change in operations, EGAT will notify and provide information in advance within a reasonable time period.

Performance Appraisal

Employee performance appraisal is based on key performance indicators (KPIs), which include individual behavior indicators, accounting for 30% of the overall appraisal score, and a set of goals and objectives agreed upon by subordinates and superiors, accounting for 70% of the overall appraisal score. The appraisal results are used to support a consideration of remuneration, appointment, and personnel development. EGAT requires that the performance appraisal be conducted for every employee, and that men and women be given equal salary and remuneration rates according to their positions and duties.

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Remuneration Ratio of women to men

Type of Employee	2020		2019		2018	
	Female	Male	Female	Male	Female	Male
Permanent Employee	0.98	1	0.98	1	0.98	1
Contract Employee	1.11	1	1.10	1	1.02	1

Human Resource Development

EGAT faces many challenges such as technological changes and the impacts of the COVID-19 pandemic, prompting it to improve and change in every dimension in order to achieve the organization's missions, compete against competitors, and respond to government plans and policies. EGAT has developed its personnel development plan and allocated a budget for developing target employees in technical, managerial, and leadership areas in hopes of helping employees acquire the knowledge, skills, abilities, and mindset needed to perform their jobs and support the undertakings that will take place in the future such as the expansion of new and related businesses based on EGAT's innovations. EGAT also provided 36 scholarships to its employees to further their education in managerial and technical fields, and granted study leave to 26 employees to pursue further studies using private funds or funds they have personally acquired. The academic progress of the scholarship employees was monitored and an evaluation was carried out to assess how the programs they studied were related to EGAT's strategies, their risk, and their necessity to the organization. EGAT also followed up on how the scholarship recipients have applied their knowledge and used the follow-up results to improve the scholarship program.

EGAT has designed short-term personnel developments plans and long-term development roadmap, based on

employees' level, position and career path, along with a Successor & Talent Development Roadmap, and a New Skill and Re-skill Development Roadmap, as detailed below:

1. EGAT Development Roadmap – Management

- Competency-based development program is the elementary development program for executives and employees. EGAT's employees will be evaluated through a 360-degree assessment tool and are required to complete the competency-based e-learning courses, as well as ethics and corporate governance training on the EGAT Learning Space Platform (ELS), which will be counted as 10 percent of formal learning.
- Development of level 1-14 and special contract employees comprises 20 percent of coaching and 70 percent of learning by doing. This consists of courses designed for employees at different levels in line with the organization's strategies and competencies that may become important in the future to prepare personnel for changes. Various session formats will be offered including workshops, e-learning, a virtual classroom, self-learning, and external training. Moreover, competency gap will be used as an input data in developing an individual development program (IDP) for employees at level 8 and above.

2. The Successor & Talent Development Roadmap

is designed to develop and prepare selected executives and employees for succession and important positions in EGAT to ensure management continuity. It focuses on non-classroom formats such as one-on-one coaching, one person one project (OPOP), project-based learning, workshop, an apprenticeship program, sharing sessions, and an individual development program (IDP). Opportunities for furthering education in leading institutions at home and abroad and networking with high-level executives in both government and private sectors will also be offered.

Every year when there are employees retiring, EGAT will organize a training program to prepare them for the transition to life after retirement. In 2020, it organized the Final Orientation Special Lecture: A Must-Know for Retirees to provide retiring employees with knowledge about financial management and welfare benefits and prepare them for retired life.

3. New Skill and Re-skill Development

aim to develop new skills and capabilities that are important to the missions of the organization. Both in-house training and external training will be offered to equip participating employees with knowledge and skills needed to carry out EGAT's missions such as skill development programs in power plant operation, maintenance and transmission fields

Total number and rate of employees eligible to retire in the next 5 to 10 years

Employee	Next 5 years				Next 6-10 years				Total employee (person)	%
	Central (person)	%	Provincial (person)	%	Central (person)	%	Provincial (person)	%		
Employee										
Technician	233	1.32	1,368	7.75	296	1.68	1,639	9.29	3,536	20.04
Special Skilled Worker	84	0.48	253	1.43	12	0.07	29	0.16	378	2.14
Machinery operator	16	0.09	77	0.44	4	0.02	4	0.02	101	0.57
Engineer	228	1.29	259	1.47	334	1.89	469	2.66	1,290	7.31
Other	646	3.66	520	2.95	618	3.50	463	2.62	2,247	12.74
Total	1,207	6.84	2,477	14.04	1,264	7.17	2,604	14.76	7,552	42.81
Contract employee										
Machinery operator	1	0.01	3	0.02	2	0.01	14	0.08	20	0.11
Other	21	0.12	15	0.09	25	0.14	24	0.14	85	0.48
Total	22	0.12	18	0.102	27	0.15	38	0.22	105	0.60
Total	1,229	6.97	2,495	14.14	1,291	7.32	2,642	14.98	7,657	43.40

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Total and average training hour per employee

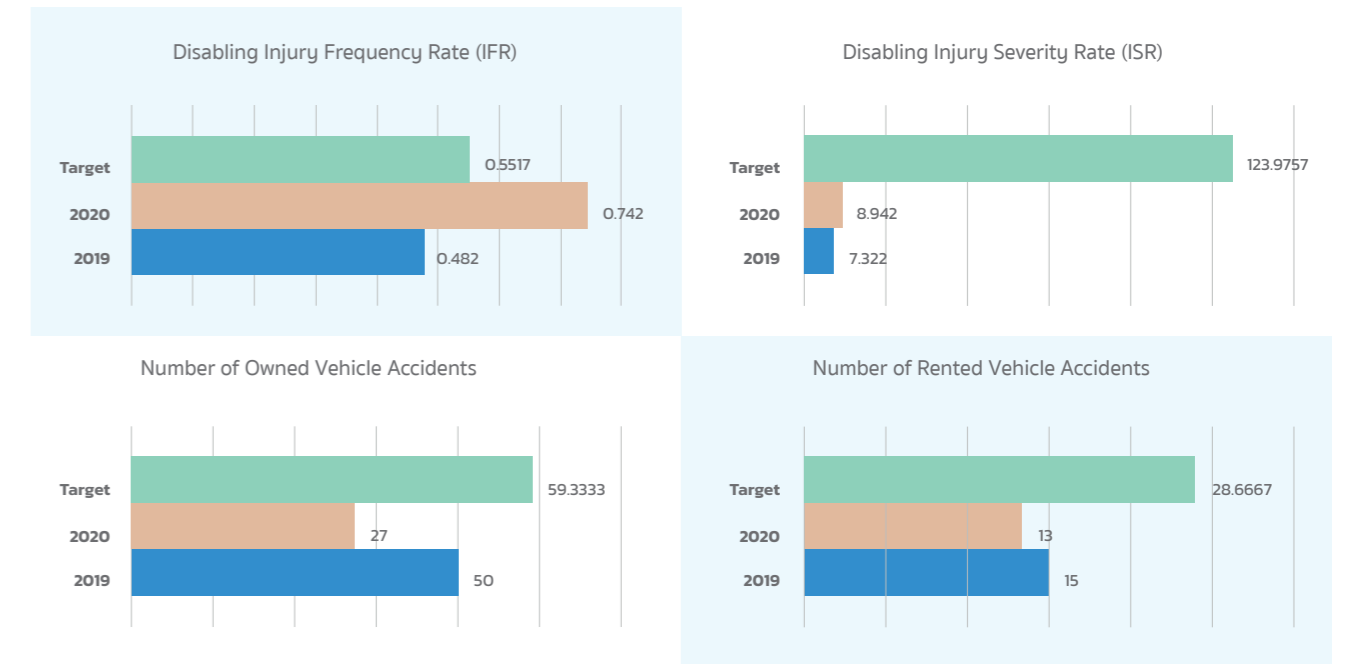
Employee category	2020		2019		2018	
	Male	Female	Male	Female	Male	Female
Total training hour per employee per year						
Senior executive (Level 12 or higher)	10,512	3,423	16,734	3,441	10,794	2,190
Senior executive (Level 8-11)	133,005	71,490	143,898	71,175	129,672	54,750
Practitioner level (lower than level 8)	224,628	99,795	341,214	119,025	382,566	134,436
Average training hour per employee per year						
Senior executive (Level 12 or higher)	98.24	136.92	150.76	137.64	90.71	87.60
Senior executive (Level 8-11)	35.35	46.60	36.19	44.29	30.74	32.69
Practitioner level (lower than level 8)	23.97	33.42	33.98	38.19	34.93	40.06

Occupational Health and Safety

As EGAT is engaged in electric power generation and transmission, as well as other related businesses, effective safety management is very important to its operations. It strives to manage risks and minimize damages to life, property and the production process.

EGAT attaches great importance to occupational health and safety management at the policy level and has continuously communicated this commitment to its internal and external stakeholders. In addition to complying with applicable laws and regulations, EGAT has put in place the quality, safety, health and environmental management system (EGAT QSHE), provided support resources to achieve occupational health and safety objectives, and enhanced employee capabilities to create a safety culture within the organization. The occupational health and safety management standards ISO 45001:2018 and TIS 18001-2554 have been adopted, and EGAT has been audited to be certified to these standards.

To drive occupational health strategies, the Quality Management Development and Productivity Committee has identified five performance indicators, including disabling injury frequency rate (IRF), disabling injury severity rate (ISR), the number of EGAT owned vehicle accidents, the number of rented vehicle accidents, and the number of fire accidents, and required that the operational targets to be achieved for all indicators be lower than the average of the previous three years (2017-2019). In 2020, the number of fire accidents was zero, and the remaining four indicators are shown in the charts below.



The Occupational Health, Safety, and Environment Committee is a unit or site-level committee, consisting of representatives from management and non-management functions and responsible for considering safety action and training plans, ensuring compliance with applicable laws, putting an unsafe condition reporting system in place, monitoring operation progress, and supporting safety activities. EGAT has a total of 34 Occupational Health, Safety, and Environment Committees located at the headquarters, dams, mines, and high voltage substations to drive safety performance in an effective and efficient manner.

To ensure effective occupational health, safety, and environment management, EGAT conducts an evaluation of occupational health, safety, and environment performance of its internal units, which are divided into three groups based on associated risks.

Certified Group	Power plants, mines, maintenance, and regional operations, which must be audited for ISO 45001 certification by an external certification body
Verified Group	Engineering, construction, transportation, service, survey, system control, communication, supplies, medicine and hygiene, and safety, which must be assessed to verify that their safety management is in compliance with the rules, procedures, and conditions set by the Safety Division.
Monitored Group	Office management and support units which must be monitored and randomly assessed to ensure that their safety management is in compliance with the rules, procedures, and conditions set by the Safety Division.

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Occupational Risk Assessment and Hazard Control

EGAT identifies and controls occupational hazards and diseases in two groups of employees: employees with high-risk jobs and employees with low-risk jobs. Employees with high-risk jobs, including underwater operations, working in confined spaces, and working with hazardous chemicals, are required to undergo proactive supervision (e.g., specialized safety training, safety rules, and safety inspection) and passive measures (e.g., use of personal protective equipment and risk-based health checkups). Employees with low-risk jobs, such as finance, accounting, supplies, and procurement, will undergo appropriate supervision, including knowledge improvement and annual health checkups.

Health Services

To monitor employee health, employees are required to receive an annual health checkup at least once a year and a risk-based health checkup as prescribed by the Ministry of Labor. EGAT also provides a health checkup for injured or ill employees before returning to work and regularly monitor occupational diseases. In the event of a work-related injury or illness, employees will receive compensation and reimbursement of medical expenses for treatment at public or private hospitals, as well as coverage in accordance with EGAT's regulations and the rules set by the State Enterprise Labor Relations Committee. In addition, various health promotion programs have been initiated, such as self-care training, EGAT healthy idol project, NCDs prevention course, EGAT-starred restaurant project, no smoking campaign, EGAT non-smoking suggestion project, food safety practices for restaurant operators and workers training, CPR course, happy workplace course, and occupational disease course.

Enhancing Safety Knowledge and Building a Safety Culture

EGAT provides job-based training courses for employees at all levels to develop their health and safety knowledge and skills. These courses include an executive safety officer course, supervisory safety officer course, occupational health, safety, and environment courses for existing employees and new hires. There are also offer risk-based training courses, such as introduction to chemical hazards in the workplace, safety management risk assessment, confined space safety, general safety inspection and planned maintenance course, basic and advanced firefighting courses, and fire prevention and suppression for emergency response. Furthermore, EGAT has continuously conducted activities to promote a safety culture, such as a safety video contest, safety week, behavior-based safety activity, and visible safety leadership.

Contractor Safety Management

To ensure that all contractor work practices are carried out safely, EGAT has issued EGAT Regulation No. 396 on Contractor Safety Management, covering five stages of contract management: contractor selection, pre-contract management, contract execution management, delivery, inspection and acceptance, and performance assessment and reporting. It sets important safety requirements, which include:

- Determining contractor safety criteria as part of a term of reference (TOR).

- Requiring contractors to submit information about their safety practices and management before starting work under the contract, including a safety training certificate and license, as required by law.
- Submitting a safety plan, including occupational safety training to be provided for workers.
- Requiring contractors to provide and ensure that their workers wear standard personal protective equipment. If a contractor's worker fails to wear personal protective equipment, EGAT's superintendent shall suspend that worker from working until he wears personal protective equipment.

In 2020, total working day of contractor and subcontractor employee in strip mining at a lignite coal mine in Mae Moh District, Lampang, and transmission construction are 365 and 360 days respectively, and a 100 percent of these employees received health and safety training.

EGAT's work-related injury rate in 2020 was 0.000355, down by 10.1% from the previous year.

Safety Performance

Data	Unit	2019	2020
Employees covered by an occupational health and safety management system			
People covered by an occupational health and safety management system			
Employees	person	18,806	17,782
	%	100	100
People covered by an occupational health and safety management system validated by an internal unit			
Employees	person	8,098	7,734
	%	100	100
People covered by an occupational health and safety management system validated by a third party			
Employees	person	10,708	10,048
	%	100	100
Work-related injuries			
Hours worked			
Employees	hour	29,792,168	29,635,200
Fatalities			
Employees	person	0	0
	person/1,000,000 hours worked	0	0
Serious injuries (not including fatalities)			
Employees	person	15*	20*
	person/1,000,000 hours worked	0.50	0.67

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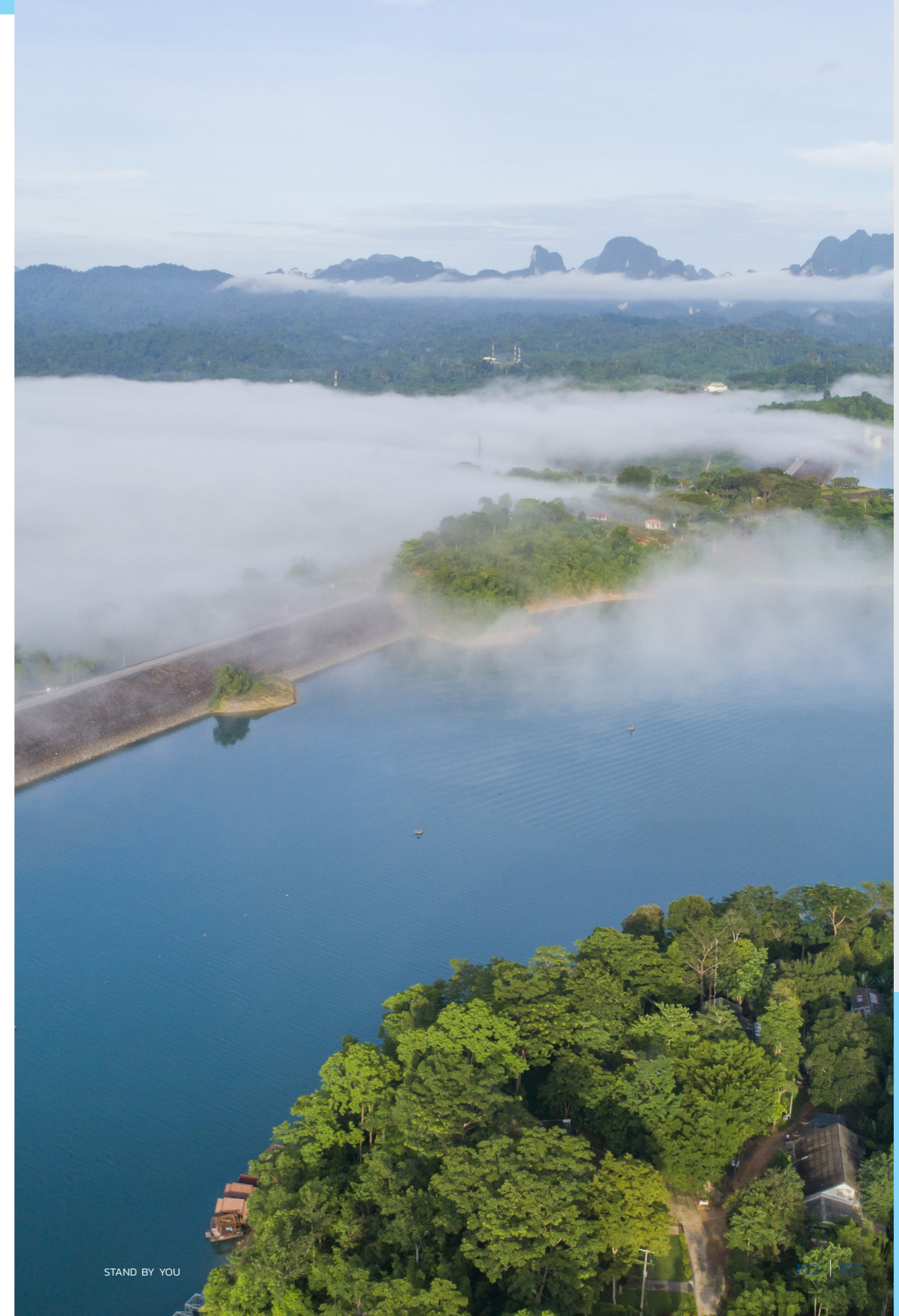


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Data	Unit	2019	2020
Total work-related injuries			
Employees	person	79	71
	person/1,000,000 hours worked	0.000395	0.000355
Lost time injury frequency rate (LTIFR)			
Employees	person	15	20
	person/1,000,000 hours worked	0.50	0.67
Work-related ill health			
Work-related fatalities			
Employees	person	0	0
	person/1,000,000 hours worked	0	0
Total work-related ill health			
Employees	person	0	0
	person/1,000,000 hours worked	0	0

Remark: No data available, *absence from work only



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Community Involvement and Development

As part of EGAT's mission in securing the power reliability, it has continually implemented various infrastructure development projects, such as power plant extensions and transmission system maintenance and expansions (high voltage transmission line and high-voltage stations). However, these activities may inevitably cause impacts on or inconvenience to the communities surrounding the projects. For example, certain rights to use or occupy the land around a grid system may be limited or local communities may be affected by dust and wastewater from construction activities. The potential impacts of every EGAT project are assessed in advance in an environmental impact assessment (EIA) report, which also identifies mitigation measures to reduce the impacts on communities during project construction and operation phases. For small-scale projects not requiring an EIA report, mitigation measures are strictly implemented by project owners. Moreover, EGAT has measures in place for paying compensation and damages during construction and provide financial aid to those affected by power grid construction as a remedy for evictions and such construction. In addition, land owners are entitled to file an appeal with the Energy Regulatory Commission within 30 days after receiving written notice of compensation from EGAT, as per the Energy Regulatory Commission RE: Criteria, Principles and Conditions for Appeals and Consideration of Appeals B.E. 2552 (2009).

Displacement and relocation are impacts that EGAT take seriously and try to prevent, especially in protected areas (e.g., Class 1A watersheds and non-hunting areas), community areas, and sensitive areas (e.g., temples, schools, and religious places). In 2020, no projects carried out by EGAT caused any communities to relocate. However, there were some land management issues due to the grid system development project that will pass through a 100-year-old tree in Hat Yai Subdistrict, Lang Suan District, Chumphon Province and land plots currently under allocation by the Agricultural Land Reform Office in Hong Charoen Subdistrict, Tha Sae

District, Chumphon Province. EGAT has already discussed these concerns with the Office of Energy Regulatory Commission and related agencies to minimize the impact.

In addition to managing direct impacts on communities from project activities, EGAT has regularly communicated with the public in compliance with its corporate communication plan and upheld our responsibilities towards communities and society. EGAT is committed to developing and implementing projects to benefit communities, which is one of the key stakeholders, in line with its sustainable development policy, the Fifth National Strategy on Green Growth Development, and United Nations Sustainable Development Goals (UN SDGs). Social engagement procedures with the neighboring communities have been established in all of EGAT operating areas, accounting for 100 percent, in the context of community engagement, impact assessment and community development projects. Important projects carried out in 2020 include:

Community Engagement in Project Areas

EGAT engaged local communities and promoted the quality of life and wellbeing in communities through the following projects.

Local Community Engagement through field visits and activities, such as:

- **Attended meetings** with heads of government agencies and village headmen every month to listen to concerns related to EGAT's operations and clarify issues of EGAT's projects.

Building Understanding through group discussions to clarify facts and listen to concerns about upcoming projects and exchange information and views about ongoing projects.

- **North Bangkok Power Plant Project (Extension) Phase 1:** Held six group discussions in the Bang Kruai District to share opinions and clarify facts and one group discussion with the Sunthornsiri Community located near EGAT. Coordinated internal units to strictly comply with measures to prevent impacts on communities. Organized three study trips for 376 members of the Bang Kruai Village Headman Club, the Bang Kruai Village Health Volunteer Group, and the Bang Kruai Community Committee to the North Bangkok Power Plant and Srinagarind Dam in Kanchanaburi and to participate in the 'Mound, Reservoir, and Paddy Model' activity.
- **North Bangkok Power Plant Project:** Organized a site visit for 48 teachers and students from the Faculty of Science and Technology, Rajamangala University of Technology North Bangkok, to enhance their understanding of power generation and environmental management.
- **Surat Thani Power Plant Blocks 1-2 Project:** Organized two study trips for 96 public servants from the Phunphin and Mueang Surat Thani Districts to the North Bangkok Power Plant and the EGAT Learning Center, Central Office.
- **Nam Phong Power Plant Replacement Project:** Organized two study trips for 135 heads of government agencies and community leaders from the Nam Phong District and executives, medical workers, and officials from Nam Phong Hospital, District Public Health, and Subdistrict Health Promoting Hospital to the Hydro-Floating Solar Hybrid Construction Project at Sirindhorn Dam in Ubon Ratchathani Province.
- **Nam Phong Power Plant Project:** Organized a site visit for 79 vocational teachers and students from Nam Phong Technical College to enhance their understanding of power generation and environmental management.

- **Hydro-Floating Solar Hybrid Construction Project at Sirindhorn Dam:** Organized four study trips for 410 students and teachers from Sirindhorn Wittayanusorn School, Ban Kham Khuean Kaeo School, Mu Ban Tua Yang School (Pa Dong Hin Kong), and Thairath Wittaya 87 School (Self-Development Community 1) to the Hydro-Floating Solar Hybrid Construction Project. Organized a study trip for members of the Ban Saeng Udom Giant Bamboo Steamer Basketry Group, Kolan Subdistrict, Buntharik District, Ubon Ratchathani Province to learn and develop skills to make baskets from giant bamboo at local bamboo basketry handicrafts at the Ban Wenbuk Arts and Crafts Center.
- **Floating Storage and Regasification Unit Project:** Organized a study trip for 50 leaders from the Song Khlong Subdistrict to the Pipeline Operations Center Region 8, Tha Muang District, Kanchanaburi Province, and Srinagarind Dam.

Community, Social, and Environmental Development Project

EGAT has implemented projects to improve the quality of life in communities, worked together with communities to develop the local environment, and encouraged youth to participate in social development.

Biological Way of Life for Sustainable Development Project: This development project aims to help communities achieve a sustainable quality of life by transforming them into a social enterprise community capable of creating stable incomes. To achieve this goal, EGAT has adopted the following two strategies.

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- Selected two model Biological Way of Life for Sustainable Development communities and supported them to set up and register a community enterprise. These communities were the Ban Lao Noi Community in Maha Sarakham Province and the Ban Dong Pa Sak Community in Phu Phiang District, Nan Province. A social return on investment analysis (SROI) was conducted at Ban Dong Pa Sak Community by ERM Siam Co., Ltd. to measure the socio-economic impacts of the project. The study results showed that the project created many benefits for participating families. For example, farmers earned more income by applying the knowledge learned from the project to raise catfish and frogs for sale and household consumption. They also made use of effective microorganisms (EM), thereby reducing the cost of chemical fertilizers and pesticides and had access to clean water due to a pipeline installed to bring water from the mountain. The SROI analysis also found that every 1 baht invested in the project would generate 1.97 baht of social value.
- Provided budget support under the MOU on Bioway for Sustainable Development between EGAT and the Office of the Vocational Education Commission for vocational agriculture students and teachers from Lamphun College of Agriculture and Technology to further develop a portable solar bag for agriculture to help farmers achieve the objectives set by the Bioway Project more efficiently.

Reforestation Project: This project involves communities and network partners to conserve and restore forest resources. In 2020, the project planted trees in a total of 1,300 rai of land, including 760 rai in Chumphon Province and 540 rai in Chanthaburi Province, provided maintenance for up to 1,615 rai of forest in Nan, Phrae, Chumphon, and Nakhon Si Thammarat Provinces, and

returned 500 rai of forested land in Nan and Phrae Provinces to the Department of National Parks, Wildlife and Plant Conservation.

EGAT Seeds of Volunteer Spirit Project: This project aims to use the King's principle of understanding, comprehending, developing and sufficiency economy philosophy to foster creativity and a spirit of volunteerism among young people through volunteering for development camps. In 2020, five volunteers for development camp projects were selected: (1) Engineering Volunteer for Community Development Project by Nakhon Phanom University, (2) Ant Volunteer for the Community Development Project Year 2 Following in the King's Footsteps by King Mongkut's University of Technology Thonburi, (3) Restoring Land and Water for Self-Sufficient Living Project Year 2: A Green-Blue Community by Rambhai Barni Rajabhat University, (4) Rajabhat Volunteer for Community Development Camp Year 9: Cooperatives and Sufficiency Economy by Sisaket Rajabhat University, and (5) Rural Teacher Volunteer for Community Development Camp Project Year 9 Rural: Bringing Innovation to Community by Lampang Rajabhat University.

Waen Kaew Project: This project is a partnership between EGAT, Metta International Eye Center (Wat Rai Khing), and Better Vision Group Co., Ltd. to provide services to poor people with vision problems. In 2020, the project dispatched nine vision testing units to deliver services to 4,559 people with vision problems, achieving a satisfaction rate up to 97.80 percent.

Natural Resource Restoration and Management Project: This project is a collaboration between EGAT and the Faculty of Environmental Technology, Prince of Songkla University Phuket to conduct the Sustainable Para - Phang Nga Bay Research and Development. It aims to restore natural and environmental resources

affected by the construction of 500 kV transmission lines and the expansion of 230 kV high voltage cables in the Phuket and Phang-nga Provinces as part of the impact mitigation measures outlined in the Initial Environment Examination Report (IEE). It includes nine research and career development activities to promote incomes for local fishermen over a period of five years (2021-2025): seagrass tissue culture research; career development for coastal fishing communities; study of factors affecting marine litter reduction in coastal communities; research and restoration of mangrove forests; management and restoration of coral reefs; biodiversity and fish habitat for marine life; crab bank; study of water quality, plankton, and larvae; and larval nursery research and development to increase marine animals.

Disaster and Crisis Relief

EGAT provided relief to victims of natural disasters and crises causing harm and damage to health, life, and property.

COVID-19 Situation

Provided 155 million baht of funding to support the following activities.

- 25 million baht to support 75 hospitals across the country.
- 20 million baht to produce EGAT innovations, including 250 positive and negative pressure swab cabinets for 200 hospitals in 50 provinces, 30 negative pressure cabinets for moving patients, and 1,500 foot-pedal alcohol gel dispensers.
- 110 million baht to support communities and society, including:
 - Supplied 992,000 liters of alcohol to the public under the Energy Partnership Against COVID-19 Project between the Ministry of Energy, EGAT, and PTT.
 - Supplied 200,000 surgical masks.
 - Established soup kitchens at 11 temples,

including Wat Bang Oi Chang, Wat Sak Yai, Wat Chalaw, Wat Tanot, Wat Choeng Krabue, Wat Song Phlu, Wat Hu Chang, Wat Konon Maha Sawat, Wat Pho Phueak, Wat Si Prawat, and Wat Mai Phadungkhet, and 7 hospitals in Nonthaburi.

- Supplied 40,000 liters of alcohol gel.
- Supported the EGAT Care Back to School Project, which provided hand sanitizers, foot-pedal alcohol gel dispensers, liquid hand soaps, and cloth masks to 185,937 students in 602 schools across the country.

In addition, EGAT set up a quarantine facility at the Bang Pakong Training Center and Mae Moh Training Center and has supported the government's policies to provide relief during the Covid-19 pandemic, such as the electricity bill relief measure and short-term employment to help unemployed people.

Fine Particulate (PM2.5) Air Pollution

- Delivered surgical masks to five Social and Economic Rehabilitation for the Disabled and Elderly Centers and 34 communities in the Bang Kruai District to promote health and reduce exposure to air pollutants.
- In response to the EGAT Air TIME Plan, EGAT has formed a public-private partnership to set up PM2.5 sensors in areas across the country and developed a dust forecasting system to find sustainable solutions for better quality of life under the Sensor for All Project. In 2020, EGAT prepared to installed PM2.5 sensors in offices and communities around EGAT and developed a mobile application with a research team from Chulalongkorn University.

Other Hazards

- Donated blankets, consumer goods, and drinking water to support winter and flood reliefs.

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Awards and Recognition



SOE Awards 2020 organized by the State Enterprise Policy Office, Ministry of Finance

- Outstanding Creativity and Innovation Award in the innovation category for 'An Estimation of Remaining Life Expectancy of Generator Step-Up Transformer.'
- Outstanding Social and Environmental Contribution Award for the 'Bhumibol Dam Watershed Forest Conservation Project.'

The Prime Minister's Industry Award 2020 from the Ministry of Industry

- Outstanding Achievement in Corporate Social Responsibility for the 'Bang Pakong Model' by Bang Pakong Power Plant. This social innovation aimed to promote public participation in improving the quality of life and the environment in communities around Bang Pakong Power Plant.

CSR-DPIM Continuous Award 2020 from the Department of Primary Industries and Mines, Ministry of Industry

- CSR-DPIM Continuous Award 2020 in the mine category.

Outstanding Organization in Environment Award from the Ministry of Natural Resources and Environment

- Outstanding Organization in Environment Award for continuously implementing environmental projects that benefit society and the nation and operating with environmental responsibility.



Award for Excellence in Water Management 2020 from the Pollution Control Department, Ministry of Natural Resources and Environment

- Plaque of honor for receiving a gold rating from the Excellence Government Building in Wastewater Management Project.

National Research Council Award

- Best Invention Award in Engineering and Industrial Research for the 'Intelligent Generation Controller.'

The 9th NACC Integrity Awards organized by the Office of the National Anti-Corruption Commission

- Honorable mention award.

Greenhouse Gas Reduction Awards from the Thailand Greenhouse Gas Management Organization (Public Organization)

- Plaque of honor from the Thailand Voluntary Emission Reduction Program (T-VER) for Khlong Tron Hydropower Plant Project.
- Carbon neutral certificate from the Green Cooling Revolution: RAC NAMA Fund and the Future of Thai Industry event.
- Certificate from the Low Emission Support Scheme (LESS) for the Green Classroom Project.

Thailand Quality Class 2019 organized by the Office of Thailand Quality Award

- Thailand Quality Class 2019 Award for North Bangkok Power Plant.

Plaque and Certificate of honor in Zero Accident Campaign 2020 organized by the Thailand Institute of Occupational Safety and Health (Public Organization)

- One platinum level award for Bhumibol Dam.
- Two gold level awards for Wang Noi Power Plant and Lan Krabue Power Plant.
- Four silver level awards for Vajiralongkorn Dam, Chana Power Plant, North Bangkok Power Plant, and EGAT Nakhon Ratchasima Office.
- Five bronze level awards for Nam Phong Power Plant, Chulabhorn Dam, Tha Thung Na Dam, Rajjaprabha Dam, and Srinagarind Dam.
- One initial level award for Nam Pung Hydropower Plant Project.

Outstanding Safety, Occupational Health, and Work Environment Awards 2020 organized by the Department of Labor Protection and Welfare, Ministry of Labor

- 17 outstanding safety, occupational health, and work environment agencies.
- One outstanding safety, occupational health, and work environment committee.
- One outstanding safety agency.
- One outstanding safety officer.

Sustainability Disclosure Award 2020 from the Thaipat Institute

- Sustainability Disclosure Award for disclosing sustainability information to the public and stakeholders through a sustainability report.

Museum Thailand Awards 2020 organized by the National Discovery Museum Institute

- Honorable mention award for 'Community and Local Museum' from EGAT Learning Center, Lamtakong.



Plaque of honor for supporting the employment of people with disabilities from the Foundation for the Welfare of the Mentally Retarded of Thailand under the Royal Patronage of Her Majesty the Queen

- Plaque of honor for supporting the employment of people with disabilities.

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GRI Standard	Disclosure	Page number(s) and/or direct answers	Omission		
			Part Omitted	Reason	Explanation
GRI 101: Foundation 2016					
General Disclosures					
Organizational profile					
	102-1 Name of the organization	7	-	-	-
	102-2 Activities, brands, products, and services	7-9	-	-	-
	102-3 Location of headquarters	10	-	-	-
	102-4 Location of operations	10	-	-	-
	102-5 Ownership and legal form	7	-	-	-
	102-6 Markets served	7-9, 47	-	-	-
	102-7 Scale of the organization	9, 92	-	-	-
	102-8 Information on employees and other workers	92	-	-	-
	102-9 Supply chain	9-10	-	-	-
	102-10 Significant changes to the organization and its supply chain	No Change	-	-	-
	102-11 Precautionary Principle or approach	28-32	-	-	-
	102-12 External initiatives	28, 34, 68, 98	-	-	-
	102-13 Membership of associations	10, 75	-	-	-
	EU1 Installed capacity, broken down by primary energy source and by regulatory regime	11	-	-	-
	EU2 Net energy output broken down by primary energy source and by regulatory regime	47	-	-	-
	EU3 Number of residential, industrial, institutional and commercial customer accounts	47	-	-	-
	EU4 Length of above and underground transmission and distribution lines by regulatory regime	56	-	-	-
	EU5 Allocation of CO ₂ e emissions allowances or equivalent, broken down by carbon trading framework	80-81	-	-	-
	Strategy				
	102-14 Statement from senior decision-maker	4-5	-	-	-
	102-15 Key impacts, risks, and opportunities	30-31	-	-	-
	Ethics and integrity				
	102-16 Values, principles, standards, and norms of behavior	26, 32	-	-	-
	102-17 Mechanisms for advice and concerns about ethics	26	-	-	-
	Governance				
	102-18 Governance structure	18-19	-	-	-
	102-19 Delegating authority	19	-	-	-
	102-20 Executive-level responsibility for economic, environmental, and social topics	19	-	-	-
	102-21 Consulting stakeholders on economic, environmental, and social topics	22	-	-	-
	102-22 Composition of the highest governance body and its committees	19, 21	-	-	-
	102-23 Chair of the highest governance body	19	-	-	-
	102-24 Nominating and selecting the highest governance body	20	-	-	-
	102-25 Conflicts of interest	21	-	-	-
	102-26 Role of highest governance body in setting purpose, values, and strategy	22	-	-	-
	102-27 Collective knowledge of highest governance body	22	-	-	-
	102-28 Evaluating the highest governance body's performance	22	-	-	-
	102-29 Identifying and managing economic, environmental, and social impacts	23	-	-	-
	102-30 Effectiveness of risk management processes	23	-	-	-
	102-31 Review of economic, environmental, and social topics	23	-	-	-
	102-32 Highest governance body's role in sustainability reporting	13	-	-	-
	102-33 Communicating critical concerns	23	-	-	-
	102-34 Nature and total number of critical concerns	23-24	-	-	-
	102-35 Remuneration policies	24-25	-	-	-
	102-36 Process for determining remuneration	24-25	-	-	-
	102-37 Stakeholders involvement in remuneration	25	-	-	-
	102-38 Annual total compensation ratio	25	-	-	-
	102-39 Percentage increase in annual total compensation ratio	25	-	-	-
	Stakeholder engagement				
	102-40 List of stakeholder groups	42-43	-	-	-
	102-41 Collective bargaining agreements	95	-	-	-
	102-42 Identifying and selecting stakeholders	40-41	-	-	-
	102-43 Approach to stakeholder engagement	41-43	-	-	-
	102-44 Key topics and concerns raised	42-43	-	-	-
	Reporting practice				
	102-45 Entities included in the consolidated financial statements	12	-	-	-
	102-46 Defining report content and topic Boundaries	13	-	-	-
	102-47 List of material topics	13-15	-	-	-
	102-48 Restatements of information	No restatement	-	-	-
	GRI 102: General Disclosures 2016				

GRI Standard	Disclosure	Page number(s) and/or direct answers	Omission		
			Part Omitted	Reason	Explanation
	102-49 Changes in reporting	No change	-	-	-
	102-50 Reporting period	12	-	-	-
	102-51 Date of most recent report	12	-	-	-
	102-52 Reporting cycle	12	-	-	-
	102-53 Contact point for questions regarding the report	12	-	-	-
	102-54 Claims of reporting in accordance with the GRI Standards	12	-	-	-
	102-55 GRI content index	110-113	-	-	-
	102-56 External assurance	114-115	-	-	-
Material Topics					
GRI 200 Economic Standard Series					
Anti-corruption					
	103-1 Explanation of the material topic and its Boundary	26	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	26-27	-	-	-
	103-3 Evaluation of the management approach	26-27	-	-	-
	205-1 Operations assessed for risks related to corruption	26-27	-	-	-
GRI 205: Anti-corruption 2016	205-2 Communication and training about anti-corruption policies and procedures	27	-	-	-
	205-3 Confirmed incidents of corruption and actions taken	27	-	-	-
Availability and Reliability					
	103-1 Explanation of the material topic and its Boundary	46	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	46	-	-	-
	103-3 Evaluation of the management approach	46	-	-	-
	DMA (Former EU6) Management approach to ensure short and long-term electricity availability and reliability	46, 49-52	-	-	-
Sector Specific: Electric Utilities	EU10 Planned capacity against projected electricity demand over the long term, broken down by energy source and regulatory regime	46	-	-	-
Demand-side Management					
	103-1 Explanation of the material topic and its Boundary	57	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	57-61	-	-	-
	103-3 Evaluation of the management approach	57-60	-	-	-
Sector Specific: Electric Utilities	DMA (Former EU7) Demand-side management programs including residential, commercial, institutional and industrial programs	57-61	-	-	-
Research and development					
	103-1 Explanation of the material topic and its Boundary	62	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	62-63	-	-	-
	103-3 Evaluation of the management approach	63	-	-	-
Sector Specific: Electric Utilities	DMA (Former EU8) Research and development activity and expenditure aimed at providing reliable electricity and promoting sustainable development	63-65	-	-	-
System Efficiency					
	103-1 Explanation of the material topic and its Boundary	55	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	55	-	-	-
	103-3 Evaluation of the management approach	55-56	-	-	-
Sector Specific: Electric Utilities	EU11 Average generation efficiency of thermal plants by energy source and by regulatory regime	55	-	-	-
	EU12 Transmission and distribution losses as a percentage of total energy	56	-	-	-
GRI 300 Environmental Standards Series					
Materials					
	103-1 Explanation of the material topic and its Boundary	70	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	70-71	-	-	-
	103-3 Evaluation of the management approach	70-71	-	-	-
	301-1 Materials used by weight or volume	70-71	-	-	-
GRI 301: Materials 2016	301-2 Recycled input materials used	No recycled input material	-	-	-
	301-3 Reclaimed products and their packaging materials	No reclaimed products	-	-	-
Energy					
	103-1 Explanation of the material topic and its Boundary	70	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	70-72	-	-	-
	103-3 Evaluation of the management approach	72	-	-	-
	302-1 Energy consumption within the organization	71	-	-	-
	302-2 Energy consumption outside of the organization	72	-	-	-
	302-3 Energy intensity	72	-	-	-
	302-4 Reduction of energy consumption	72	-	-	-
GRI 302: Energy 2016	302-5 Reductions in energy requirements of products and services	-	Reductions in energy requirements of products and services	Not applicable	EGAT's product and service are electricity and transmission.
Water and Effluents					
	103-1 Explanation of the material topic and its Boundary	74	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	74-75	-	-	-
	103-3 Evaluation of the management approach	74-75	-	-	-
	303-1 Interactions with water as a shared resource	74-75	-	-	-
	303-2 Management of water discharge-related impacts	75	-	-	-
GRI 303: Water and Effluents 2018	303-3 Water withdrawal	75	-	-	-
	303-4 Water discharge	75	-	-	-
	303-5 Water consumption	75	-	-	-
Biodiversity					
	103-1 Explanation of the material topic and its Boundary	85	-	-	-
GRI 103: Management Approach 2016	103-2 The management approach and its components	84-86	-	-	-
	103-3 Evaluation of the management approach	84-87	-	-	-

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01 Economic Performance

- Corporate Governance
- Risk Management and Internal Control
- Business Continuity Management
- Information System Management
- Stakeholder Management
- Customer Satisfaction
- Management Efficiency
- Innovation, Research and Development

02 Environmental Performance

- Energy Management
- Water Management
- Air Quality Management
- Biodiversity
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GRI Standard	Disclosure	Page number(s) and/or direct answers	Omission		
			Part Omitted	Reason	Explanation
GRI 304: Biodiversity 2016	304-1 Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	84	-	-	-
	304-2 Significant impacts of activities, products, and services on biodiversity	84	-	-	-
	304-3 Habitats protected or restored	85-87	-	-	-
	304-4 IUCN Red List species and national conservation list species with habitats in areas affected by operations	85	-	-	-
Sector Specific: Electric Utilities	EU13 Biodiversity of offset habitats compared to the biodiversity of the affected areas	86-87	-	-	-
Emissions					
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	76	-	-	-
	103-2 The management approach and its components	76-77	-	-	-
	103-3 Evaluation of the management approach	76-77	-	-	-
GRI 305: Emissions 2016	305-1 Direct (Scope 1) GHG emissions	77	-	-	-
	305-2 Energy indirect (Scope 2) GHG emissions	78	-	-	-
	305-3 Other indirect (Scope 3) GHG emissions	78	-	-	-
	305-4 GHG emissions intensity	77-78	-	-	-
	305-5 Reduction of GHG emissions	79-80	-	-	-
	305-6 Emissions of ozone-depleting substances (ODS)	81	-	-	-
	305-7 Nitrogen oxides (NO _x), sulfur oxides (SO _x), and other significant air emissions	82	-	-	-
Effluents and Waste					
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	88	-	-	-
	103-2 The management approach and its components	57, 88	-	-	-
	103-3 Evaluation of the management approach	89	-	-	-
GRI 306: Effluents and Waste 2016	306-1 Water discharge by quality and destination	75	-	-	-
	306-2 Waste by type and disposal method	89	-	-	-
	306-3 Significant spills	89	-	-	-
	306-4 Transport of hazardous waste	89	-	-	-
	306-5 Water bodies affected by water discharges and/or runoff	75	-	-	-
Environmental Compliance					
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	26	-	-	-
	103-2 The management approach and its components	26, 31, 68	-	-	-
	103-3 Evaluation of the management approach	31	-	-	-
GRI 307: Environmental Compliance 2016	307-1 Non-compliance with environmental laws and regulations	27	-	-	-
GRI 400 Social Standards Series					
Employment					
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	92	-	-	-
	103-2 The management approach and its components	92	-	-	-
	103-3 Evaluation of the management approach	92	-	-	-
GRI 401: Employment 2016	401-1 New employee hires and employee turnover	92	-	-	-
	401-2 Benefits provided to full-time employees that are not provided to temporary or part-time employees	93-94	-	-	-
	401-3 Parental leave	95	-	-	-
Sector Specific: Electric Utilities	EU15 Percentage of employees eligible to retire in the next 5 and 10 years broken down by job category and by region	97	-	-	-
	EU17 Days worked by contractor and subcontractor employees involved in construction, operation & maintenance activities	101	Data of contractor and subcontractor employees involved in other operations except mining and transmission construction.	Information unavailable	The information cannot currently be obtained because the boundary of the topic is beyond the organization. EGAT is developing data collection procedure with the related parties and expect to disclose the information in the 2021 sustainability report.
Sector Specific: Electric Utilities	EU18 Percentage of contractor and subcontractor employees that have relevant health and safety training	101	Data of contractor and subcontractor employees involved in other operations except mining and transmission construction.	Information unavailable	The information cannot currently be obtained because the boundary of the topic is beyond the organization. EGAT is developing data collection procedure with the related parties and expect to disclose the information in the 2021 sustainability report.
	Labor/Management Relations				
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	95	-	-	-
	103-2 The management approach and its components	95	-	-	-
	103-3 Evaluation of the management approach	95	-	-	-
GRI 402: Labor/Management Relations 2016	402-1 Minimum notice periods regarding operational changes	95	-	-	-

GRI Standard	Disclosure	Page number(s) and/or direct answers	Omission			
			Part Omitted	Reason	Explanation	
Occupational Health and Safety						
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	98	-	-	-	
	103-2 The management approach and its components	98-101	-	-	-	
	103-3 Evaluation of the management approach	98-99	-	-	-	
	403-1 Occupational health and safety management system	98-99	-	-	-	
	403-2 Hazard identification, risk assessment, and incident investigation	100	-	-	-	
	403-3 Occupational health services	100	-	-	-	
	403-4 Worker participation, consultation, and communication on occupational health and safety	99	-	-	-	
	403-5 Worker training on occupational health and safety	100	-	-	-	
GRI 403: Occupational Health and Safety 2018	403-6 Promotion of worker health	100	-	-	-	
	403-7 Prevention and mitigation of occupational health and safety impacts directly linked by business relationships	99-100	-	-	-	
	403-8 Workers covered by an occupational health and safety management system	101	-	-	-	
	403-9 Work-related injuries	101-102	Workers who are not employees but whose work and/or workplace is controlled by the organization.	Information unavailable	The information cannot currently be obtained because the boundary of the topic is beyond the organization. EGAT is developing data collection procedure with the related parties and expect to disclose the information in the 2021 sustainability report.	
	403-10 Work-related ill health	102	Workers who are not employees but whose work and/or workplace is controlled by the organization.	Information unavailable	The information cannot currently be obtained because the boundary of the topic is beyond the organization. EGAT is developing data collection procedure with the related parties and expect to disclose the information in the 2021 sustainability report.	
	Training and Education					
	GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	96	-	-	-
		103-2 The management approach and its components	96-97	-	-	-
		103-3 Evaluation of the management approach	96	-	-	-
	GRI 404: Training and Education 2016	404-1 Average hours of training per year per employee	98	-	-	-
404-2 Programs for upgrading employee skills and transition assistance programs		96-97	-	-	-	
404-3 Percentage of employees receiving regular performance and career development reviews		95	-	-	-	
Local Communities						
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	104	-	-	-	
	103-2 The management approach and its components	104-107	-	-	-	
	103-3 Evaluation of the management approach	104-106	-	-	-	
GRI 413: Local Communities 2016	413-1 Operations with local community engagement, impact assessments, and development programs	104-107	-	-	-	
	413-2 Operations with significant actual and potential negative impacts on local communities	104	-	-	-	
Sector Specific: Electric Utilities	EU22 Number of people physically or economically displaced and compensation, broken down by type of project	104	-	-	-	
Socioeconomic Compliance						
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	26	-	-	-	
	103-2 The management approach and its components	26, 31	-	-	-	
	103-3 Evaluation of the management approach	31	-	-	-	
GRI 419: Socioeconomic Compliance 2016	419-1 Non-compliance with laws and regulations in the social and economic area	27	-	-	-	
Disaster/Emergency Planning and Response						
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	34	-	-	-	
	103-2 The management approach and its components	34-36	-	-	-	
	103-3 Evaluation of the management approach	35-36	-	-	-	
Sector Specific: Electric Utilities	DMA (Former EU21) Contingency planning measures, disaster/emergency management plan and training programs, and recovery/restoration plans	34-36	-	-	-	
Customer Privacy						
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	38	-	-	-	
	103-2 The management approach and its components	38-39	-	-	-	
	103-3 Evaluation of the management approach	38-39	-	-	-	
GRI 418: Customer Privacy 2016	418-1 Substantiated complaints concerning breaches of customer privacy and losses of customer data	39	-	-	-	

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Independent limited assurance report

To the Directors of Electricity Generating Authority of Thailand (“EGAT”)

Conclusion

Based on the procedures performed, as described below, nothing has come to our attention that causes us to believe that the selected subject matters (“Subject Matters”) identified below and included in the Sustainability Report 2020 (the “Report”) for the year ended 31 December 2020, are not, in all material respects, prepared in compliance with the reporting criteria (the “Criteria”).

Our Responsibilities

We have been engaged by EGAT and are responsible for providing a limited assurance conclusion in respect of the Subject Matters for the year ended 31 December 2020 to be included in the Report as identified below.

Our assurance engagement is conducted in accordance with the International Standard on Assurance Engagements ISAE 3000 *Assurance Engagements other than Audits*. These standards require the assurance team to possess the specific knowledge, skills and professional competencies needed to provide assurance on sustainability information, and that we plan and perform the engagement to obtain limited assurance on whether the Subject Matters are prepared, in all material respects, in compliance with the Criteria. We have complied with the independence and other ethical requirements of the International Ethics Standards Board for Accountants: *International Code of Ethics for Professional Accountants (including International Independence Standards)* (IESBA Code), which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior. The firm applies International Standard on Quality Control 1 and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

We have not been engaged to provide an assurance conclusion on any other information disclosed within the Report.

Subject Matters

Subject Matters comprised of the following data expressed numerically or in descriptive text for the year ended 31 December 2020:

- GRI 303-3 Water withdrawal
- GRI 305-7 Nitrogen Oxide (NOx), Sulphur Oxide (SOx), and other significant air emissions (Particular Matter (PM))
- EUSD - Disclosures on Management Approach: Demand-side Management
- EUSD - Disclosures on Management Approach: Availability and Reliability

Criteria

The Subject Matters were assessed according to the following criteria:

- The Sustainability Reporting Standards of the Global Reporting Initiative (“GRI Standards”), and
- The Electric Utility Sector Disclosures (“EUSD”).

Directors’ and management’s responsibilities

The directors and management of EGAT are responsible for the preparation and presentation of the Subject Matters, specifically ensuring that in all material respects the Subject Matters are prepared and presented in accordance with the Criteria. This responsibility also includes the internal controls relevant to the preparation of the Report that is free from material misstatement whether due to fraud or error.



Procedure performed

In forming our limited assurance conclusion over the Subject Matters, our procedures consisted of making enquiries and applying analytical and other evidence gathering procedures including:

- Interviews with senior management and relevant staff at corporate and operating sites;
- Inquiries about the design and implementation of the systems and methods used to collect and process the information reported, including the aggregation of source data into the Subject Matters;
- Inquiries about managements practices and procedures related to identifying stakeholders and their expectations, determining material sustainability matters and implementing sustainability policies and guidelines;
- Remote site visit to 2 sites; Bang Pakong Power Plant, and EGAT’s Head office, selected on the basis of risk analysis including the consideration of both quantitative and qualitative criteria;
- Agreeing the Subject Matters to relevant underlying sources on a sample basis to determine whether all the relevant information has been included in the Subject Matters and prepared in accordance with the Criteria.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for, a reasonable assurance engagement and consequently the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had a reasonable assurance engagement been performed. Accordingly, we do not express a reasonable assurance opinion.

Inherent limitations

Due to the inherent limitations of any internal control structure it is possible that errors or irregularities in the information presented in the Report may occur and not be detected. Our engagement is not designed to detect all weaknesses in the internal controls over the preparation and presentation of the Report, as the engagement has not been performed continuously throughout the period and the procedures performed were undertaken on a test basis.

Restriction of use of our report

Our report should not be regarded as suitable to be used or relied on by any party wishing to acquire rights against us other than EGAT, for any purpose or in any other context. Any party other than EGAT who obtains access to our report or a copy thereof and chooses to rely on our

report (or any part thereof) will do so at its own risk. To the fullest extent permitted by law, we accept or assume no responsibility and deny any liability to any party other than EGAT for our work, for this independent limited assurance report, or for the conclusions we have reached.

KPMG Phoomchai Audit Ltd.

KPMG Phoomchai Audit Ltd.

Bangkok

30 June 2021

KPMG Phoomchai Audit Ltd., a Thai limited liability company and a member firm of the KPMG network of independent member firms affiliated with KPMG International Cooperative (“KPMG International”), a Swiss entity.





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