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Current Status of Power Sector

Framework, policies, demand-supply overview, existing transmission lines,

Outlook

Capacity and Generation Mix, transmission lines

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RE, EE&C, BESS, and Smart Grid

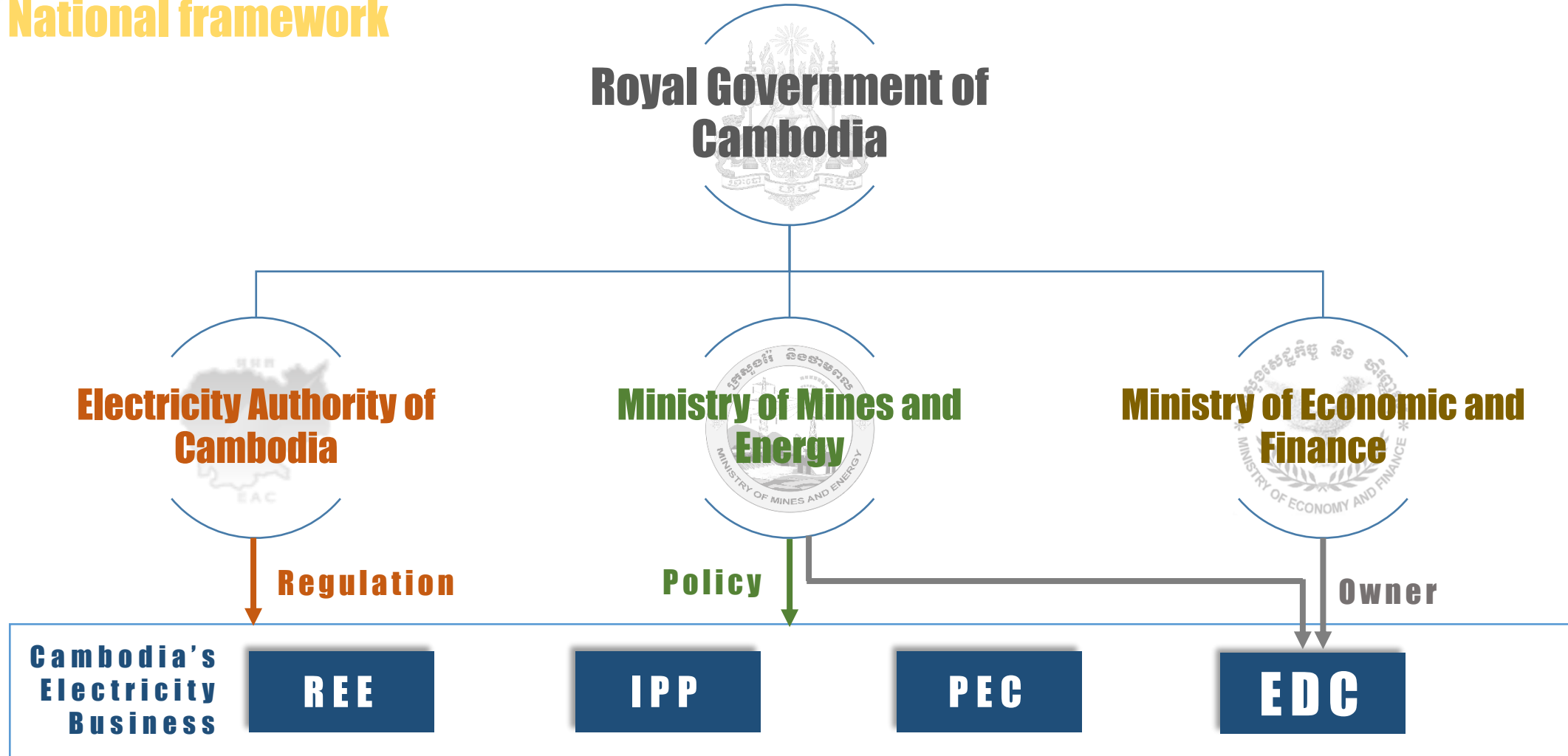
Brief on policies or projects

Country Update: the Kingdom of Cambodia

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General Department of Energy
Ministry of Mines and Energy, Cambodia

1 Current Status of Power Sector

National framework



➤ Tariff, License, Financial Performance, Enforce the regulation, rule and standard

➤ Setting and administrating the government policies, strategies and planning, Technical Standard

➤ Ownership of EDC

1 Current Status of Power Sector

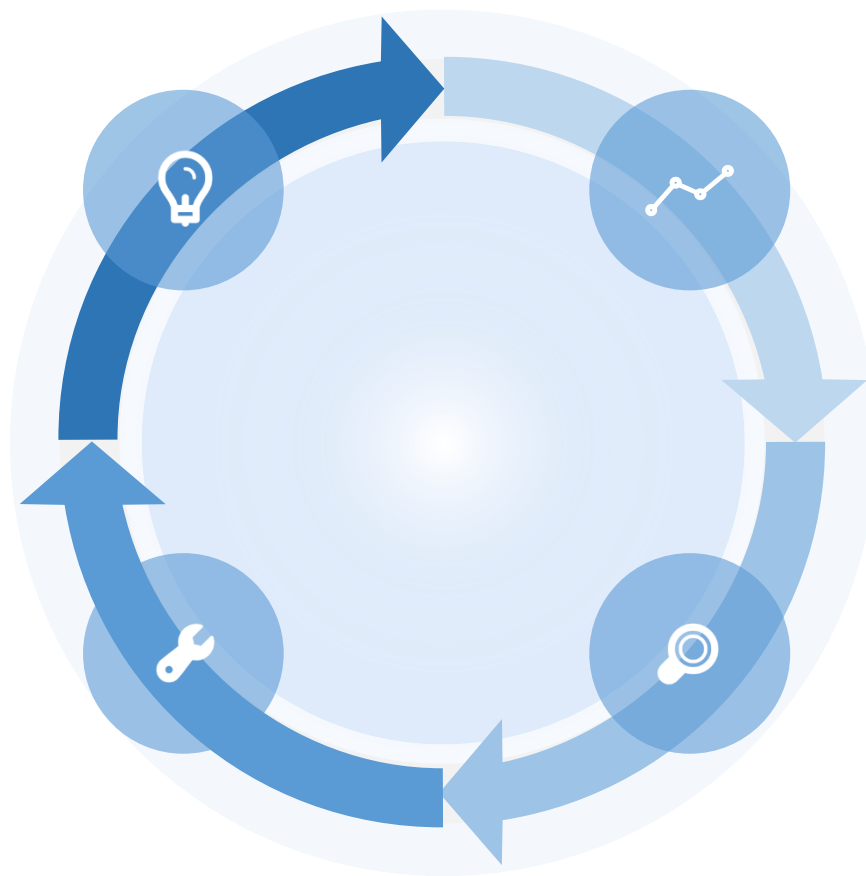
Basics of Energy Policy

• SUPPLY

To provide an **adequate supply of energy** throughout Cambodia at reasonable and affordable price

• EFFICIENCY

To encourage the **efficient use of energy** and to **minimize the detrimental environmental affects** resulted from energy supply and consumption.



• INVESTMENT

To ensure a reliable and secured electricity supply at reasonable price, which **facilitates investment** in Cambodia and development of national economy

• EXPLORATION

To encourage exploration and **environmentally and socially acceptable development of energy resources** needed for supply to all sectors of Cambodia economy

1 Current Status of Power Sector

Power Development Strategy

1 DEVELOPMENT OF GENERATION

Increasing **diversify of power supply** such as **hydro, coal, import electricity, biomass and other renewable energy sources** to meet the electricity demand, and **reduce fuel oil** for power generation

2 DEVELOPMENT OF TRANSMISSION LINES

Develop the **national transmission line, GMS & ASEAN power grid, maximize mini-grid to rural areas**, and **upgrade existing HV, MV** and as well as **LV transmission lines**.

3 DEVELOPMENT OF RURAL ELECTRIFICATION

Supply from the **national grid, mini-grid, grid extension** and **stand-alone system**; renewable energy

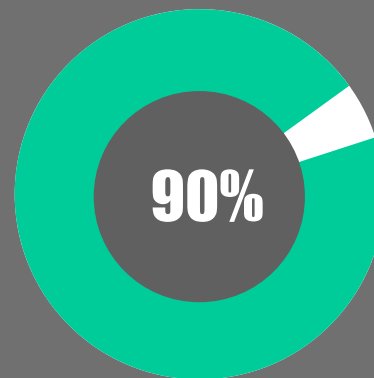
1 Current Status of Power Sector

Main targets and achievement

RGC's Target

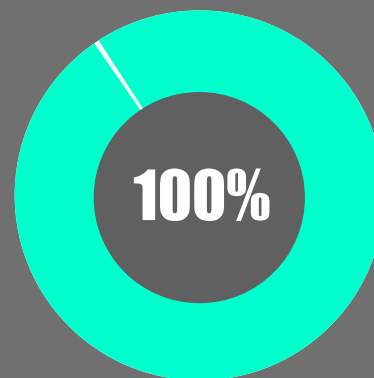
“to achieve enough electricity supply of proper quality to be able to meet the demand in a sustainable, stable manner and at a reasonable prices throughout the Kingdom of Cambodia”

[source: EAC]



2030

at least 90% of households will have access to **GRID-QUALITY ELECTRICITY**
As of 2020: 81.06%



2020

100% of villages in Cambodia have access to **ANY TYPE** of electricity's services
Results: 97.13% by the end of 2020

1 Current Status of Power Sector

Categories of electricity supply (as of 2020)



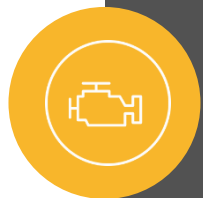
National Grid

Mostly in urban area with high density of population, as well as requirement for commercial purposes



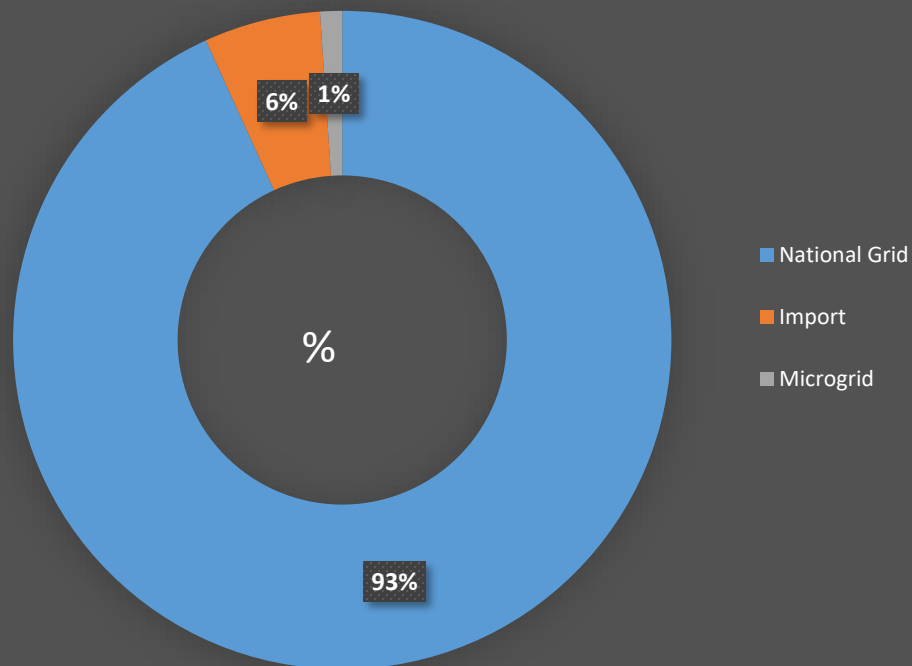
Imports

From neighboring countries such as Vietnam, Thailand and Lao PDR to supply where national grid has not yet reached



Micro-gen

Where there is no availability of both national grid and import electricity



13738/14168
Villages

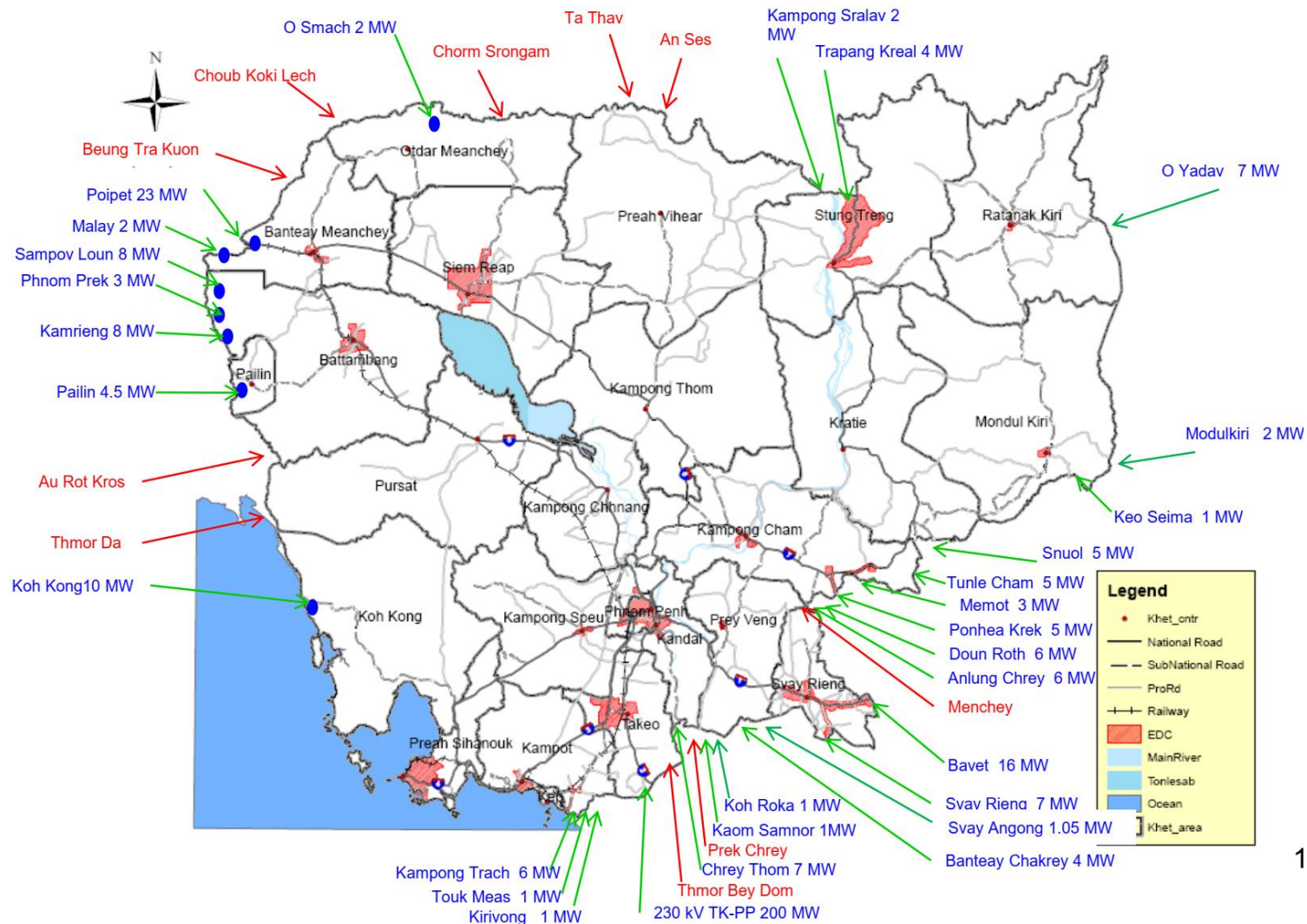
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Licenses

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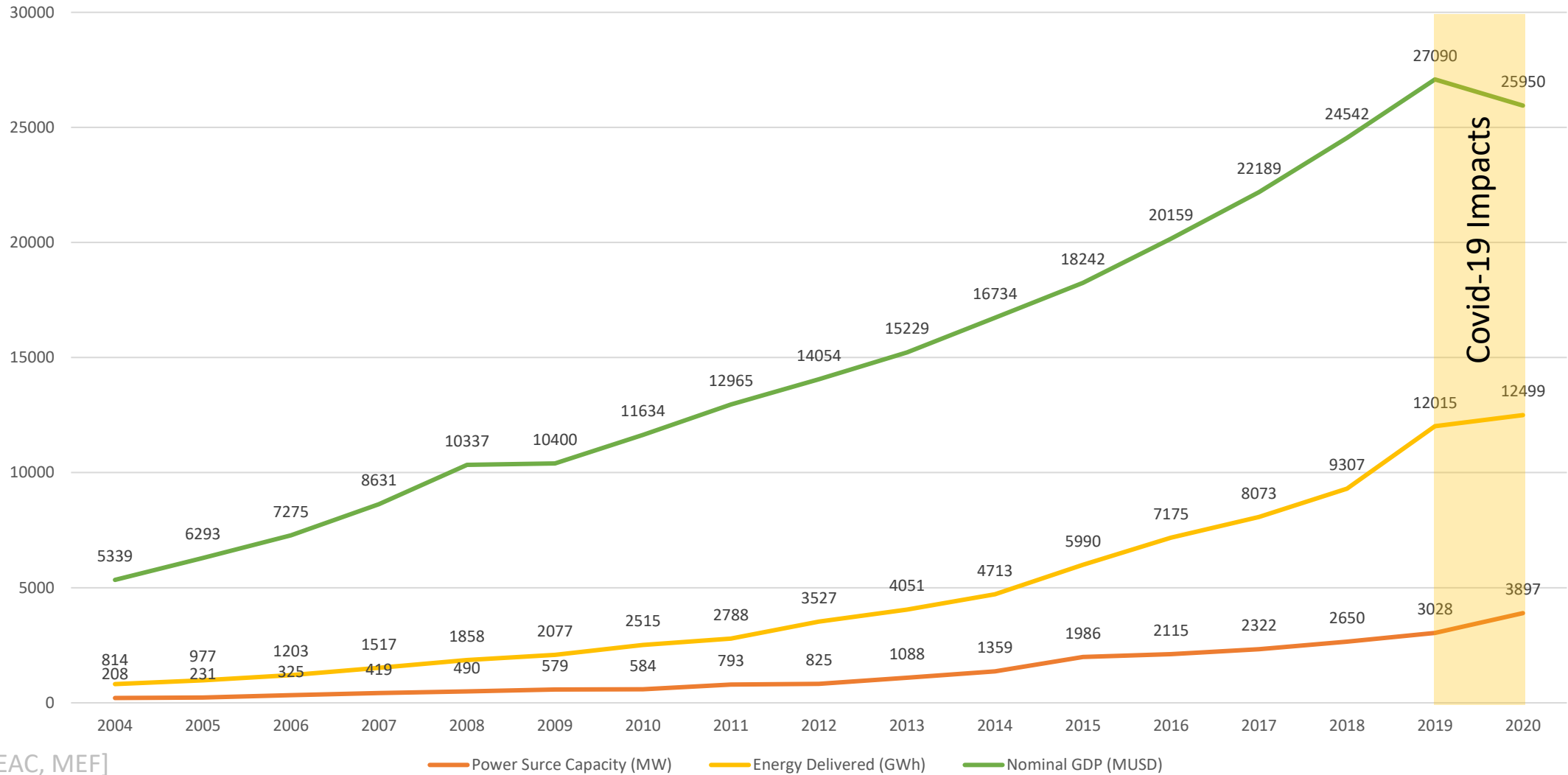
Current Status of Power Sector

Connection points from neighbouring countries



1 Current Status of Power Sector

Trends and Impacts of Covid-19



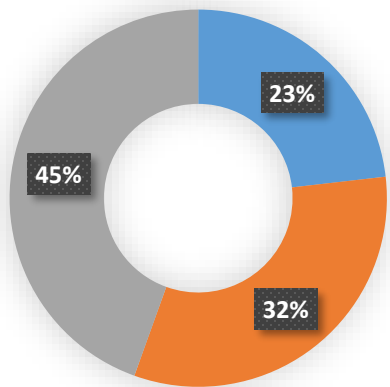
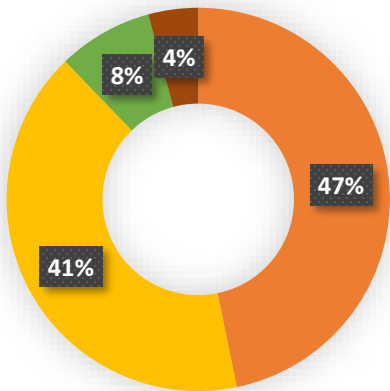
[source: EAC, MEF]

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Current Status of Power Sector

Power Source & Generation Mix in 2020

Coal Hydro Fuel Oil RE



Thailand Vietnam Laos

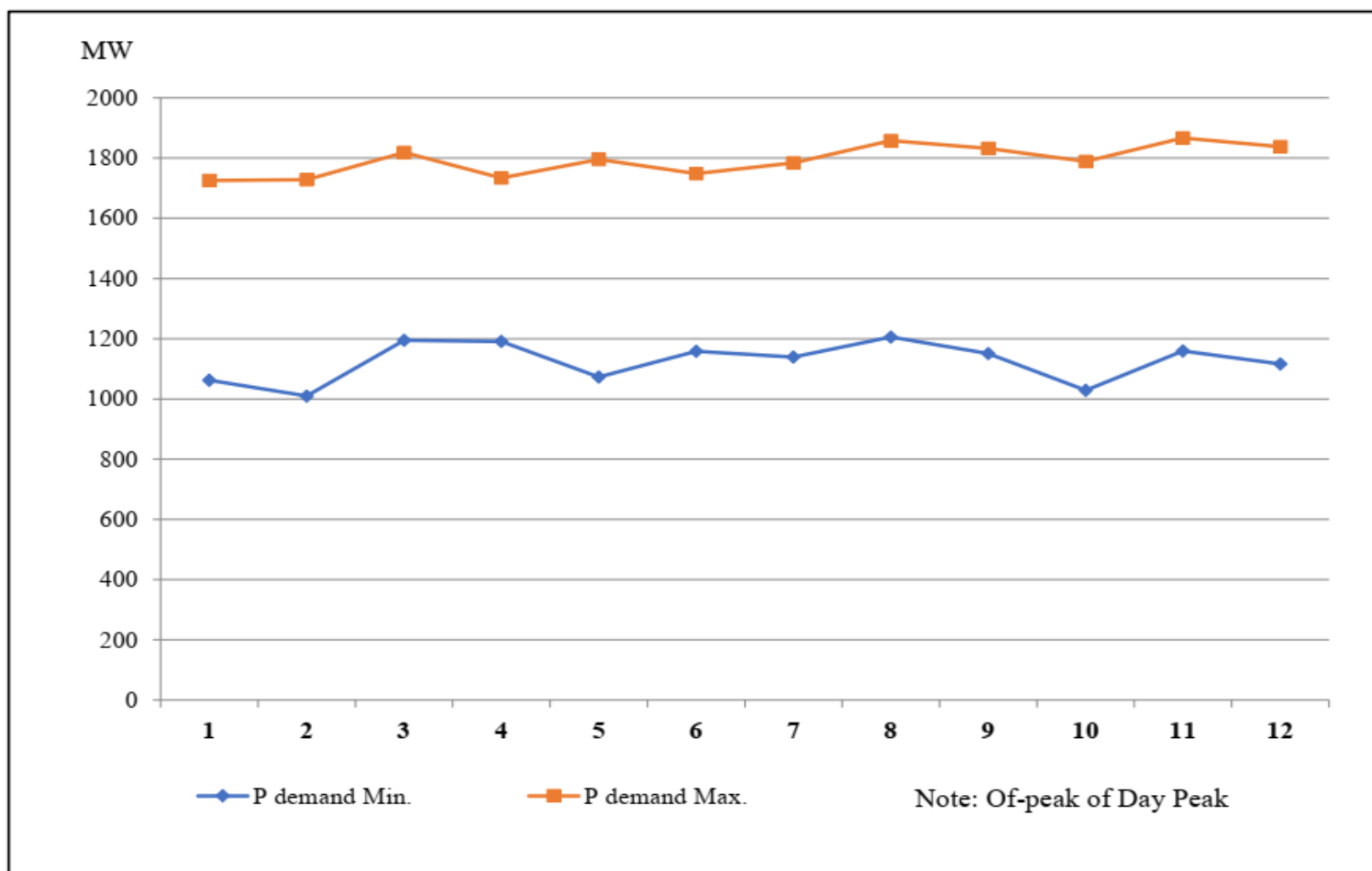
[source: EAC]

Power Sources	2019				2020				Plan for 2021			
	Installed Capacity		Energy		Installed Capacity		Energy		Installed Capacity		Energy	
	MW	%	GWh	%	MW	%	GWh	%	MW	%	GWh	%
1. Domestic Generation												
- Non-renewable Energy	918.95	38.74%	4,465.86	51.48%	1,318.95	45.23%	4,661.42	54.76%	1,318.95	43.16%	5,476.91	55.09%
+ Coal	675.00	28.45%	3,734.01	43.04%	675.00	23.15%	3,981.58	46.77%	675.00	22.09%	3,840.87	38.63%
+ Fuel Oil	243.95	10.28%	731.85	8.44%	643.95	22.08%	679.84	7.99%	643.95	21.07%	1,636.04	16.46%
- Renewable Energy	1,453.27	61.26%	4,209.39	48.52%	1,597.07	54.77%	3,851.26	45.24%	1,737.07	56.84%	4,465.35	44.91%
+ Hydro power	1,329.70	56.05%	4,025.34	46.40%	1,329.70	45.60%	3,493.15	41.03%	1,329.70	43.51%	4,091.42	41.15%
+ Solar Power	90.00	3.79%	91.71	1.06%	236.80	8.12%	278.84	3.28%	376.80	12.33%	302.51	3.04%
+ Biomass Power	33.57	1.42%	92.34	1.06%	30.57	1.05%	79.27	0.93%	30.57	1.00%	71.42	0.72%
Total Domestic Generation	2,372.22	100%	8,675.25	100%	2,916.02	100%	8,512.68	100%	3,056.02	100%	9,942.26	100%
2. Import Power Sources												
+ Thailand	227.30	36.27%	1,161.21	37.92%	277.30	28.27%	923.99	23.18%	277.30	28.27%	924.35	22.80%
+ Vietnam	323.45	51.61%	1,772.21	57.87%	332.45	33.90%	1,288.05	32.31%	332.45	33.90%	1,275.48	31.46%
+ Laos	76.00	12.13%	129.23	4.22%	371.00	37.83%	1,773.94	44.50%	371.00	37.83%	1,855.07	45.75%
Total Import Power Sources	626.75	100%	3,062.65	100%	980.75	100%	3,985.98	100%	980.75	100%	4,054.90	100%
3. Power Sources												
+ Total Domestic Generation	2,372.22	79.10%	8,675.25	73.91%	2,916.02	74.83%	8,512.68	68.11%	3,056.02	75.70%	9,942.26	71.03%
+ Total Import Power Sources	626.75	20.90%	3,062.65	26.09%	980.75	25.17%	3,985.98	31.89%	980.75	24.30%	4,054.90	28.97%
Total Power Sources	2,998.97	100%	11,737.90	100%	3,896.77	100%	12,498.66	100%	4,036.77	100%	13,997.17	100%

1 Current Status of Power Sector

Peak demand in 2020

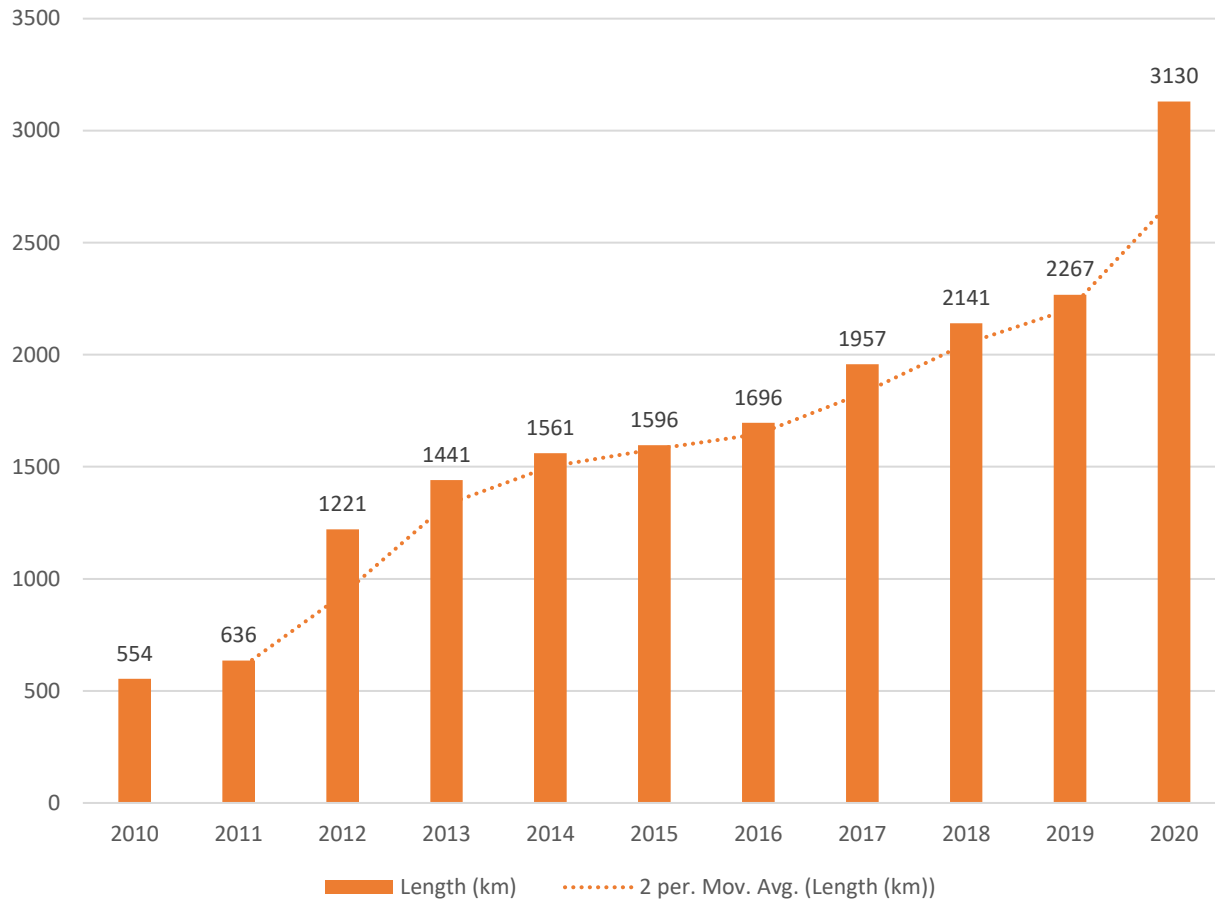
Months	P demand	
	Min.	Max.
1	1061.91	1725.47
2	1009.80	1728.32
3	1194.99	1818.31
4	1190.64	1733.83
5	1072.51	1795.33
6	1158.16	1748.32
7	1139.12	1784.29
8	1205.76	1857.53
9	1150.33	1832.10
10	1028.91	1788.74
11	1158.88	1866.81
12	1115.58	1837.87
P.(Min,Max)	1158.88	1866.81



1 Current Status of Power Sector

Existing transmission lines

Transmission lines in the past 10 years



[source: EAC]

Transmission System (as of 2020)

Name of system	Transmission Lines
1. Southern System	230 kV : 337 km (x2) 115 kV : 246 km (x1) 115 kV : 251.7 km (x2) 500 kV : 130 km (x2)
2. Western System	230 kV : 631.43 km (x2) 115 kV : 237.5 km (x1) 115 kV : 145 km (x2)
3. North-east System	230 kV : 671.5 km (x2) 500kV : 49 km (x2)
4. Northern System	115 kV : 189.5 km (x2) 230 kV : 241.2 km (x2)
Total	115-230-500 kV= 3,129.83 km

2 The Outlook

Electric Power Demand Forecast

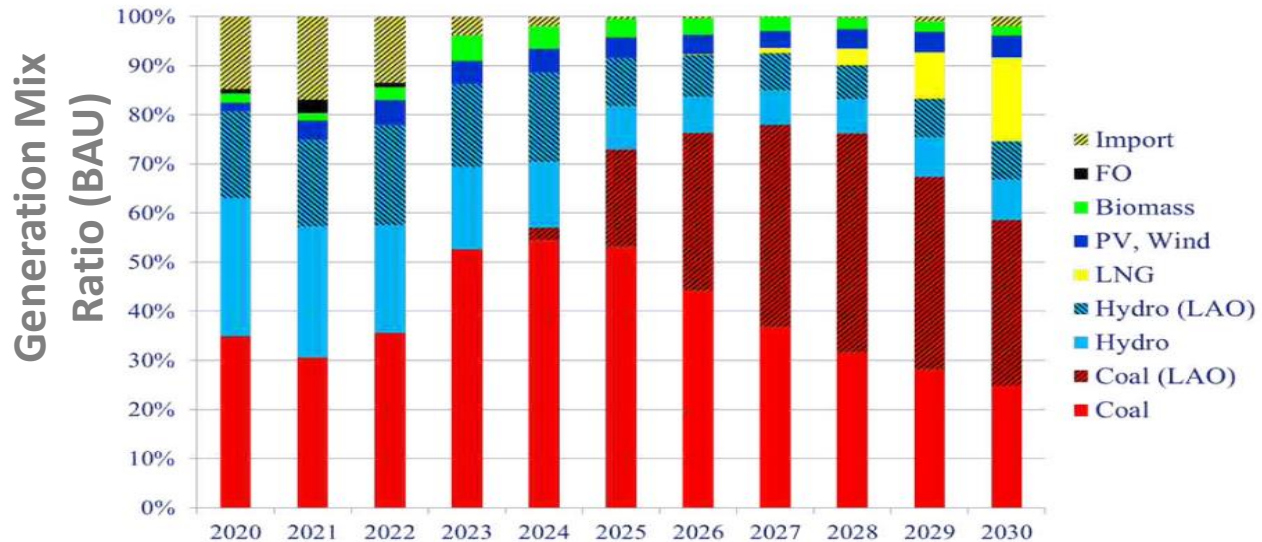
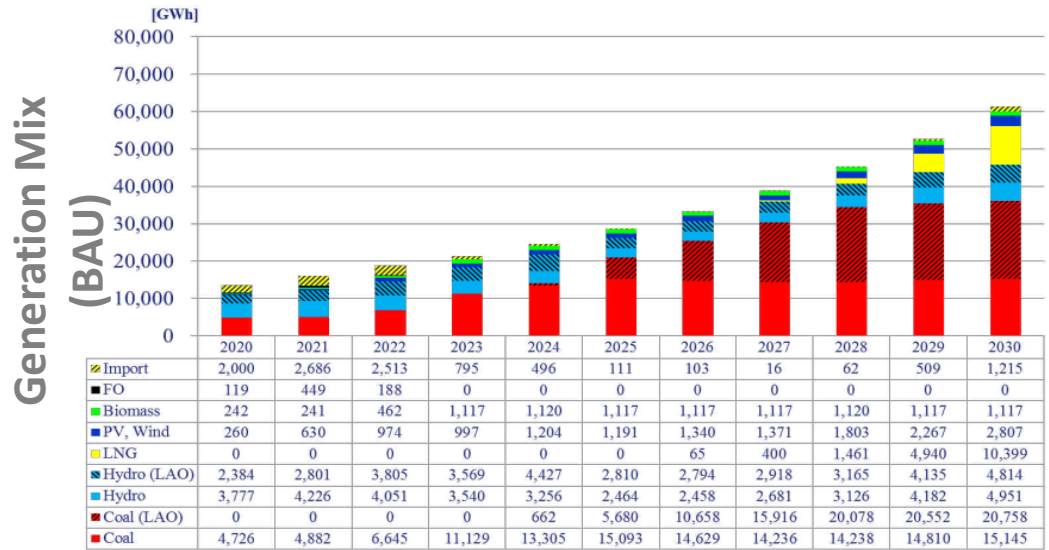
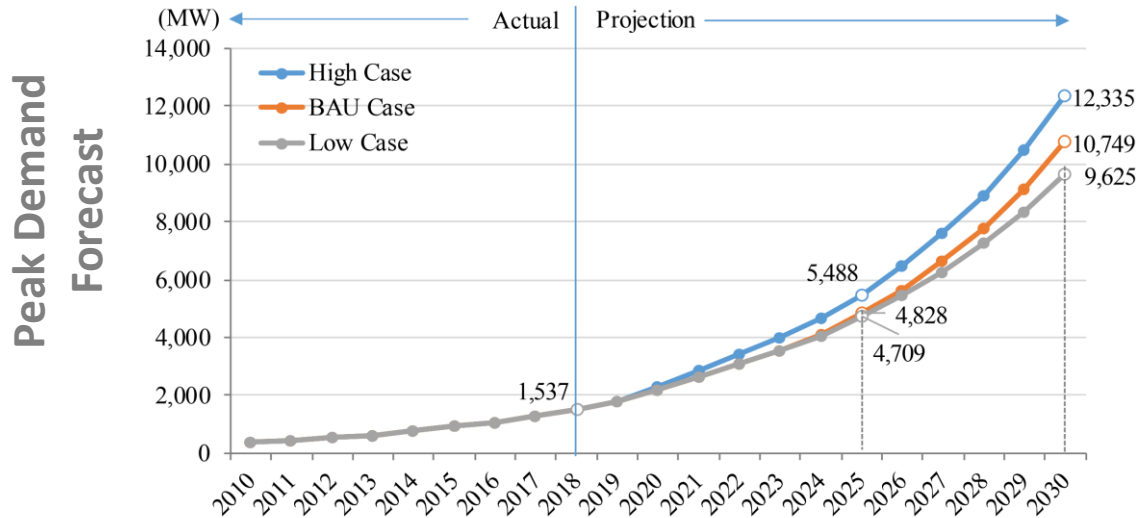
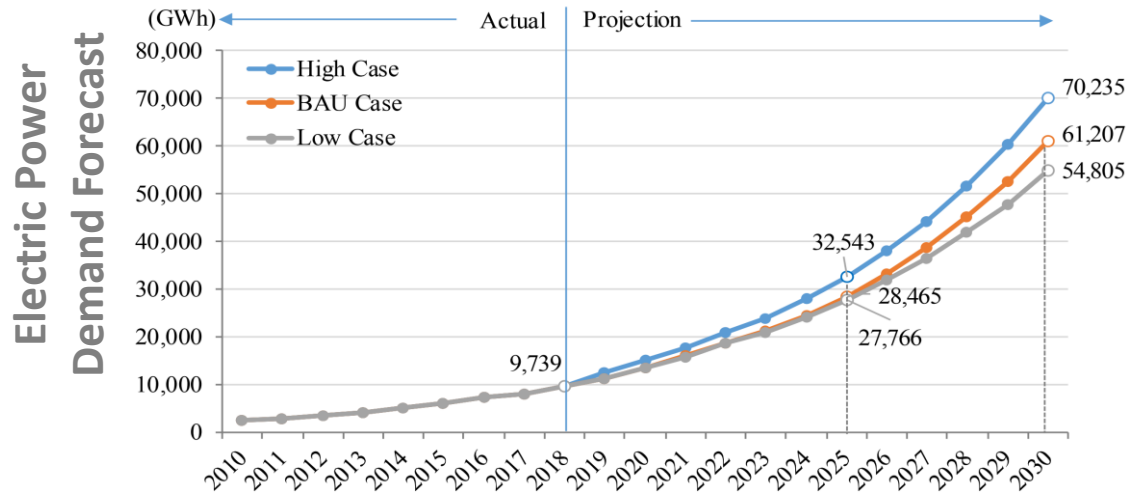
	Unit	Actual	Projection												Annual Average Growth Rate (%)
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2030/2018
Total Final Consumption	GWh	8,235	9,468	11,590	13,744	16,184	18,463	21,444	25,050	29,309	34,299	40,132	46,949	54,919	17.1
Industry	GWh	1,827	2,131	2,768	3,325	4,013	4,875	5,900	7,117	8,562	10,278	12,312	14,723	17,578	20.8
Residential	GWh	2,672	3,063	3,541	4,066	4,640	5,251	5,912	6,628	7,402	8,235	9,132	10,098	11,138	12.6
Commercial and others	GWh	3,737	4,274	5,281	6,354	7,530	8,336	9,632	11,305	13,345	15,786	18,688	22,128	26,203	17.6
Own use	GWh	242	279	336	399	469	462	536	626	733	857	1,003	1,174	1,373	15.6
Losses	GWh	1,262	1,413	1,582	1,772	1,985	2,223	2,490	2,789	3,124	3,498	3,918	4,388	4,915	12.0
Total Electricity Demand	GWh	9,739	11,160	13,508	15,915	18,638	21,148	24,470	28,465	33,165	38,655	45,054	52,511	61,207	16.6
Growth rate	%	20.6	14.6	21.0	17.8	17.1	13.5	15.7	16.3	16.5	16.6	16.6	16.6	16.6	
Own use	%	2.5	2.5	2.5	2.5	2.5	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
Losses	%	13.0	12.7	11.7	11.1	10.7	10.5	10.2	9.8	9.4	9.1	8.7	8.4	8.0	
Load Factor	%	72.3	70.1	69.6	69.2	68.7	68.2	67.8	67.3	66.8	66.4	65.9	65.5	65.0	
Peak Demand	MW	1,537	1,818	2,215	2,627	3,097	3,538	4,122	4,828	5,664	6,647	7,802	9,157	10,749	17.6

[source: Cambodia PDP, by CHUGOKU EPCO]

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The Outlook

Demand and Generation (Pre-pandemic analysis)



[source: Cambodia PDP, by CHUGOKU EPCO]

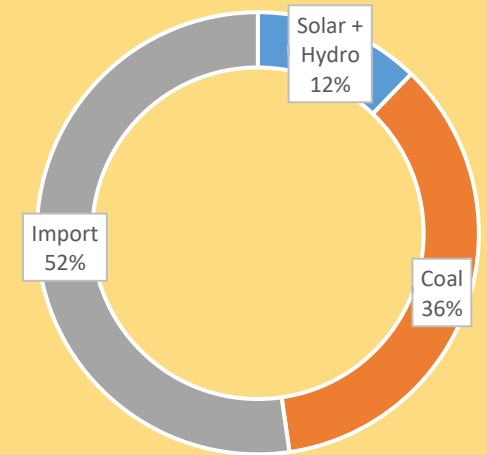
2 The Outlook

Domestic Generation and Importation

Technologies	Capacity (MW)	COD	Status
Solar	60	2021	Operation
Solar	60	2021	Operation
Solar	20	2021	Under Cons.
Solar	30	2021	Planned
Solar	60	2021	Operation
Coal	130	2022	Under Cons.
Coal	100	2022	Under Cons.
Coal	350	2022	Under Cons.
Solar	60	2022	Under Cons.
Coal	350	2023	Under Cons.
Solar	40	2023	Planned
Coal	350	2023	Under Cons.

Technologies	Capacity (MW)	COD	Status
Coal	350	2024	Under Cons.
Import	300	2025	Planned
Hydro	80	2026	Planned
Import	300	2026	Planned
Hydro	150	2026	Planned
Import	300	2027	Planned
Import	300	2027	Planned
Import	300	2028	Planned
Import	300	2028	Planned
Import	300	2029	Planned
Import	300	2029	Planned
Import	100	2030	Planned

Incremental Capacity Mix (2021-2030)



2 The Outlook

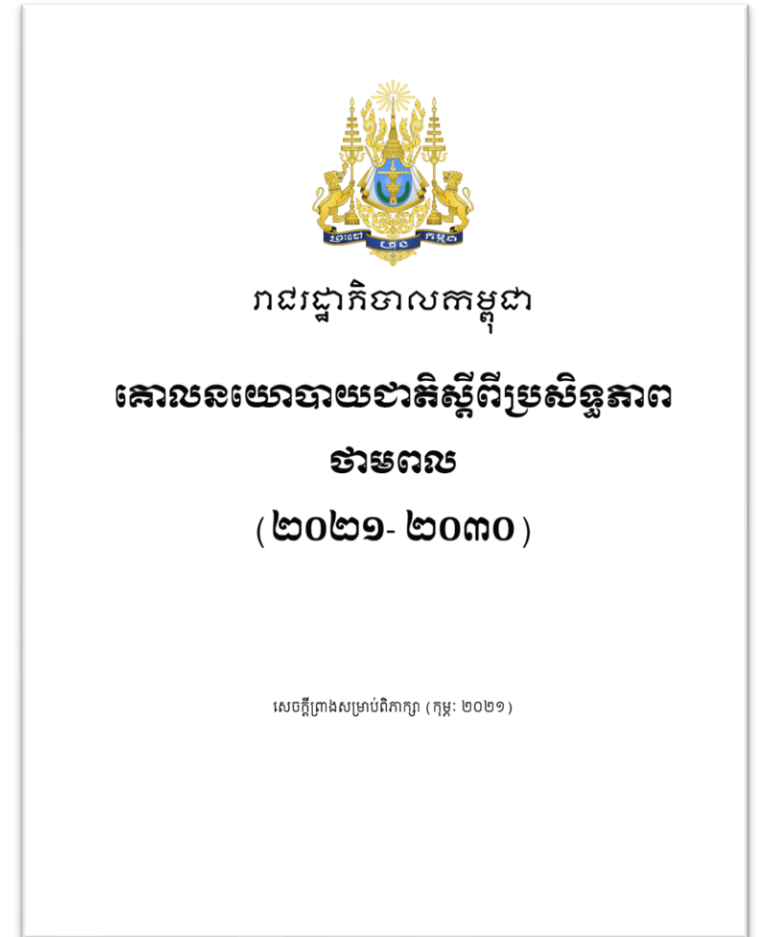
Transmission lines planned and under cons.

Project	Transmission Lines
1. Koh Kong-Bek Chan Grid Substation	230 kV : 204 km (x2)
2. Tatai-Botumsakor Grid	230 kV : 68 km (x2)
3. GS7-Koh Thom Grid Substation	115 kV : 50 km (x1)
4. Bek Chan-East Phnom Penh Grid	500 kV : 45 km (x2)
5. Steung Hav-Otres-Preah Sihanouk Grid	230 kV : 16.2 km (x2) 115 kV : 6 km (x2)
6. GS4 -Kampong Speu New Grid Substation -Kampong Speu Grid Substation	230 kV : 31 km (x2) 115 kV : 6 km (x1)
7. GS6-ADB Solar Park Substation	230 kV : 40 km (x2)
8. Chheu Tom-Krokro Grid Substation	115 kV : 30 km (x1)
9. Oddor Meancheay Grid (Coal Power Plant) -East Siem Reap Grid Substation	230 kV : 135 km (x2)
10. East Phnom Penh-Laos Border Grid Substation	500 kV : 300 km (x2)
11. East Battambang-Thai Border Grid Substation	500 kV : 110 km (x2)
12. Coal Power Plant Thmor Sor-Botumsakor	230 kV : 36 km (x2)

13. GS4-Kampong Speu-Thnol Torteng Grid Substation	230 kV : 15 km (x2)
14. Krong Suong-Memut Grid	230 kV : 55 km (x2)
15. East Phnom Penh-Krong Suong-Stung Teng Grid	500 kV : 296 km (x2)
16. Steung Trang-Baray Grid	115 kV : 55 km
17. Kampong Cham-Prek Brasob-Kratie Grid	115 kV : 111.2 km
18. Krokro-Kampong Tralach-Thnol Keng Grid	115 kV : 114.86 km (x2)
19. Kratie-Snuol-Memut Grid	230 kV : 108.67 km (x2)
20. Kampot-Chip Mong Grid Substation	115 kV : 46 km
21. Kirirom III Hydro Power Station-Chamkaloung Grid Substation	115 kV : 30 km (x1)
22. Botumsakor Grid-Oral Grid Substation-ADB Solar Substation	230 kV : 134 km (x2)
23. Krong Suong-Ponhea Kraek Grid	115 kV : 45 km (x1)
24. Takeo-Koh Thom Grid	115 kV : 45 km (x1)
Total	115kV-230kV-500kV= 2,132.9km

3 RE, EE&C, BESS, and Smart Grid

- RE: prioritize utilization of domestic RE, and if such resource are insufficient, we will consider import RE from neighboring countries.
- BESS: low-interest loan from ADB for a pilot project of National Energy Storage Program for Utility-Scale Solar Plants. (12MWh-15MWh)
- Energy Efficiency and Conservation: after having prepared EE&C Master Plan in 2020, currently, we are preparing the Preparation of National Energy Efficiency Policy (2021-2030).
- Smart Grid: depends on the definition; I would say it's still a long way to have fully digitalized smart-grid system.



Thank You

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