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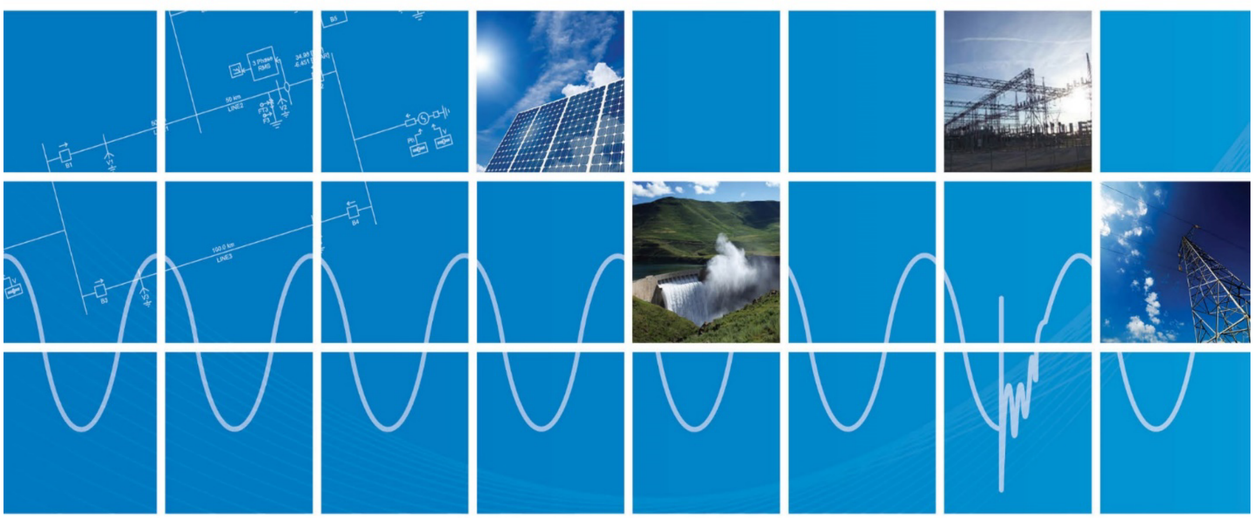
Final Report – Regional Power Master Plan: Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade



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Asian Development Bank

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Final Report: Regional Power Master Plan– Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade

October 2020

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Abbreviations and Acronyms

ADB	Asian Development Bank
AGC	Automatic Governor Control
APERC	Asia Pacific Energy Research Centre
CAPEX	Capital Expenditure
CO_2	Carbon dioxide
EV	Electric Vehicle
GMS	Greater Mekong Subregion
GW	Giga-Watt
HPP	Hydro Power Plant
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IPP	Independent Power Producer
km	Kilometer
kV	Kilo-Volts
kWh	Kilo-Watt Hours
LCC	Line Commutated Converter
LV	Low Voltage
MHI	Manitoba Hydro International
MOU	Memorandum Of Understanding
MW	Mega-Watt
MWh	Mega-Watt Hours
MVA	Mega-Volt Amperes
MVAC	Medium Voltage Alternating Current
NPV	Net Present Value

O&M	Operating and Maintenance Costs
OPEX	Operating Expenditure
PDA	Power Development Agreement
PDP	Power Development Plan
PSS	Power System Stabilizer
PV	Photo-Voltaic
RAS	Remedial Action Scheme
RPTCC	Regional Power Trade Coordination Committee
TA	Technical Assistantship
TPP	Thermal Power Plant
VRE	Variable Renewable Energy
VSC	Voltage Sourced Converter
$	United States dollars

Acknowledgment

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I. Executive Summary

1. Manitoba Hydro International (MHI) was contracted by the Asian Development Bank (ADB) to perform studies to develop a regional power master plan for the Greater Mekong Subregion (GMS). The planning period is from 2022 to 2035. Power master plan recommends options for GMS regional power trade to meet the requirements and facilitate the investigation of “Harmonizing the GMS Power Systems to Facilitate Regional Power Trade” under the ADB technical assistantship (TA) 8830.

2. The GMS regional power master plan development is based on a comprehensive study that analyzed the following key factors and the associated uncertainties and variations over the study period.

- Demand forecast
- Potential generation resources of the region for the study period
- Transmission options of the region

The study results are derived from simulations performed using the industry-standard stochastic generation and transmission planning software OptGen™/SDDP™. Optimum solutions were further analyzed using PSS®E transmission reliability software.

3. In total, thirty-six (36) regional generation planning scenarios are developed for the period from the year 2022 to the year 2035 considering medium, high and low demand growth conditions. Cross-border power transmission plans to facilitate the identified (36) generation plans are derived for the period from the year 2022 to the year 2032.

- Three (3) reference study scenarios are developed for the comparison of costs for each demand growth (medium, high and low) condition.
    - A reference scenario is developed for each of the three demand growth conditions for cost comparison purposes. These reference scenarios represent the planned and proposed regional generation and transmission developments based on individual country plans and already committed cross-border transmission development projects.
- Three (3) base study scenarios are developed considering the most likely economic, technical and policy factors.
    - A base scenario is also identified for each of the three demand growth conditions. The base scenario[1] under each category considered the most likely conditions with respect to economic and technological uncertainties (and hence termed the ‘Base Scenario’). Credible transmission projects that are not included in the reference scenario are included for consideration under the base scenario (OptGen™/SDDP™ based optimization simulations will determine the final list of generation and transmission developments proposed under any scenario, including the base scenario (base case)).
- Thirty (30) scenarios are considered to identify potential impact of credible variations of study inputs on the base case results.
    - The impact of the uncertainties associated with economic, technical and policy factors are considered under the thirty (30) scenarios.

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[1] This is the most likely future development scenario if GMS countries are willing to establish an interconnected regional power system with bilateral as well as multilateral cross-border interconnections.

4. In addition to the thirty-six (36) scenarios described above, a sensitivity assessment is performed. Twelve (12) ‘sensitivity’ scenarios are identified to cover unforeseen and extreme future situations including COVID-19.

5. Major outcomes of the study include the following.

- Identify the most beneficial regional generation and transmission developments.
- Evaluation of the cost-benefit of each potential scenario.
- Identify the most impactful projects from an economic perspective.
- Verify the resilience of key projects to future uncertainties.
- Verify the technical feasibility of the identified projects from a transmission reliability perspective.
- The assessment of interconnection strategy.

The study outcomes will be useful for regional planners and decision makers when making policy decisions regarding regional power development plans.

A. Methodology

6. A main task of this study is the development of the study model, capturing the demand, available generation resources and transmission options. The study model is developed based on data obtained from the following sources.

- Power development plans of individual countries.
- Data from independent study reports.
- Public domain data gathered from the internet and other sources.
- RPTCC meeting presentations and feedback from country representatives.
- Meetings and discussions with government and utility representatives of GMS member countries.

The data sources are identified in the references (section XII).

7. The regional power master plan is developed for the most likely scenario to identify the key generation and transmission developments. In order to account for future uncertainties, a number of additional scenarios representing economic, technological and policy variations are also analyzed.

8. All study scenarios and the corresponding results are analyzed in detail and generation and transmission developments with the most benefit as well as corresponding important development trends are identified.

9. Due to technical reasons and current operating practices of the individual countries, a number of challenges need to be resolved (harmonizing grid codes and operating practices) before fully interconnected operation may be feasible. As a part of the study, challenges in interconnecting the GMS region using synchronous interconnections (HVAC[2] connections) are studied and the financial impact of delays are evaluated. Study has also evaluated the potential for interconnecting the GMS region using asynchronous interconnections (HVDC[3] connections) until the synchronous interconnections become viable.

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[2] High Voltage Alternating Current.
[3] High Voltage Direct Current.

B. Economic Benefit

10. The expected economic benefit is an outcome of the OptGen™/SDDP™ based optimization[4] of generation and transmission plans. Cost savings that can be attributed to the base scenario is listed in Table 1.

Table 1: Cost benefit summary of Reference and Base case - Medium demand growth scenarios

Scenario No.	Scenario Description	Cost in US $ billion - 2022 NPV			
		Total Cost	**Cost Savings**	**Total Investment**	**Incremental Investment**
RM	Reference scenario	235	-	52	-
BM	Base scenario (most likely development scenario)	215	20	55	3

11. The total cost consists of the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) for the planning period. The total investment reflects the full capital cost.

12. Cost savings that can be attributed to each scenario (compared to the reference scenario) are listed below. These scenarios reflect the potential impact of credible variations of study inputs.

Table 2: Cost benefit summary - Medium demand growth scenarios

Scenario No.	Scenario Description	Cost in US $ billion - 2022 NPV			
		Total Cost	**Cost Savings**	**Total Investment**	**Incremental Investment**
S1	Reduced gas price	197	**38**	50	-2
S2	Reduced VRE costs	214	20	60	8
S3	High fossil fuel prices	248	-13	67	15
S4	Battery storage systems (BSS) for Solar	216	19	55	3
S5	Reduced VRE costs and BSS for Solar	215	20	60	8
S6	Nuclear generation option	216	19	53	1
S7	High fossil fuel price with nuclear generation option	248	**-13**	77	25
S8	High cross-border power trade	204	**31**	56	4
S9	High fossil fuel price and high cross-border power trade	234	**1**	68	17
S10	Reduced VRE costs and high cross-border power trade	203	**31**	60	8

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[4] Optimized transmission solution may be adjusted using PSS®E software based reliability studies.

13. Medium demand growth – Economic benefit summary.

- The base scenario shows a cost saving of $20 billion compared to the reference scenario.
- Reduced gas price scenario (S1) and aggressive interconnection development scenario (S8) show higher cost saving compared to the base scenario (BM). A scenario with both reduced VRE costs and aggressive interconnection development (S10) does not show any significant additional savings.
- High fossil fuel price scenario (S7) results in an increased cost (of $13 billion) due to the increased operating cost. Such increment due to fuel cost can be offset by facilitating increased cross-border power trade as shown in the scenario 'high fossil fuel price and high cross-border power trade' (S9).

14. In most scenarios, the additional investment (Incremental Investment in Table 1 and
15. The total cost consists of the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) for the planning period. The total investment reflects the full capital cost.

16. Cost savings that can be attributed to each scenario (compared to the reference scenario) are listed below. **These scenarios reflect the potential impact** of credible variations of study inputs.
17.
18. Table 2) is less than the total cost savings during the period. This is an indication that the total additional investment to facilitate to cross-border power transfer could be paid back using the cost benefit accumulated over the planning period. It should be noted that these investments will continue to provide cost savings beyond the planning period as well.

19. Cost savings calculated for the base scenarios under high, medium and low demand growth are $45 billion, $20 billion and $16 billion, respectively.

20. The cost saving trends of different scenarios are similar, irrespective of low, medium or high demand growth. In general, the expected cost savings increase with the demand growth.

C. Main Findings: Most beneficial Generation and Transmission Development Projects

21. When analyzing the generation and transmission developments under different study scenarios, several common development trends are observed. Development projects related to these trends are vital as cost benefit of these project are significant in most scenarios regardless of the uncertainties of the study inputs (i.e. load growth, economic and technological/policy factors). Major generation and transmission trends for each GMS country is summarized below. [5]

22. Cambodia

a. Hydro potential in the northeast and southwest regions of Cambodia (3-6 GW) is proposed under all study scenarios due to their positive economic impact. Development of Solar generation (mostly in the central region (2-3 GW)) will also have high economic impact.

[5] The staging of the generation & transmission projects related to these trends are impacted by the demand growth. In high demand growth conditions, project staging is advanced and in low demand growth conditions, project staging is delayed.

b. Cambodia will have to develop a large amount of thermal generation (mainly gas) and import power from neighboring countries towards the latter part of the planning period to supply the expected demand growth.
c. Candidate interconnections between Cambodia-Lao PDR, Cambodia-Thailand and Cambodia-Viet Nam appear in most study scenarios to import power to Cambodia.

23. Lao PDR

a. Lao PDR has significant large hydro potential in the North and South regions. Most scenarios show that Hydro developments between 3 to 5 GW are economically viable and energy can be exported. In addition, a small amount of wind generation (about 0.5 GW) is developed in the southern region.
b. Lao PDR has several candidate interconnections with Viet Nam, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection that is also connected to Cambodia.
c. The candidate interconnection, Namo – Kenglatt – Tachileik between Lao PDR and Myanmar is developed in all scenarios.
d. The candidate interconnection from Luang Prabang province in Lao PDR to Yunnan province in PRC is developed in most scenarios. This interconnection will export power from northern Lao PDR to PRC.

24. Myanmar

a. Myanmar has significant hydro potential, mainly in the Northern region. Most scenarios show that Hydro developments between 8 to 12 GW are economically viable with most of the power exported to Thailand. In addition, development of wind generation (1-3 GW) in the central and southern regions is also viable.
b. Three candidate interconnections between Myanmar and Thailand are developed in all scenarios. One of these is the Mae Khot – Mae Chan interconnection which is intended to connect a thermal power plant in Myanmar to the Thailand grid. Once developed, this interconnection could also be utilized to transfer hydro power in the central area of Myanmar to Thailand if Myanmar-Thailand grids could be synchronized. It is also observed that the hydro potential in the southern region of Myanmar could potentially be exported to Thailand in the later stages of the planning period.
c. The candidate cross-border interconnection Namo – Kenglatt – Tachileik between Lao PDR and Myanmar is developed in all scenarios. This interconnection would enhance the power export capability to Thailand from both Myanmar and Lao PDR. This interconnection will also enhance grid reliability of the region.
d. The candidate interconnection Mandalay (Myanmar) – Yunnan (PRC) is developed in most scenarios. Hydro power from northern Myanmar (including plants such as Naopha and Kunlong HPPs) could be exported to PRC based on mutual agreement.

25. Thailand

a. Major generation developments in Thailand are mainly thermal and solar. Coal generation (about 3 GW) is observed in central and southern regions. Gas generation (about 3 GW) is located mainly in the central region. Solar generation (about 7 GW) is distributed in the north, central and northeast regions.

b. Several candidate interconnections between Thailand and Myanmar are developed in most scenarios including Mae Khot – Mae Chan 230 kV interconnection.
c. The candidate interconnection between Thailand and Cambodia (Wangnoi – Kampong Cham) is developed in many scenarios. This interconnection could be utilized to export power to Cambodia via the Thailand network. This interconnection will also provide an opportunity for power trade between Thailand and Viet Nam via the Cambodia network in latter part of the planning period.

26. Viet Nam

a. Major generation developments in Viet Nam are thermal and variable renewable energy (VRE) generation. Coal generation (8-17 GW) is observed in northern and southern regions. Wind generation (6-7 GW) is mostly in the southern region and solar generation (5-9 GW) is distributed in southern and central regions.
b. A number of interconnections between Viet Nam and Lao PDR are developed in many scenarios, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection that is also connected to Cambodia. Since Lao PDR has hydro potential in the south and north regions, these interconnections could be used to supply loads in different parts of Viet Nam.
c. The candidate interconnections between Viet Nam and Cambodia (Lower Se San 2 HPP– Pleiku and Kampong Cham – Tay Ninh) are developed in all scenarios. Power is exported from Viet Nam to Cambodia to support the (expected) very high demand growth in Cambodia.

27. Peoples' Republic of China (PRC)[6]

a. PRC is considered a potential importer and hence candidate generation in PRC is not modeled in the main scenarios (since PRC may be unlikely export power in the near future[7]). However, the possibility of power exporting and power wheeling through PRC are studied under sensitivity scenarios.
b. The candidate interconnection Mandalay (Myanmar) – Yunnan (PRC) is developed in most scenarios, which could be used to export power to PRC.
c. The candidate line from Luang Prabang province in Lao PDR to Yunnan province in PRC is developed in most scenarios. This interconnection is used to export hydro power from northern Lao PDR to PRC.

D. Interconnection Challenges and Timeline

28. Developing synchronous HVAC interconnections in the GMS region is challenging since there are significant differences in dynamic performance of local grid operations. In particular, it is important to implement frequency regulation and control measures such as governor droop control, Automatic Generator Control (AGC). This challenge must be addressed through a regional Grid Code. Individual country Grid Codes should be made compatible and harmonized with the regional Grid Code. A regional Grid Code is prepared under a task of GMS Regional Power Trade Coordination Committee (RPTCC).

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[6] Only Yunnan and GuangXi provinces of PRC are considered for the GMS regional study.
[7] Based on feedback from representatives of PRC (see Appendix 5: Comments Matrix)

29. Based on the technical challenges, it is estimated that bulk cross-border power transfer between all countries in GMS region using synchronous HVAC interconnections may only be possible around year 2030. This estimate is based on study reports, country Power Development Plans (PDPs) and public domain data. The timeline may be advanced (or even delayed) depending on factors such as political will, private and government investments, economic situation and technological advancements.
30. If synchronous grid-grid interconnections are significantly delayed, asynchronous HVDC cross-border interconnections could be a potential economically viable alternative. Although the cost of HVDC is generally higher, there are a number of advantages that will make it well suited for cross-border interconnections such as power transfer flexibility, fast control, blocking capability, etc. HVDC technology have some drawbacks such as higher cost for shorter transmission lines and difficulties with increasing the number of terminals, when the system expands. Table 3 summarizes study results on the impact of grid synchronization delays with and without HVDC option.

Table 3: Impact of grid synchronization delay, Medium demand growth - base scenario

Study case	Description	CAPEX ($ billion)			OPEX ($ billion)	Total Cost ($ billion)	Investment cost ($ billion)	Incremental investment cost ($ billion)
		Gen.	HVAC	HVDC				
A	No delay for Grid-Grid interconnections	22	4	-	190	215	55	3
B	With likely synchronization delays (with HVDC option)	23	3	2	194	222	57	5
C	With likely synchronization delays (no HVDC option)	22	3	-	201	226	55	3

31. In Table 3, three cases are analyzed,

- No delay of synchronous connections and operation (option A),
- Likely delay of synchronising but HVDC technology is used for cross-border interconnections (option B)
- Cross-border interconnections are delayed until grid synchronization is possible (option C).

Delaying cross-border interconnections (option C) increases the total cost (CAPEX and OPEX) by $11 billion compared to the study case with no delay (option A). With the HVDC option (option B), total investment cost is slightly increased due to higher cost of HVDC technology. However, there is a significant reduction in OPEX which result in a cost saving of about $4 billion.

32. The analysis considering the HVDC option indicates that there is a significant overall benefit in timely regional interconnection, despite the higher capital cost of HVDC transmission, compared to delaying the cross-border power sharing.

E. Sensitivity Scenarios

33. A total of twelve (12) sensitivity scenarios are studied. The outcomes related to the four selected sensitivity scenarios are summarized below.

34. COVID-19 demand scenario - The potential impact of COVID-19 pandemic to future regional demand is studied. The regional demand is assumed to decrease by 8% compared to the low demand growth scenario. The reduction in demand causes a significant reduction in the total cost ($159 billion compared to $183 billion). The investments required in the initial years of the panning period for new thermal generation can be delayed.

35. Dry future scenario - Low future hydro availability is studied by reducing the hydro inflows by 20%. Under this condition, new thermal generation is required to be developed earlier due to low hydro availability. This results in higher overall costs. The total cost increases to $225 billion compared to $215 billion under medium demand growth base scenario.

36. Reduced carbon emission scenario – Adoption of carbon emission reduction policy is studied by implementing an additional cost of 30 $/ tCO2 for thermal generation. In this scenario, a decrease in the thermal energy usage and increased VRE development is observed. Increased VRE generation development increases cross-border power trade which will require development of additional cross-border interconnections. The total cost of this scenario is $242 billion compared to $215 billion for medium demand growth base scenario. The cost increment is mainly due to the collection of the carbon cost. The funds accumulated from applying a carbon emission tariff can be used to reinforce a carbon emission reduction policy by investing in technologies with low carbon footprints such as VRE.

37. No import restrictions scenario - The aggressive cross-border transmission development scenario is studied with the restrictions on imports into Thailand and Viet Nam removed.
VRE developments in Thailand and Viet Nam are significantly increased (32 GW with no import restrictions, compared to 17 GW for Base scenario) and the development of thermal generation is reduced with 11 GW less thermal generation developed during the study period. Hydro developments in Lao PDR and Myanmar are increased to support the VRE based generation in Thailand and Viet Nam during the times of reduced availability. The total cost is significantly reduced ($194 billion) compared to medium demand base scenario ($215 billion).

38. The major generation and transmission development trends observed in the main scenarios are also observed in sensitivity scenarios, which confirms that these trends are resilient to changes in the sensitivity factors studied.

F. Major Conclusions and Recommendations

39. Study results clearly indicate that cross-border power trade among GMS countries will provide significant benefits. Study results also indicate that the total additional investment required to facilitate cross-border transfer could be paid back using the cost-benefits accumulated during the study period.

40. Several major power development options and trends in the GMS region are identified for the study period.

a. Future hydro generation development in Lao PDR, Myanmar and PRC[8] is economically viable and beneficial for cross-border power trade. There is also

[8] PRC commented that they may not have excess power to export after 2023. However, it was also mentioned that there could be a large amount of hydro developments after 2025. This possibility is considered under sensitivity analysis.

potential hydro generation development in Cambodia which could be utilized to cater the growth of local demand.

b. Thailand and Viet Nam are expected to develop a large amount of Variable Renewable Energy (VRE) based generation (mainly wind and solar) while some VRE generation developments are observed throughout the region.
c. Increased development of VRE and hydro based generation reduces the utilization of thermal generation. Intermittent nature of VRE based generation can be effectively managed with parallel development of hydro generation capacity in the region.
d. Region wide bulk power transfer assists to reduce the cost of electricity in GMS region by transferring power from locations with cheaper generation to load centers. Cross-border power transfer corridors between Myanmar-Thailand, Lao PDR-Viet Nam, Lao PDR-Cambodia, Viet Nam-Cambodia, and Myanmar-PRC are expected to have the largest impact. Transmission projects proposed for these corridors may yield high cost benefit and these transmission projects are expected to have high utilization.

41. Development of VRE and Hydro based generation along with aggressive development of cross-border transmission capacity is recommended to reduce both cost of electricity as well as carbon emissions.

42. Synchronous HVAC connections for cross-border power trade may not be realistic until around year 2030. This is mainly due to the large gaps in dynamic performance of different local grids.

a. In order to facilitate high voltage synchronous interconnections, it is recommended that GMS countries develop comprehensive grid codes based on accepted global standards and improve grid code compliance. Frequency control measures such as governor droop control, Automatic Generator Control (AGC) and tertiary reserve deployments and replenishment are the most important considerations.
b. Asynchronous (HVDC) cross-border interconnections are recommended as an initial solution to harness the benefits of cross-border power trade if the dynamic performance improvements are delayed.

43. The major generation and transmission development trends observed in the main scenarios are also observed in the sensitivity scenarios. This confirms that these key trends are resilient to the sensitivity factors considered in this study.

II. Introduction

A. Background

44. MHI was contracted to develop GMS regional power master plan for the period, 2022 – 2035 and recommend options for GMS regional power trade with power system infrastructure development needs through technical studies, and economic assessments to meet the requirements and facilitate the investigation of, “Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade” under the Asian Development Bank (ADB) technical assistantship (TA) 8830.

45. Regional energy planning, power transmission infrastructure, performance standards, regulatory gaps, lack of coordination among the GMS countries have been identified as a key impetus area reflecting ADB's commitment of supporting regional cooperation in Asia. ADB, under its previous regional technical assistance TA 6440-REG "Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion" completed various studies including, GMS reference document on performance standards, preliminary report on metering arrangement, and review of regulatory framework in the GMS countries and conceptual design of GMS market[9].

B. Project Overview

46. There is vast amount of undeveloped low-cost renewable energy resources available in the GMS region. However, bulk of the potential generation located far from the demand centers and these energy resources are unevenly distributed among individual countries.

47. There are large untapped hydro resources available in Lao PDR and Myanmar. Most of these resources are not required to meet the local demand growth in these countries in the foreseeable future. Cross-border power trade could be utilized to harness this hydro potential and gain long term economic benefits to both power exporters and power importers. There is also potential hydro generation development in Cambodia which could be utilized to cater the growth of local demand. PRC may not have excess power to export after the year 2023. However, there could be a large amount of potential hydro developments after 2025.

48. The main load centers in the GMS region are Thailand and Vietnam. Both these countries have exhausted most of their bulk hydro power potential. However, there are ample amount of Variable Renewable Energy (VRE) resources in these two countries. There is significant potential for solar generation in the northeast, central and northern regions of Thailand. Viet Nam has, a large potential for wind and solar generation, mostly in the southern and central regions. Variation of availability in VRE based generation in these countries could be complemented by increased cross-border power trade to ensure reliable power supply.

49. The distribution of these potential energy sources in the GMS region is presented in Figure 1.

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[9] Final report was published in October 2010.

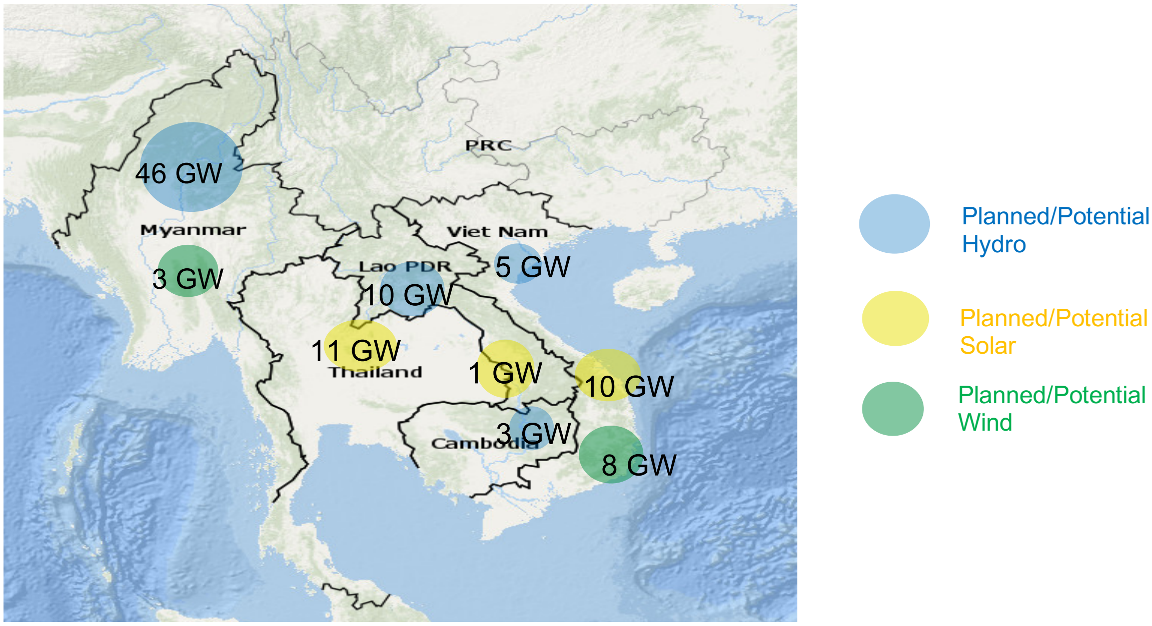

Figure 1: Distribution of potential renewable energy resources in the GMS region[10]

50. As explained, these energy resources can be effectively utilized through cross-border power trade. In addition to the economic benefits, there are many advantages to enhancing the regional cross-border interconnections. These include improvement of power system security and reliability, enhancement of power quality and reduction of transmission losses.

51. A comprehensive study is performed considering demand, generation and transmission data of the GMS countries for the study period and associated uncertainties and variations to derive a refined set of generation and transmission planning scenarios for the GMS region and quantified economic benefits. These outcomes and recommendations could be used as a framework for developing the future regional cross-border power trade plans by the decision makers.

52. This report outlines the main objectives, methodology, tasks and results of the study for the development of the regional power master plan (2022-2035) performed to meet the requirements and facilitate the investigation of the, “Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade” under the Asian Development Bank (ADB) technical assistantship (TA) 8830.

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[10] Based on Power development plans of individual countries, study reports and presentations [12], [17], [22], [38], [40]

C. Objective

53. The main objective of this project is to perform studies to develop a regional generation and transmission master plan for the GMS for the period, 2022 – 2035. The regional generation and transmission master plan to be developed through technical studies, and economic assessments and options are recommended for GMS regional power trade with associated power system infrastructure development needs[11]. This objective is achieved through following milestones.

54. A review of the existing literature about the GMS region is performed in order to propose a procedure for the development of the regional power development plan, including the scope, methodology, data collection, planning methods and modeling techniques.

55. Based on the data collected in collaboration with ADB and power system experts of individual countries, a regional study model (OptGen™/SDDP) is developed to obtain a comprehensive set of optimized generation and transmission development scenarios for GMS considering the variation of a number of technical and economic factors.

56. Regional generation (the year 2022 to the year 2035) and transmission planning scenarios (year 2022 to year 2032) are optimized to determine the most beneficial generation and transmission projects. PSS®E based cursory studies are performed to verify the technical feasibility of the major generation and transmission upgrades identified in the study scenarios.

57. A refined set of generation and transmission planning scenarios is identified to be included in the regional generation and transmission master plan. These scenarios are expected to yield financial benefits to both the region as a whole and to the individual countries.

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[11] Terms of reference for this study are provided in Appendix 6: Terms of Reference

III. GMS Power System Overview

58. In this section, an overview of the power system of each country is discussed. Demand, generation and transmission system summary for the study period 2022-2035 for the power system of each country are presented.

59. The following data is gathered based on power development plans of GMS countries, comments from country representatives, study reports and other public domain data. Assumptions and engineering judgement are used to approximate missing information and complete the required data inputs.

A. Power System of Cambodia

60. The demand forecast used for the Cambodia system is taken from Cambodia information provided at RPTCC-26 [40]. The demand forecast is presented in Figure 2. The original demand forecast spans the years 2018-2030. This demand forecast is expanded to 2035 to be used in the study model.

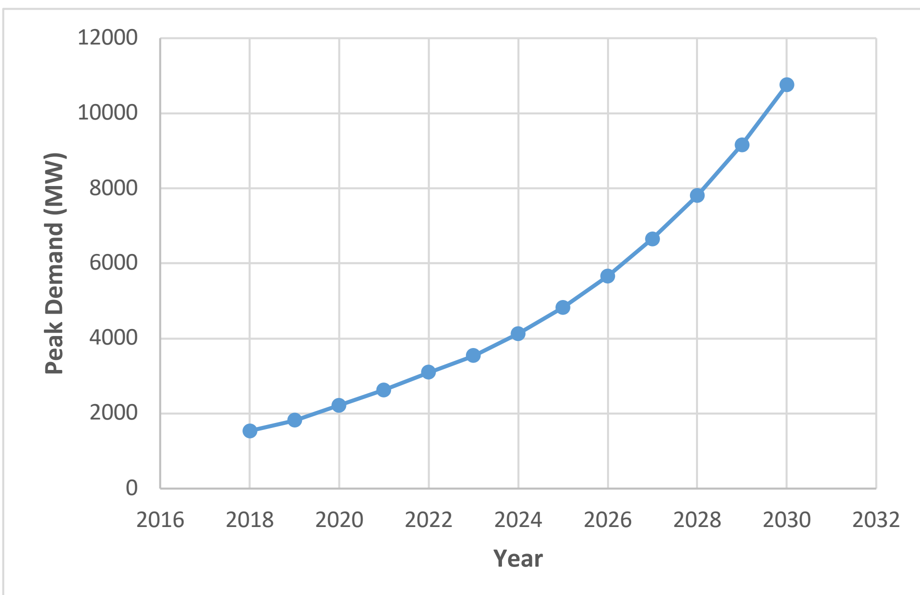

Figure 2: Cambodia Demand Forecast

61. The demand forecast of Cambodia shows very high growth, about 17% growth rate each year up to 2030. The peak demand more than triples from 2022 to 2030.

62. The Cambodia daily demand curve [1] used for the study, represented as a percentage of the daily peak is shown in Figure 3.

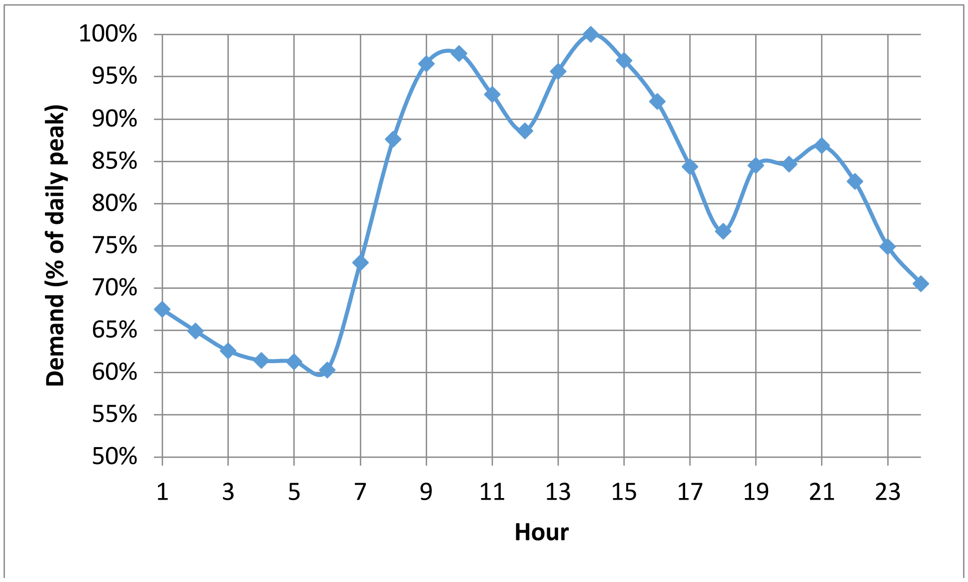

Figure 3: Cambodia Typical Daily Demand Curve

63. Demand distribution for the Cambodia power system is developed based on the peak demand per area [1]. Table 4 provides a breakdown of the peak demand per area and the demand distribution.

Table 4: Cambodia Regional Demand Distribution

Region	Peak Demand (MW)	Percentage
Phnom Penh	757	62%
North West	172	14%
North East	56	5%
South West	107	9%
South East	127	10%

64. Pie charts showing the existing and future generation[12] in Cambodia are shown in Figure 4.

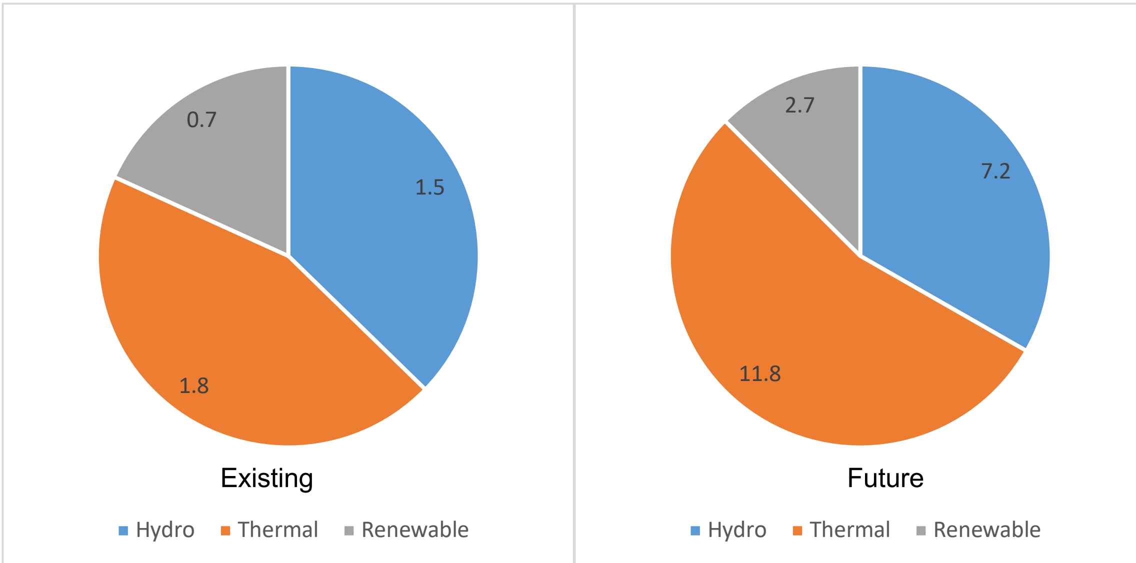

Figure 4: Existing and future generation in Cambodia (in GW)

65. There is potential for hydro development in north east and south west Cambodia, and there is potential to develop gas generation in the south. Since the available generation plan extends to 2030, some additional candidate generation that is available is included in the 2031-2035 period of the study model. A full list of the generation data is given in Appendix 1: Full Generation List per Country.

66. Figure 5 depicts the single line diagram of the high voltage transmission network of Cambodia developed in PSS®E for year 2022.

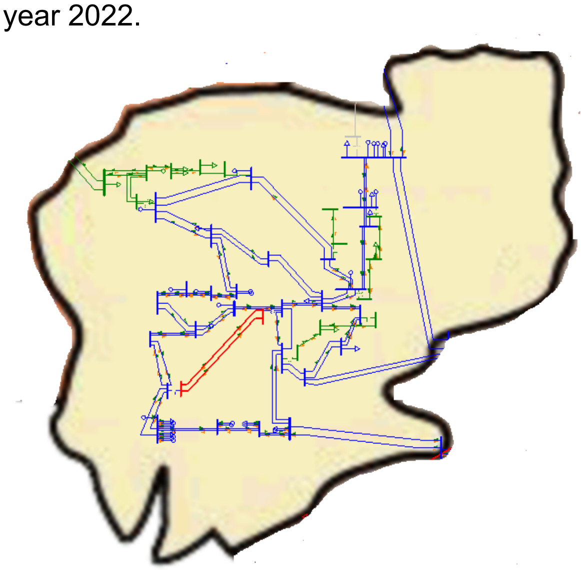

Figure 5: Single line diagram of the Cambodia Transmission Network (Red – 500 kV, Blue – 230 kV, Green – 115 kV system)

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[12] The generation data is obtained from [1], [2], [5], and [40].

B. Power System of Lao PDR

67. A demand forecast of Lao PDR for the period 2016-2030 [38] is presented in Figure 6. This demand forecast is extended to 2035 to be used in the study model.

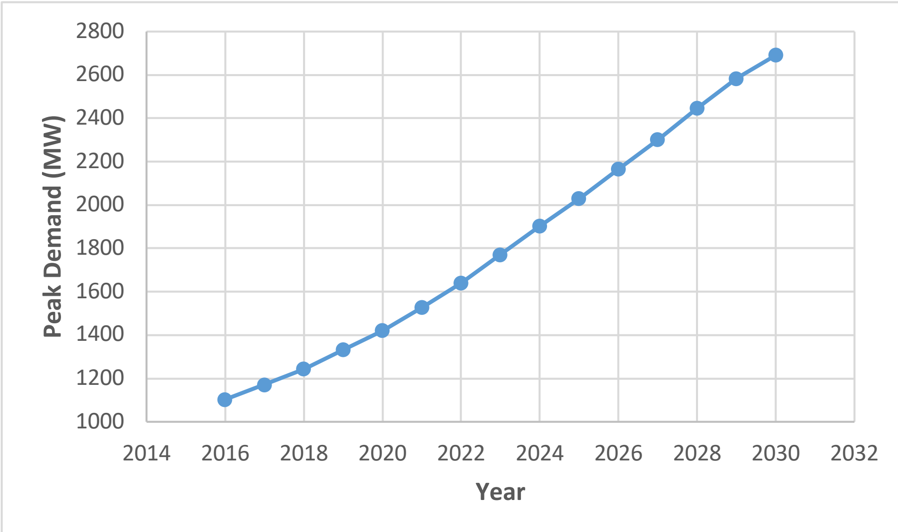

Figure 6: Lao PDR Demand Forecast

68. The demand forecast of Lao PDR shows low demand growth throughout the period. Due to the low demand, much of the generation Capacity in Lao PDR is intended for exporting.

69. The daily demand curve of Lao PDR [10] used for the study, represented as a percentage of the daily peak is shown in Figure 7.

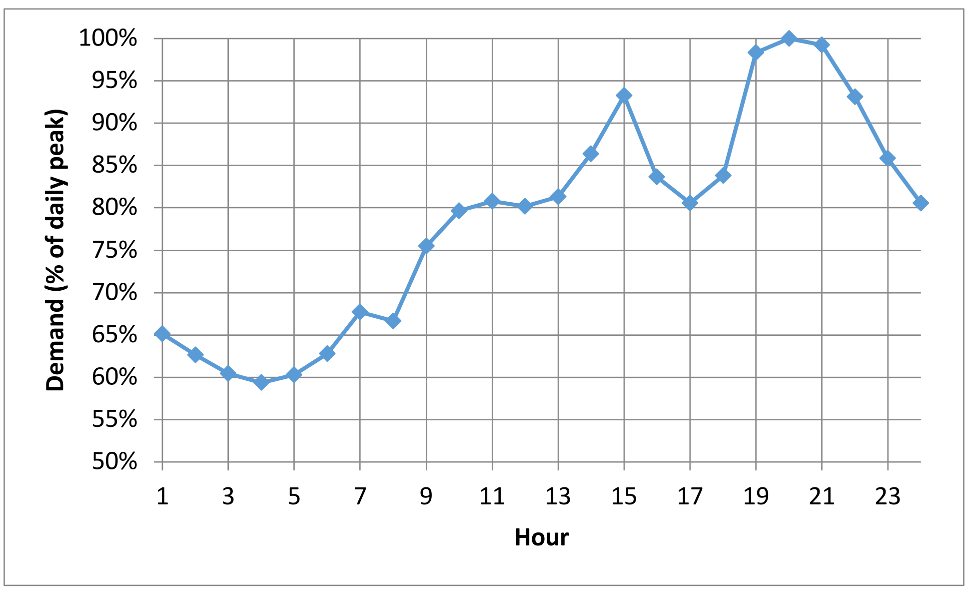

Figure 7: Lao PDR Typical Daily Demand Curve

70. Daily demand curves for each of the four regions in Lao PDR is given in [10]. These curves are used to determine the regional demand distribution in Lao PDR. The demand distribution is shown in Table 5.

Table 5: Lao PDR Regional Demand Distribution

Region	Demand Distribution
North	9%
Central 1	54%
Central 2	24%
South	13%

71. Pie charts showing the existing and future generation[13] in Lao PDR are shown in Figure 8.

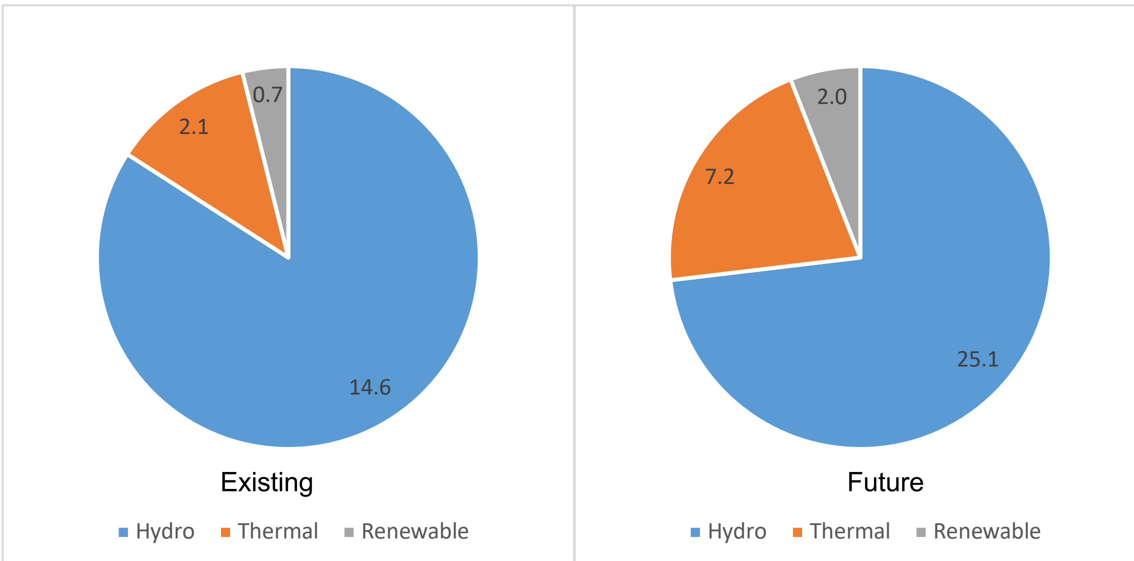

Figure 8: Existing and future generation in Lao PDR (in GW)

72. There is significant hydro potential in Lao PDR, mostly in the north and south. There is also some potential for coal plants to be developed. A full list of the generation data is given in Appendix 1: Full Generation List per Country.

[13] The generation data is obtained from [6], [7], [8], and [38].

73. Figure 9 depicts the single line diagram of the high voltage transmission network of Lao PDR developed in PSS®E for year 2022.

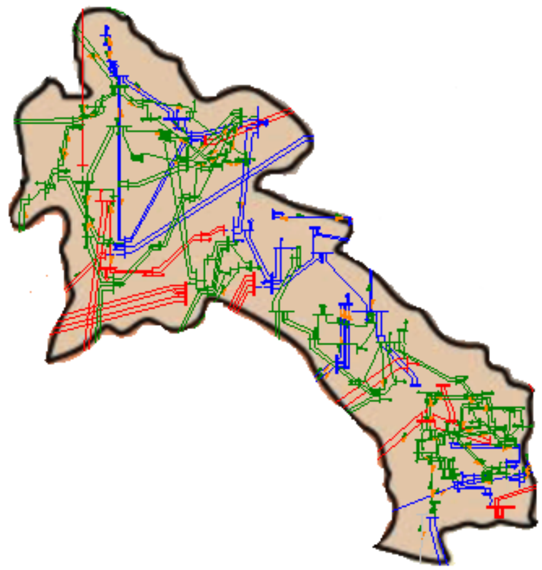

Figure 9: Single line diagram of the Lao PDR Transmission Network (Red – 500 kV, Blue – 230 kV, Green – 115 kV system)

74. It can be seen that the transmission network between central and southern regions of Lao PDR is relatively weak (only 115 kV connections along some corridors).

C. Power System of Myanmar

75. A demand forecast of Myanmar for the period 2015-2030 [13] is presented in Figure 10. This demand forecast is extended to 2035 to be used in the study model.

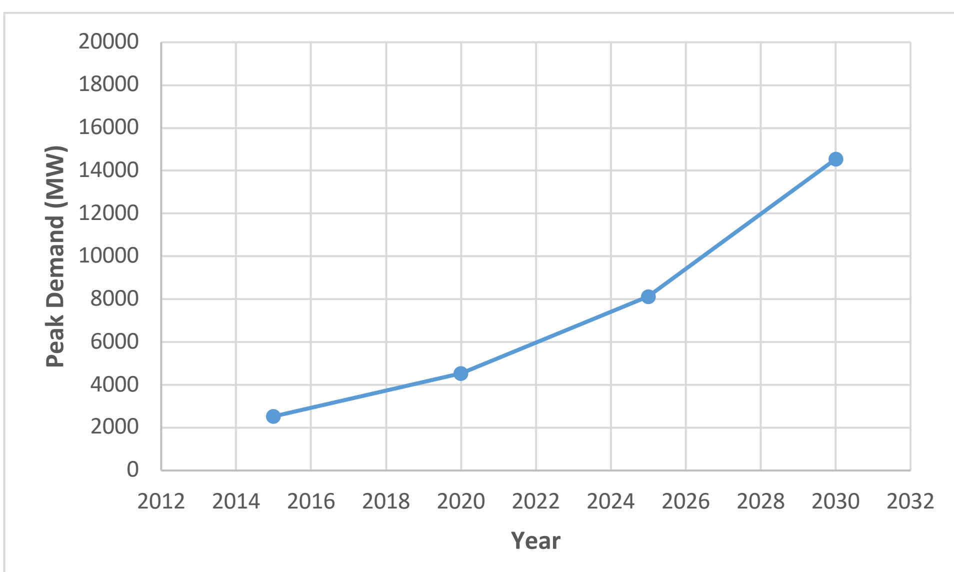

Figure 10: Myanmar Demand Forecast

76. The daily demand curve of Myanmar [12] used for the study, represented as a percentage of the daily peak is shown in Figure 11.

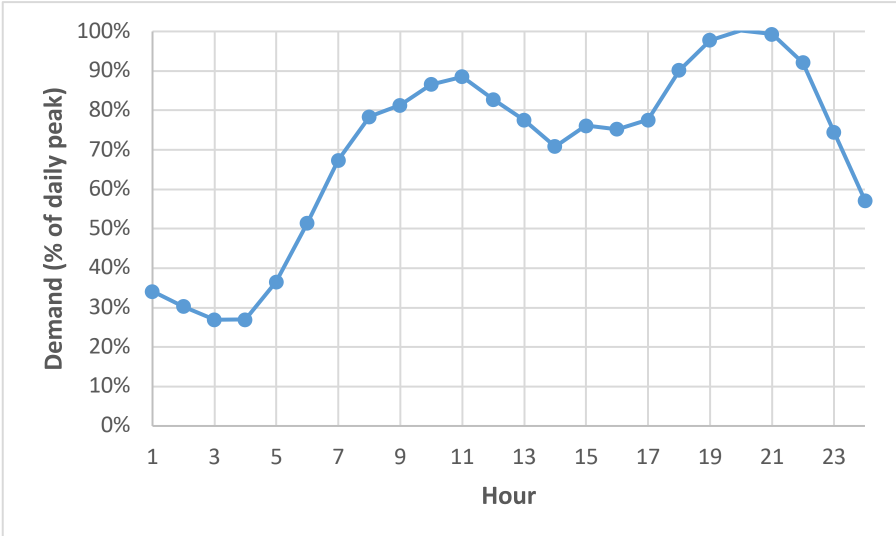

Figure 11: Myanmar Typical Daily Demand Curve

77. The peak demand for each province is provided in [15] for the year 2013. This data is used to develop the regional distribution of the demand forecast.

78. Pie charts showing the existing and future generation[14] in Myanmar are shown in Figure 12.

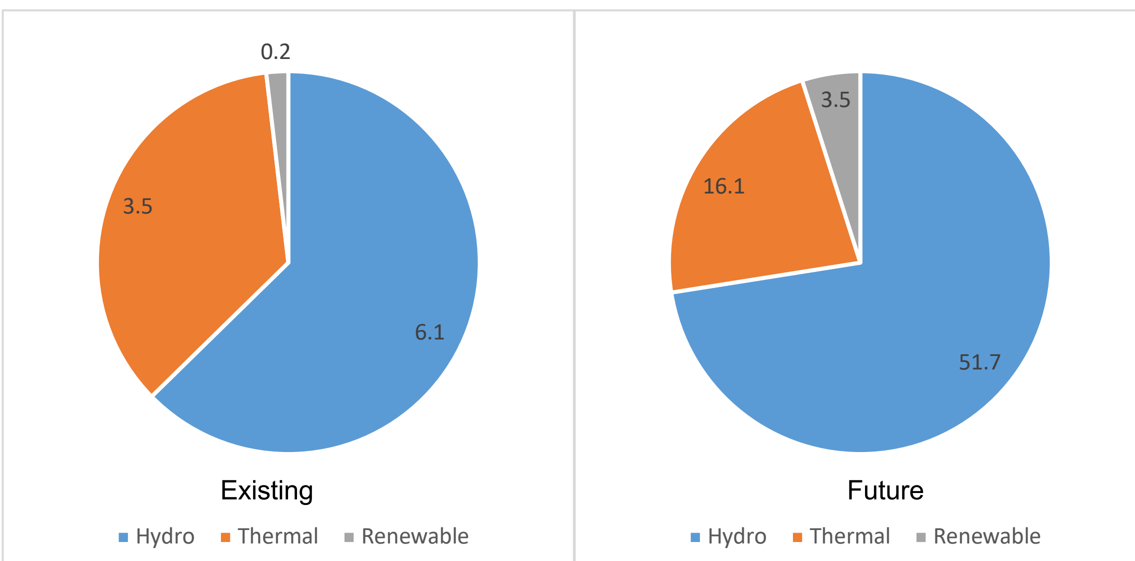

Figure 12: Existing and future generation in Myanmar (in GW)

79. There is a large potential for hydro development in Myanmar, mostly in the northern region. A full list of generation data is given in Appendix 1: Full Generation List per Country.

[14] The generation data is obtained from [12], [14] and [15].

80. Figure 13 depicts the single line diagram of the high voltage transmission network of Myanmar developed in PSS®E for year 2022.

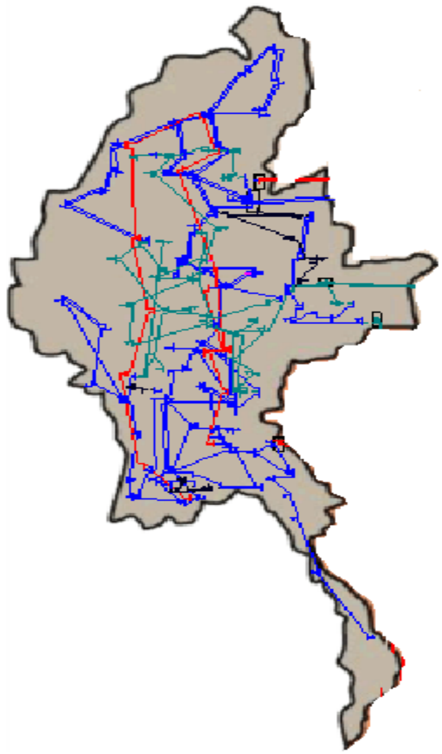

Figure 13: Single line diagram of the Myanmar Transmission Network (Red – 500 kV, Blue – 230 kV, Green – 115 kV system)

D. Power System of Thailand

81. A demand forecast of Thailand for the period 2018-2037 [17] presented in Figure 14.

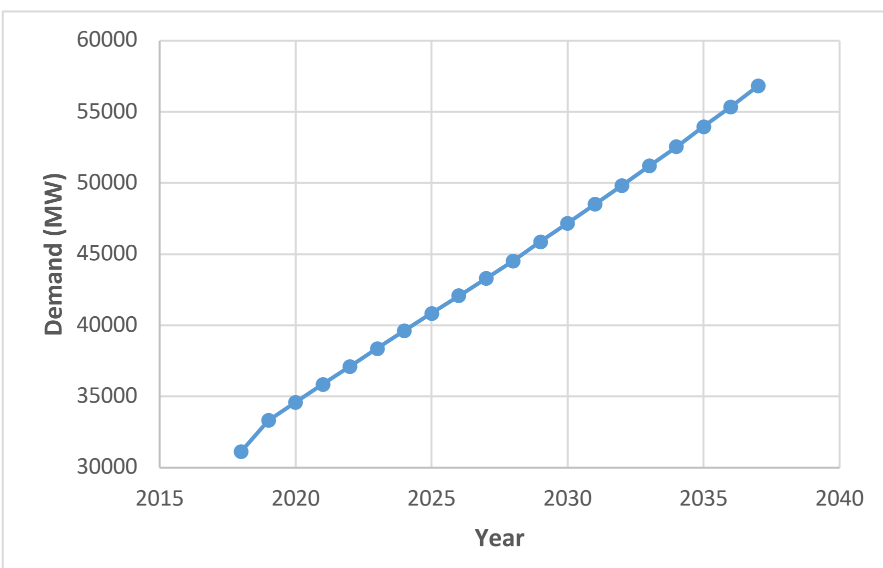

Figure 14: Thailand Demand Forecast

82. The demand in Thailand power system is high compared to the neighboring countries, however, it shows low demand growth.

83. The daily demand curve of Thailand [18] used for the study, represented as a percentage of the daily peak is shown in Figure 15.

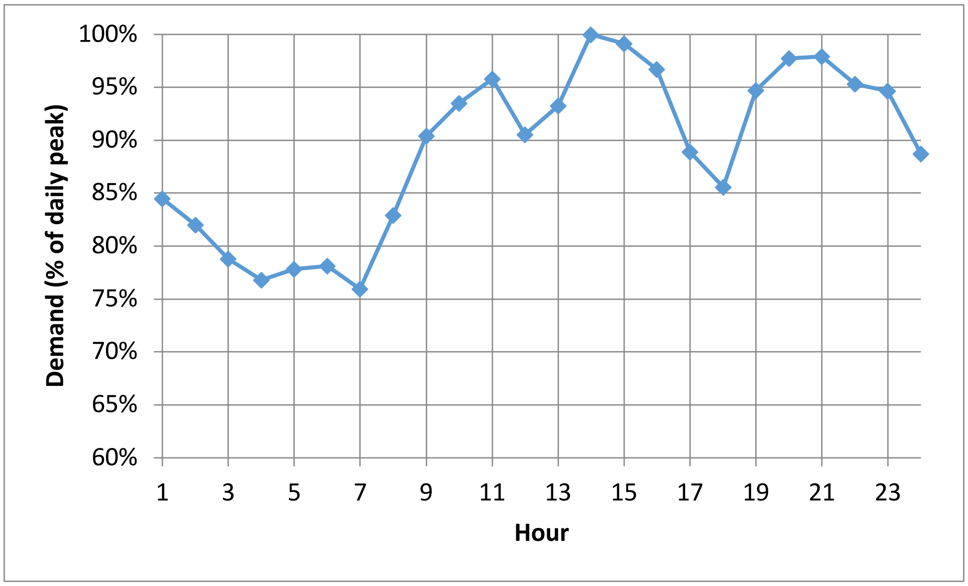

Figure 15: Thailand Typical Daily Demand Curve

84. A demand forecast for each area in the Thailand system is provided in [17] for the period 2018-2037. This data is used to calculate the regional demand distribution in Thailand.

85. Table 6 presents the demand distribution used to model the Thailand power system.

Table 6: Thailand Regional Demand Distribution

Year	Distribution per area (%)						
	Nakhon Luang	Central Upper	Central East	Central West	Northeast	South	North
2018	33.1	9.2	15.7	9.7	13.2	8.9	10.2
2019	32.6	9.4	16.0	9.9	13.2	8.8	10.0
2020	32.3	9.5	16.1	9.9	13.3	8.8	10.1
2021	32.0	9.5	16.2	10.0	13.4	8.8	10.1
2022	31.6	9.6	16.3	10.1	13.5	8.9	10.1
2023	31.2	9.6	16.4	10.1	13.6	8.9	01.2
2024	30.8	9.7	16.5	10.2	13.7	8.9	10.3
2025	30.4	9.8	16.6	10.3	13.8	8.9	10.3
2026	30.0	9.8	16.7	10.3	13.9	9.0	10.3
2027	29.6	9.9	16.8	10.4	14.0	9.0	10.3
2028	29.3	10.0	16.9	10.5	14.0	9.0	10.3
2029	29.0	10.0	17.0	10.5	14.1	9.1	10.3
2030	29.6	10.1	17.1	10.6	14.2	9.1	10.4
2031	28.3	10.1	17.2	10.6	14.3	9.1	10.4
2032	28.0	10.2	17.3	10.7	14.3	9.1	10.4
2033	27.7	10.2	17.3	10.7	14.4	9.2	10.5

Year	Distribution per area (%)						
	Nakhon Luang	Central Upper	Central East	Central West	Northeast	South	North
2034	27.4	10.3	17.4	10.8	14.5	9.2	10.5
2035	27.1	10.3	18.5	10.8	14.5	9.2	10.6

86. Pie charts showing the existing and future generation[15] in Thailand are shown in Figure 16.

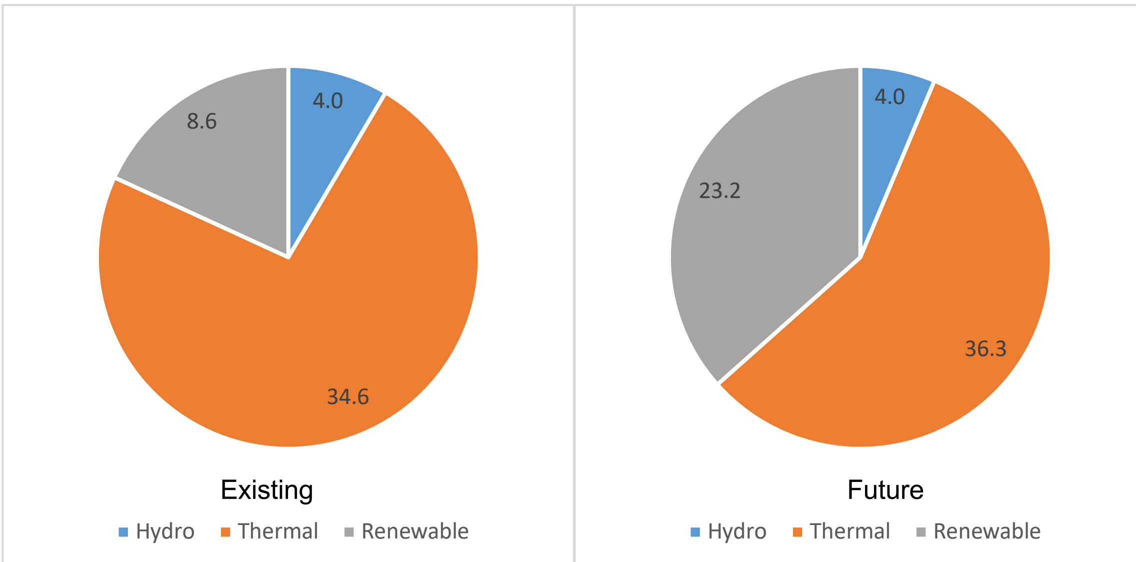

Figure 16: Existing and future generation in Thailand (in GW)

87. There is only a small net increment in thermal generation due to retirement of a large number of plants (total about 13 GW) during the study period. There is minimal remaining hydro potential in Thailand, but there is significant potential for solar generation in the northeast, central and northern regions. A full list of the generation data is given in Appendix 1: Full Generation List per Country.

88. Figure 17 depicts the single line diagram of the high voltage transmission network of Thailand developed in PSS®E for year 2022.

[15] The generation data is obtained from [17].

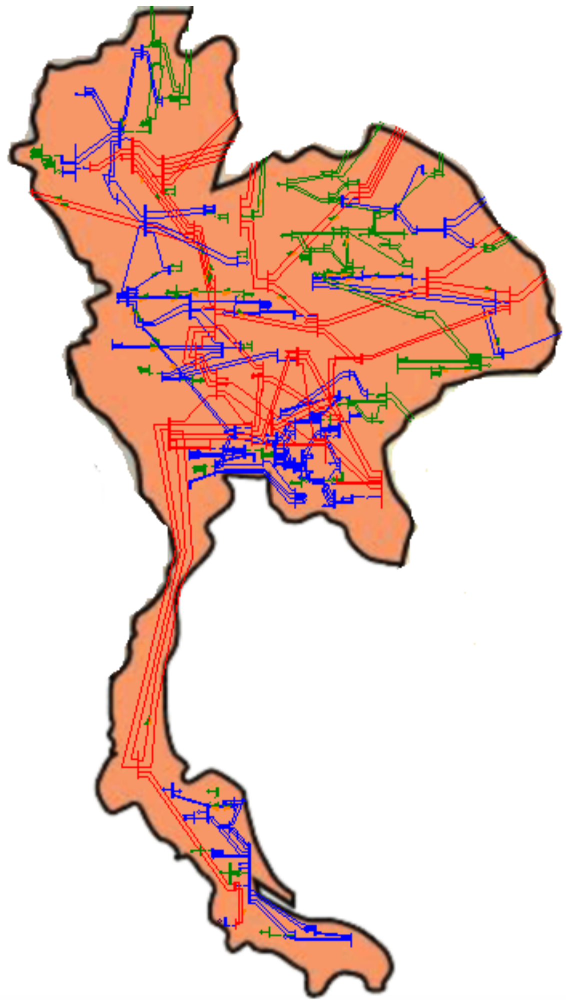

Figure 17: Single line diagram of the Thailand Transmission Network (Red – 500 kV, Blue – 230 kV, Green – 115 kV system)

E. Power System of Viet Nam

89. A demand forecast of Viet Nam for the period 2015-2030 [25] is presented in Figure 18. This demand forecast is extended to 2035 to be used in the study model.

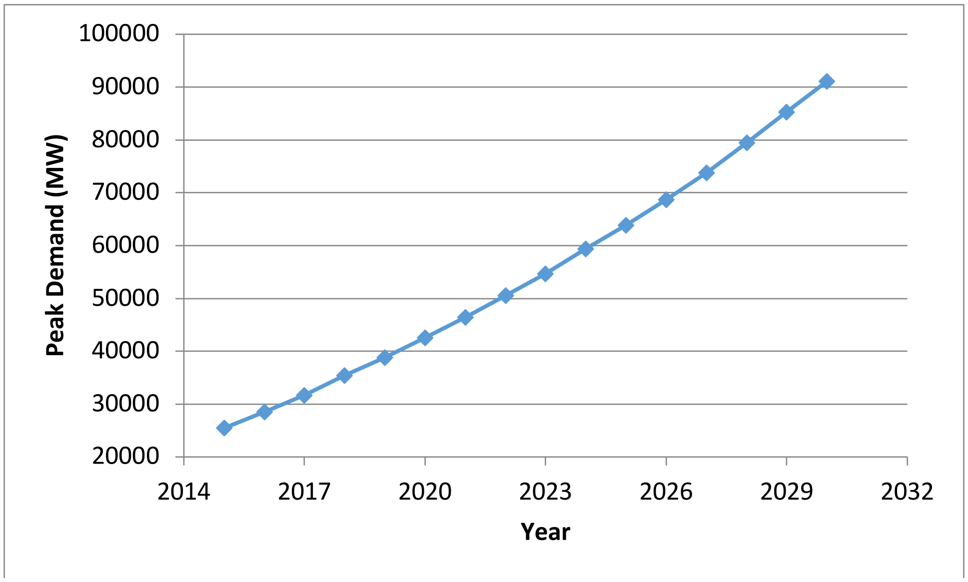

Figure 18: Viet Nam Demand Forecast

90. The demand of Viet Nam is high, and there is relatively high demand growth, which makes Viet Nam the largest load center in the GMS region. The demand is mainly concentrated in the north and south regions, with a smaller demand in the central region.

91. The daily demand curve of Viet Nam [26] used for the study, represented as a percentage of the daily peak is provided in Figure 19.

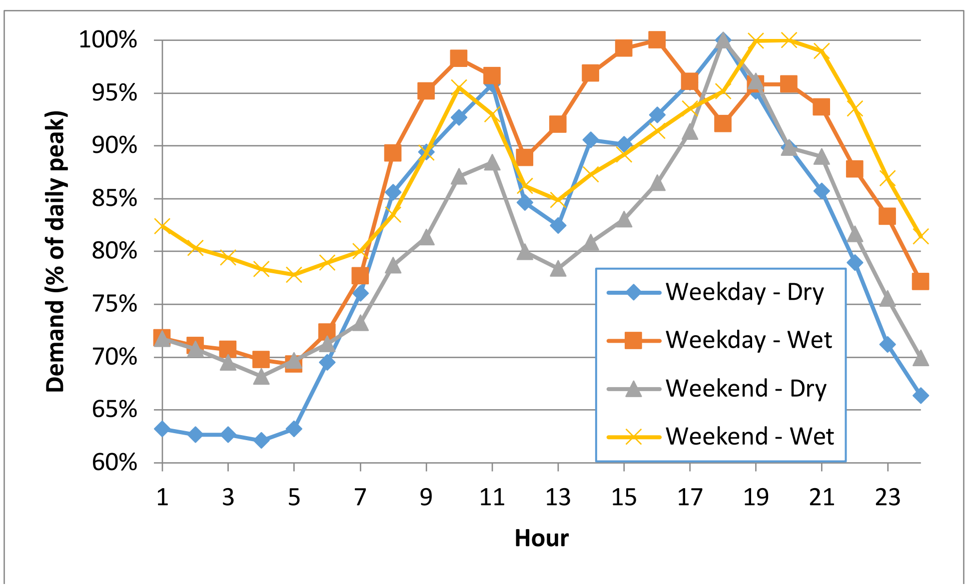

Figure 19: Viet Nam Typical Daily Demand Curve

92. The regional distribution of the demand for Viet Nam is derived from the regional distribution available in [21] and the demographic distribution found in [20].

93. Pie charts showing the existing and future generation[16] in Viet Nam are shown in Figure 20.

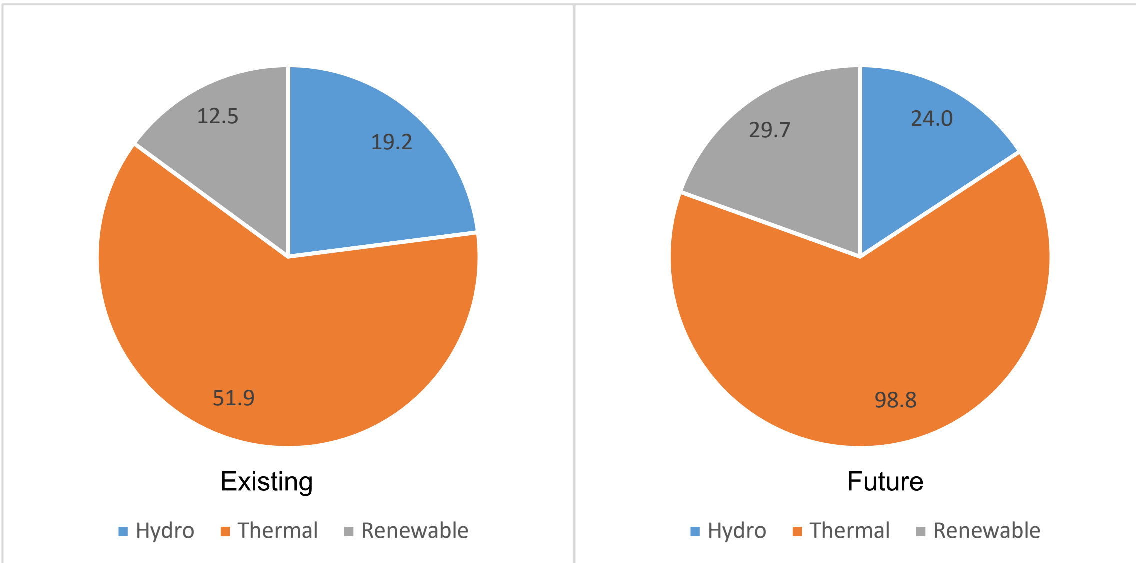

Figure 20: Existing and future generation in Viet Nam (in GW)

94. The available generation plans for Viet Nam indicate very high coal generation development in Viet Nam. There is significant potential for wind and solar generation in Viet Nam, mostly in the southern and central regions. A full list of the generation data is given in Appendix 1: Full Generation List per Country.

[16] The generation data is obtained from [21], [22], [23], [24], [27] and [38].

95. Figure 21 depicts the single line diagram of the high voltage transmission network of Viet Nam developed in PSS®E for year 2022.

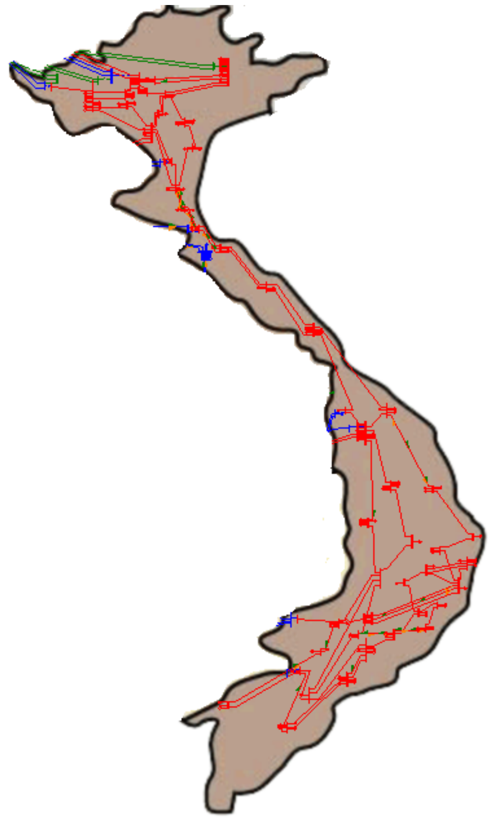

Figure 21: Single line diagram of the Viet Nam Transmission Network (Red – 500 kV, Blue – 230 kV, Green – 115 kV system)

96. Of note in the transmission network of Viet Nam is the relatively weak connections in the north-central corridor.

F. Power System of Peoples' Republic of China (PRC)

97. The power system model representation for PRC (Yunnan and GuangXi provinces) is treated differently than the representation of other countries. PRC is represented by only a small number of nodes since network data is not available. The existing power trade is maintained by connecting separate nodes to Viet Nam, Myanmar and Lao PDR with lumped generation or demand to model the cross-border power trade.

98. PRC may not have excess power to export after the year 2023. (Appendix 5: Comments Matrix). Therefore, the impact power import, export and power wheeling of PRC is studied under sensitivity scenarios. There is a possibility that PRC may develop potential hydro resources after 2025. This possibility is analyzed in a sensitivity scenario.

G. Existing/Planned Cross-Border Interconnections

99. Existing and planned (committed) cross-border interconnections have been identified through information provided in country reports. Type of interconnection (HVAC/HVDC), voltage level, connection locations, line lengths and transfer capacities are identified from available data [37]. Existing high and medium voltage cross-border interconnections are listed in Table 7.

Table 7: Existing and committed High and Medium Voltage Cross-border interconnections in GMS

From	To	Connection Points	Voltage (kV)	Type[17]	Circuits	Length (km)	Capacity (MW)
PRC	Viet Nam	Xinqiao (Guman) - Lao Cai	220	HVAC	2	56	300
PRC	Viet Nam	Maguan (Malutang) - Ha Giang	220	HVAC	1	51	200
Myanmar	PRC	Shweli 1 HPP - Dehong	220	HVDC	2	120	600
Myanmar	PRC	Dapein 1 HPP - Dehong	500	HVAC	1	120	240
Lao PDR	Thailand	Nam Theun 2 HPP - Roi Et 2	500	HVAC	2	304	950
Lao PDR	Thailand	Houay Ho HPP - Ubon 2	230	HVAC	2	230	126
Lao PDR	Thailand	Theun Hinboun HPP - Thakhek - Nakhon 2	230	HVAC	2	176	434
Lao PDR	Thailand	Nam Ngum 2 - Na Bong - Udon 3	500	HVAC	2	187	1050
Lao PDR	Thailand	Hongsa TPP - Nan - Mae Moh 3	500	HVAC	2	325	1878
Viet Nam	Cambodia	Chau Doc - Takeo - Phnom Penh	220	HVAC	2	111	200
Lao PDR	Viet Nam	Xekaman 3 HPP - Thanh My	220	HVAC	2	115	250
Lao PDR	Viet Nam	Xekaman 1 HPP (Hatxan) - Pleiku	220	HVAC	2	120	300
Lao PDR	Thailand	Takhek - Nakhon Phanom	115	MVAC	2	61	160
Lao PDR	Thailand	Nam Leuk HPP - Pakxan - Bueng Kan	115	MVAC	1	11	80
Lao PDR	Thailand	Phontong - Nong Khai 1	115	MVAC	2	51	160
Lao PDR	Thailand	Pakbo - Savannakhet - Mukdahan 2	115	MVAC	1	5	80
Lao PDR	Thailand	Xeset HPP - Sirindhorn HPP - Ubon 1	115	MVAC	1	61	80
PRC	Lao PDR	Mengla - Na Mo	115	MVAC	1	60	35
PRC	Viet Nam	Maomatiao - Ha Giang	110	MVAC	1	30	115
PRC	Viet Nam	Hekou - Lao Cai	110	MVAC	1	20	91
PRC	Viet Nam	Shengou - Mong Cai	110	MVAC	1	60	25
Thailand	Cambodia	Aranya Prathet - Banteay Manchey	115	MVAC	1	40	80
PRC	Myanmar	Menglong - Jingyang	110	MVAC	1	150	75
Lao PDR	Thailand	Xayaburi HPP - Tha Li - Kon Kaen 4	500	HVAC	2	390	1220
Lao PDR	Thailand	Pakse - Ubon 3	500	HVAC	2	90	1200

[17] HVAC > 132 kV, 66 kV ≤ MVAC ≤ 132 kV, LVAC < 66 kV.

100. The geographical distribution of high and medium voltage interconnections in the GMS region is shown in Figure 22.

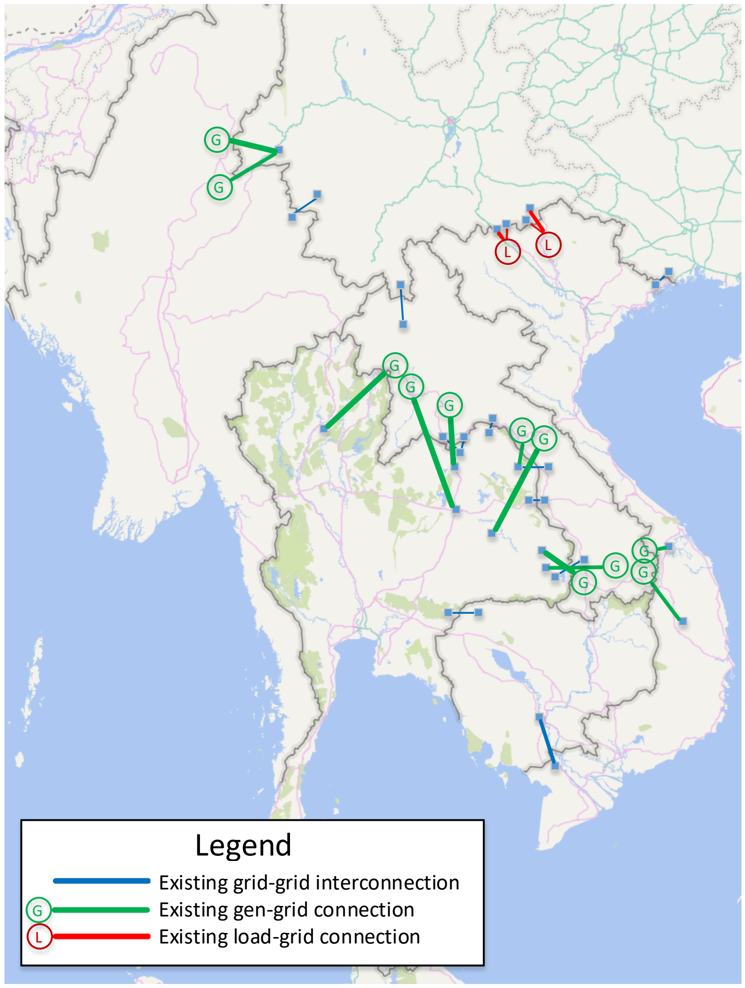

Figure 22: Existing High and Medium Voltage Cross-Border Interconnections

101. Grid to grid, generator to grid and load to grid connections are shown in the map. At present, the only high voltage grid to grid interconnection in the GMS region is between Viet Nam and Cambodia.

102. In addition, there are a number of low voltage connections (22-35 kV) between GMS countries. These low voltage connections are listed in Table 8.

Table 8: Existing Low Voltage Cross-border interconnections in GMS

LV connections			
From	**To**	**Voltage [kV]**	**Number**
Lao PDR	Cambodia	22	2
Thailand	Cambodia	22	8
Lao PDR	Viet Nam	22	6
Viet Nam	Cambodia	22/35	18

H. Candidate Cross-Border Interconnections

103. Proposed cross-border interconnections have been identified through information provided in [37], [38] and [39] as well as various country PDPs and RPTCC country presentations. Type of interconnection (HVAC/HVDC), voltage level, connection locations, line lengths and transfer capacities are identified from available data. Candidate high voltage cross-border interconnections are shown in Table 9.

Table 9: Candidate Cross-border interconnections in GMS region

No.	From	To	Connection Points	Voltage (kV)	Type	Length (km)	Capacity (MW)
1	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	500	HVAC	120	1000
2	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	220	HVAC	200	120
3	PRC	Thailand	Gan Lan Ba - Tha Wung via Lao-N	600	HVDC	1300	3000
4	Myanmar	Thailand	Yangon area - Mae Moh	500	HVAC	350	1500
5	Myanmar	Thailand	Mawlamyine - Tha Tako	500	HVAC	300	1500
6	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau - Nho Quan	500	HVAC	400	2500
7	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	500	HVAC	500	300
8	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	500	HVAC	100	300
9	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	230	HVAC	230	200
10	PRC	Viet Nam	Yunnan - Hiep Hoa	500	HVDC	1200	3000
11	Myanmar	Thailand	Mae Khot TPP - Mae Chan	230	HVAC	115	370
12	Lao PDR	Cambodia	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	500	HVAC	320	1000
13	Lao PDR	PRC	Luang Prabang - Yunnan	500	HVAC	350	650
14	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	500	HVAC	200	600
15	Myanmar	PRC	Mandalay - Yunnan	500	HVAC	350	600
16	Lao PDR	Myanmar	Namo - Kenglatt – Tachileik – Kengtung	230	HVAC	230	800
17	Lao PDR	Thailand	M. Houn – Nan	500	HVAC	130	3000
18	Lao PDR	Thailand	Thabok – Pakxan – Bungkan	230	HVAC	60	500

104. A description of the candidate cross-border interconnections used in the study are provided below.

1. Xekaman 4 HPP - Ban Soc/Ban Hatxan – Pleiku (Lao PDR – Viet Nam)

105. This 500 kV interconnection would facilitate export of hydro power from southern Lao PDR to central Viet Nam. The hydro plants to be connected includes Xekaman 4 HPP (80 MW) as well as other nearby hydro plants. These hydro plants could be connected into an export dedicated network for a generator-grid interconnection, or the interconnection could be connected as a grid-grid interconnection. If connected as a synchronous grid-grid interconnection, various challenges of operating synchronized grids would need to be addressed, as described in Chapter VIII.

106. Since there are nearby existing and committed lines that connect southern Lao PDR to Thailand and a nearby candidate interconnection that would connect southern Lao PDR to Cambodia, there is potential for power trade between Lao PDR, Viet Nam, Thailand and Cambodia.

2. Nam Mo HPP - Ban Ve (Lao PDR – Viet Nam)

107. Nam Mo HPP - Ban Ve 220 kV interconnection is a generator-grid connection that would connect Nam Mo HPP in central Lao PDR to Northern Viet Nam [37]. Initially the expected capacity would be 120 MW, however, this value could increase as additional generation is connected.

3. Gan Lan Ba - Tha Wung via Lao-N (PRC – Thailand)

108. Gan Lan Ba - Tha Wung via Lao-N interconnection is a 600 kV point-to-point HVDC scheme identified by ADB and APERC to enhance power trade in the GMS region [37]. It is intended to export hydro power from Yunnan to Thailand. There is also potential to wheel hydro power from Lao PDR in the wet season to export to PRC. This line is about 1,300 km long and would be quite expensive. Also, this will depend on the PRC's future planning on increased exports (Appendix 5: Comments Matrix).

4. Yangon area - Mae Moh (Myanmar – Thailand)

109. Yangon area - Mae Moh 500 kV interconnection would connect the Yangon area in Myanmar to Northern Thailand. Initially, this interconnection could be used to export power from Thailand to Myanmar. In the long term when Myanmar develops more generation resources, power could be exported from Myanmar to Thailand.

5. Mawlamyine - Tha Tako (Myanmar – Thailand)

110. This 500 kV interconnection from eastern Myanmar to western Thailand is intended for initially exporting power from Thailand to Myanmar. However, if Myanmar develops nearby generation resources the interconnection could potentially be used to export power from Myanmar to Thailand.

6. Luang Prabang HPP - Xam Nau - Nho Quan (Lao PDR – Viet Nam)

111. Luang Prabang HPP - Xam Nau - Nho Quan 500 kV interconnection between northern Lao PDR and northern Viet Nam is expected to export hydro power from Luang Prabang province

and Huaphanh province in Lao PDR to Nho Quan in Viet Nam, near a major load center in Hanoi. It is a generator–grid interconnection that could connect hydro generation in northern Lao PDR in excess of 1,200 MW [37].

7. Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham (Thailand – Cambodia)

112. This candidate 500 kV interconnection would connect central Thailand with Cambodia. The project would include several sections of line inside Cambodia from Banteay Mean Chey to Siem Reap to Kampong Thom and finally to Kampong Cham. This project could help support the very high demand growth in Cambodia.

113. Together with the candidate interconnection Kampong Cham – Tay Ninh, there is potential to connect Thailand to Viet Nam. There is also a nearby candidate interconnection from southern Lao PDR to Cambodia at Stung Treng, which gives an opportunity to interconnect Thailand, Viet Nam, Lao PDR and Cambodia [37].

114. Since this project includes line sections that span from Banteay Mean Chey in the northwest to Kampong Cham in the east, the length of transmission lines is about 500 km long. Therefore, the investment cost of this project is high.

8. Kampong Cham - Tay Ninh (Cambodia – Viet Nam)

115. Eastern region of Cambodia and southern Viet Nam may be interconnected using Kampong Cham - Tay Ninh 500 kV interconnection. The purpose of the development of this interconnection is for Cambodia to import power from Viet Nam to Cambodia in the short term. If Cambodia develops its generation, there is potential for Cambodia to export to Viet Nam later in the study period.

116. Together with the candidate interconnection from Thailand to Kampong Cham, there is potential to interconnect Viet Nam and Thailand. There is also a nearby candidate interconnection from southern Lao PDR to Cambodia at Stung Treng, which gives an opportunity to interconnect Thailand, Viet Nam, Lao PDR and Cambodia [37].

9. Lower Se San 2 HPP – Pleiku (Cambodia – Viet Nam)

117. Lower Se San 2 HPP – Pleiku 230 kV interconnection would be used to export power from Lower Se San 2 HPP with capacity of 400 MW from northeast Cambodia to central Viet Nam, as well as supply domestic demand.

10. Yunnan - Hiep Hoa (PRC – Viet Nam)

118. A 500 kV point-to-point HVDC scheme, Yunnan - Hiep Hoa is intended to export hydro power from Yunnan to northern Viet Nam. This interconnection would allow for resource sharing between Viet Nam and PRC due to non-coincidental peak demand [37], as well as for changes in wet and dry seasons. This line is about 1,200 km long and could be expensive. Also, this will depend on the PRC's future planning on increased exports (Appendix 5: Comments Matrix).

11. Mae Khot TPP - Mae Chan (Myanmar – Thailand)

119. The 230 kV interconnection, Mae Khot TPP - Mae Chan is intended to connect the Mae Khot TPP with 350 MW capacity in eastern Myanmar to northern Thailand. This lignite coal plant would reduce the gas generation in Thailand, providing fuel diversity [37].

12. Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng (Lao PDR – Cambodia – Viet Nam)

120. This candidate 500 kV interconnection would connect southern Lao PDR, northern Cambodia and southern Viet Nam. It is intended for exporting hydro power in southern Lao PDR and northern Cambodia to Viet Nam.

13. Luang Prabang – Yunnan (Lao PDR – PRC)

121. Luang Prabang – Yunnan 500 kV interconnection would connect northern Lao PDR and Yunnan province in PRC. The interconnection would be used to export power from northern Lao PDR to PRC in the wet season and import power in the dry season.

14. Savannakhet - Ha Tihn (Lao PDR – Viet Nam)

122. Savannakhet in southern Lao PDR could be connected to Ha Tihn in central Viet Nam using a 500 kV interconnection. Since there is an existing 115 kV interconnection from Savannakhet to Thailand, and there is a nearby 500 kV connection from Nam Theun 2 HPP to Thailand there is potential to interconnect Thailand, Viet Nam, and Lao PDR.

15. Mandalay – Yunnan (Myanmar – PRC)

123. Northern Myanmar to Yunnan province in PRC could be interconnected using this candidate 500 kV interconnection. It is intended for importing power from PRC to Myanmar in the short term, and export power from Myanmar to PRC in the long term when Myanmar develops its large hydro potential in the northern region.

16. Namo - Kenglatt – Tachileik – Kengtung (Lao PDR – Myanmar)

124. This 230 kV interconnection would connect northern Lao PDR to eastern Myanmar. The terminal bus Namo in Lao PDR is in the northern area of Lao PDR that has a surplus of hydro generation available.

125. This interconnection would enhance the power export capability and reliability of both countries. However, challenges associated with high capacity synchronous interconnection would need to be addressed (see Chapter VIII)

17. M. Houn – Nan (Lao PDR – Thailand)

126. M. Houn – Nan 500 kV interconnection would connect northern Lao PDR to northern Thailand. The terminal bus M. Houn in Lao PDR is close to a large PDA approved hydro plant MK. Pakbeng (912 MW) [38].

127. The interconnection would reduce fossil fuel costs in Thailand, and could support power wheeling from Lao PDR through Thailand to Malaysia, Cambodia, and Myanmar. However, import restrictions in Thailand could impact the usefulness of this line.

18. Thabok – Pakxan – Bungkan (Lao PDR – Thailand)

128. This 230 kV interconnection would connect central Lao PDR to northern Thailand. There is a nearby existing 115 kV interconnection Pakxan – Bungkan [38].

129. The interconnection would reduce fossil fuel costs in Thailand, and could support power wheeling from Lao PDR through Thailand to Malaysia, Cambodia, and Myanmar. However, import restrictions in Thailand could impact the usefulness of this line.

130. In addition to the above 18 candidate cross-border transmission interconnections, several other interconnections are added during the optimization process for the aggressive cross-border transmission development scenario when additional capacity is required.

IV. Methodology

131. In order to develop the regional master plan for GMS region, most beneficial regional generation and transmission scenarios are needed to be identified considering the variation of a number of technical and economic factors. The regional generation plan is developed for the 2022-2035 period and the regional transmission plan is developed for 2022-2032 period[18]. A comprehensive study model is developed by incorporating the demand, generation and transmission data for the study period based on the power development plans of individual countries, independent study reports and other public domain data. This study model is used to optimize the generation and transmission scenarios for the region.

132. A number of regional generation and transmission development scenarios are developed to include the uncertainty and variations associated with the data inputs in the study model. Figure ***23*** provides an overview of the aspects considered in deriving the planning scenarios. Exact demand in the region cannot be precisely predicted for a long period of time and hence, multiple demand growth scenarios needed to be considered. In addition, as a number of economic and technological/policy factors may affect the generation and transmission development in the region, a number of scenarios are developed to include the impact of such factors. These factors include variations in fuel cost, variation of VRE development costs, etc. OptGen™/SDDP™ is used for the analysis, which is a tool for determining the least-cost expansion of a hydrothermal system with VRE generation.

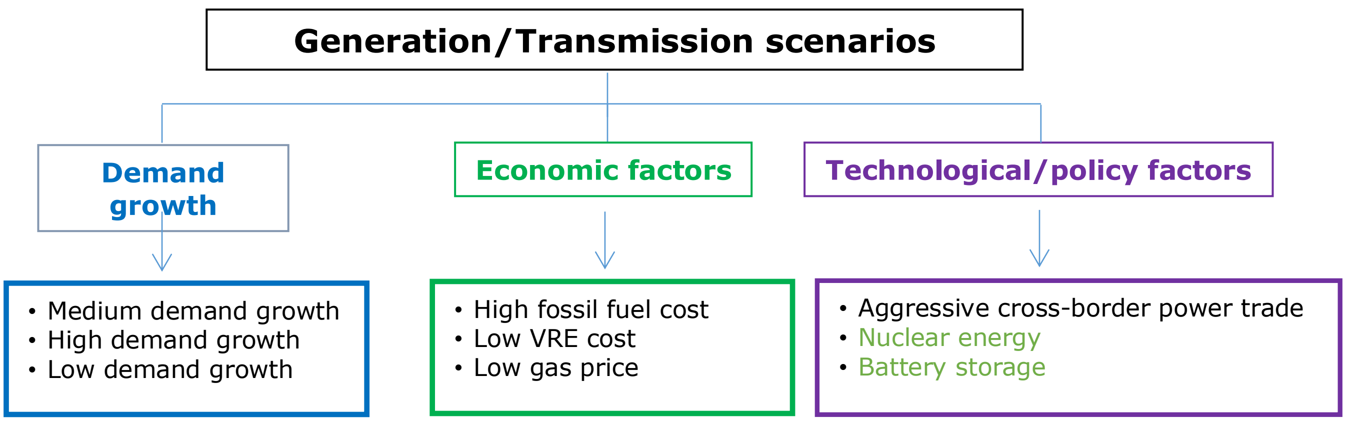

Figure 23: Various aspects considered for generation scenario development

133. The study model developed using the least-cost expansion tool is used to minimize the total cost of the GMS regional power system for the study period including the capital and operational expenditure.

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[18] It is a standard practice that generation planning is performed for a longer period than transmission planning. The uncertainty of the generation plan increases significantly towards the end of the study period. If the transmission planning period is the same as the generation planning period, the accuracy of the transmission plan towards the end of the study period will suffer due to the uncertainty of the generation plan.

134. The main component of the total cost is the operational cost of energy generation (generation OPEX) which largely consists of the fuel cost. Capital expenditure for generation and transmission (generation CAPEX and transmission CAPEX) are significantly smaller compared to the generation OPEX.

135. Generation OPEX and hence the total cost, can be reduced by investing on lower cost generation and building transmission lines (i.e. by increasing the generation and transmission CAPEX) to effectively utilize the existing and planned generation. However, if there are excessive generation and transmission investments or if they become less lucrative, the incremental CAPEX may negate the cost advantage gained by reducing generation OPEX and hence, increase the total cost. This is further illustrated in Figure 24.

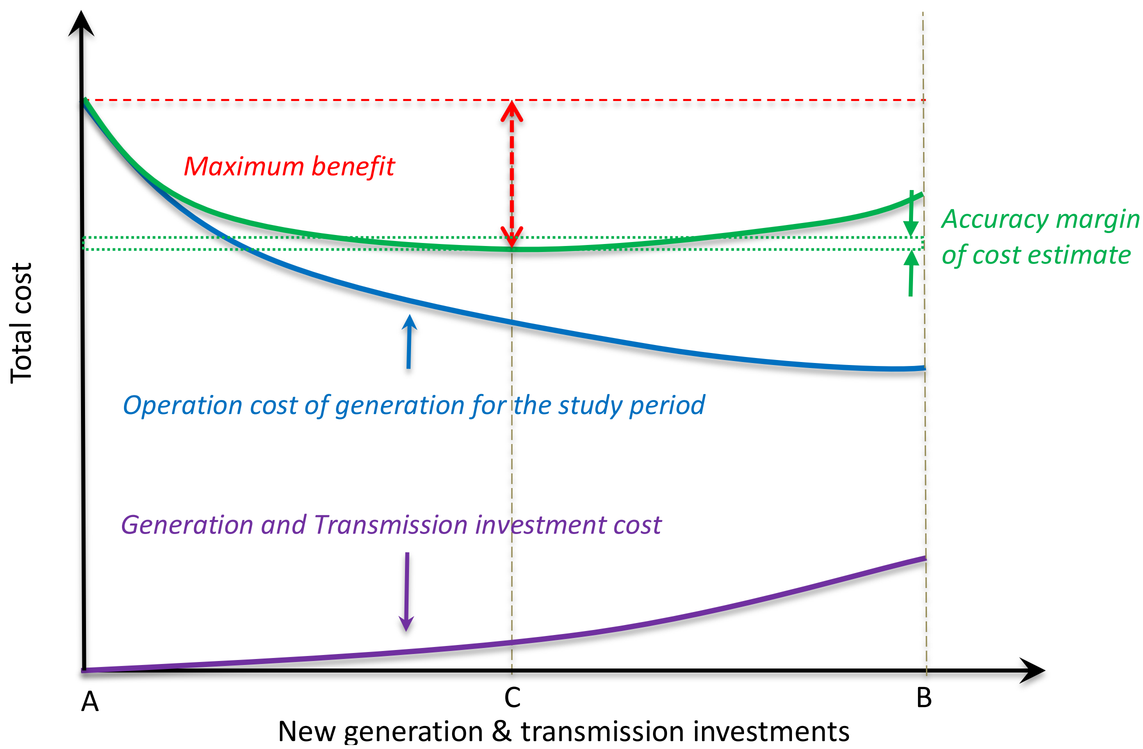

Figure 24: Total cost variation with generation & transmission development

136. Therefore, the amount, type and time (staging) for investments on generation and transmission to minimize the total cost is an optimization problem. This optimization problem is solved for the GMS regional power system for a number of scenarios (to account for the variation of technical and economic factors) using the developed study model.

137. OptGen™/SDDP™ study model used for the analysis mainly considers the costs related to generation and cross-border transmission developments. However, the cost of upgrading the transmission network of individual countries is also essential to realize the regional generation and transmission plans. Therefore, the detailed bulk transmission network of the GMS region is developed using PSS®E software to capture the complete 500 kV network and the relevant 230/220 kV and 110/115 kV networks. This model is used to identify the major transmission upgrades in individual countries for different planning scenarios and the cost of these upgrades are included for the regional plans.

138. Figure 25 illustrates the summary process flow diagram of the regional master plan development including inputs, outputs and major steps during the process.

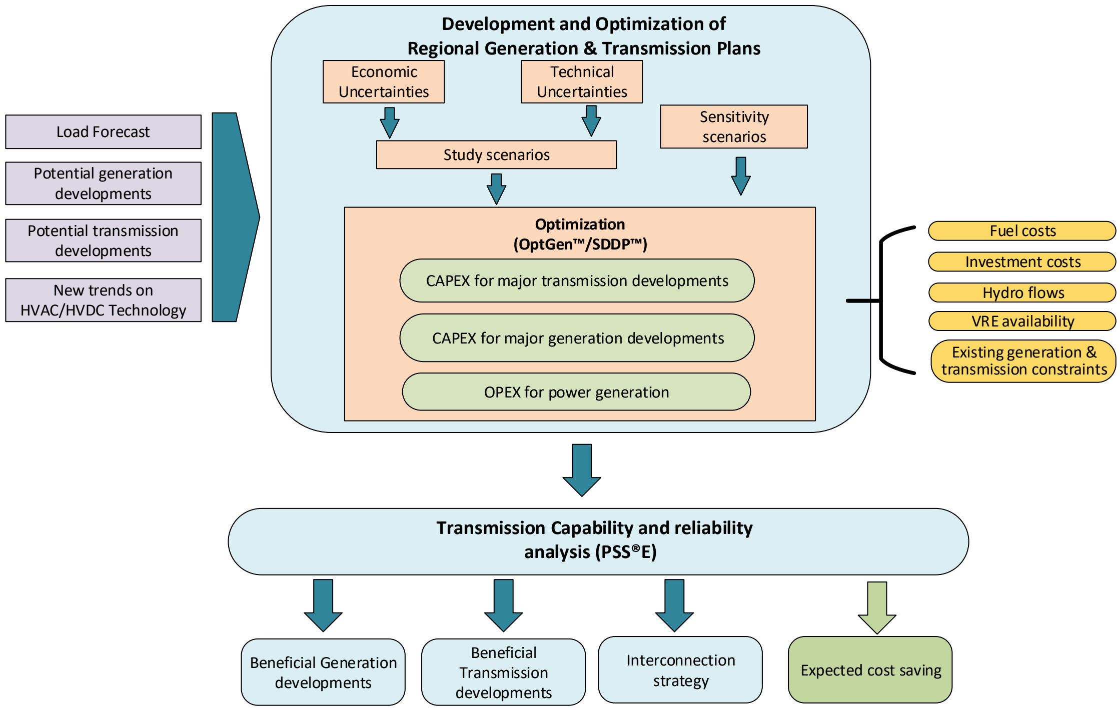

Figure 25: Process flow diagram for the GMS master plan development

139. Once each of the above steps are complete, a refined set of generation and transmission planning scenarios is identified to be included in the regional generation and transmission master plan. These scenarios are expected to yield financial benefits to both the region as a whole and to the individual countries.

A. Assumptions

140. The following global assumptions are required for the completion of the study model and to perform the technical and economic studies. They are general assumptions applied to the study model for representing power systems in the GMS region. Other specific assumptions and modelling details are explained in Chapter IV, Study Model development.

B. GMS Power System Data Related Assumptions

141. Demand forecasts for several countries do not extend to the end of the study period (2035). The demand forecast data is extended to 2035 assuming the available demand growth rates.

142. Hydrology data of the Mekong River is used to determine the variation of hydro inflows of all hydro-electric dams included in the model [28].

143. Solar variation patterns are derived from available monthly variation and daily variation data [12], [21].

144. Wind variation patterns are derived from available monthly variation and daily variation data [12], [21].

C. Cost Related Assumptions

145. The cost of each type of fuel is assumed uniform across the entire GMS region[19].

146. Capital investment cost for new generation development is assumed uniform throughout the entire GMS region (Appendix 4: Generation and Transmission Cost Estimations).

147. The investment costs for High Voltage Alternating Current (HVAC) transmission are calculated using assumed costs for the line (per km), transformers and substation bay upgrades (Appendix 4: Generation and Transmission Cost Estimations).

148. The investment costs for High Voltage Direct Current (HVDC) links are calculated using assumed costs for the line (per km), and converter stations (Appendix 4: Generation and Transmission Cost Estimations).

[19] Further details are provided in section IV -

V. Study Model Development

A. Data Inputs for Study Model

149. OptGen™/SDDP™ software program is used to perform the generation and transmission planning studies. In addition PSS®E software is used to identify the major transmission bottlenecks in the local networks which are used to capture the cost of local network upgrades.

150. In this model, the daily demand variation is modeled by specifying a number of demand "blocks" to represent the discretized daily demand curve. For this study, seven (7) blocks are used to represent the demand, as shown in Figure 26.

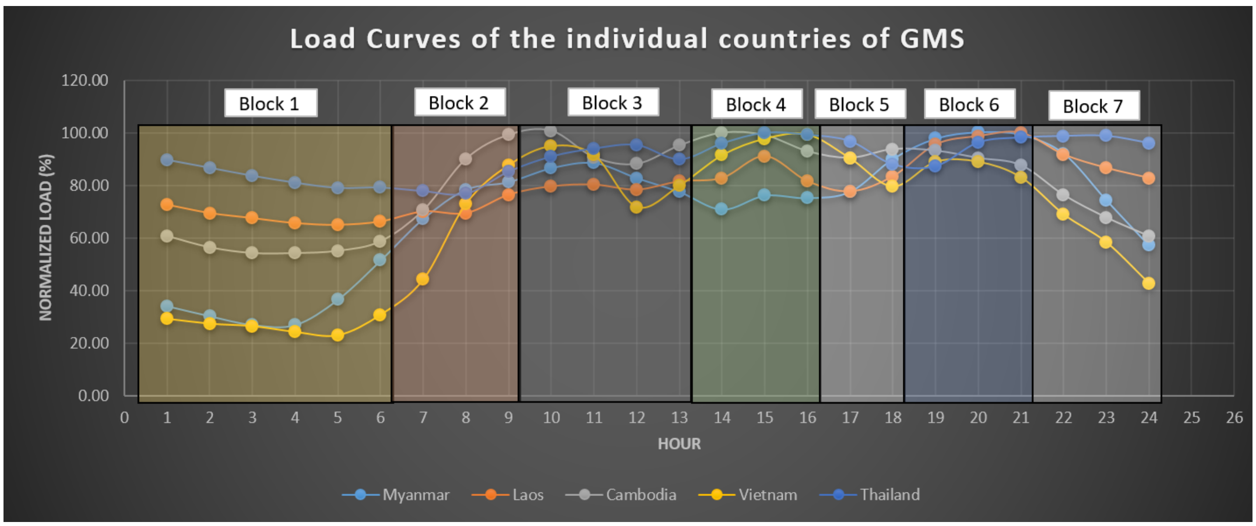

Figure 26: Demand blocks for SDDP

151. An average demand level is assigned for each block in the study model to represent the discretized demand curve of individual countries. The representative demand curves used for individual countries are also shown in Figure 26.

152. The daily demand curves are used together with demand forecasts of each county to develop the demand model for each month of the study period[20]. In addition to the base demand forecast data (assumed as the medium demand growth), high and low demand growth scenarios are also analyzed to capture the uncertainty in demand growth.

153. The generation in the GMS region is first modeled by adding the existing generation to the model, as well as generation that will be developed before year 2022 (the beginning of the study period). Any planned generation with commissioning dates in the 2022-2025 period are added to the model such that they enter into service in the beginning of the corresponding commissioning year. Any other planned generation is added to the model as "candidate" projects to be optimized by the study model.

[20] When the load forecast data is not available towards the end of the study period, same load growth rates in the available data is assumed to continue until the end of the period.

154. A simplified model of the electrical network of individual country is used in OptGen™/SDDP™ where each country is represented by several key nodes representing highly meshed area in the electrical network. The existing/planned and potential cross-border links are modelled as interconnections between the nodes belonging to different countries. Generators with similar characteristics in each node are aggregated to reduce the size of the optimization problem.

155. Once the initial generation/transmission planning results are obtained from the study model, they are implemented in the PSS®E model of the GMS region shown in Figure 27 and the required major local network upgrades are identified to capture the cost of internal transmission upgrades.

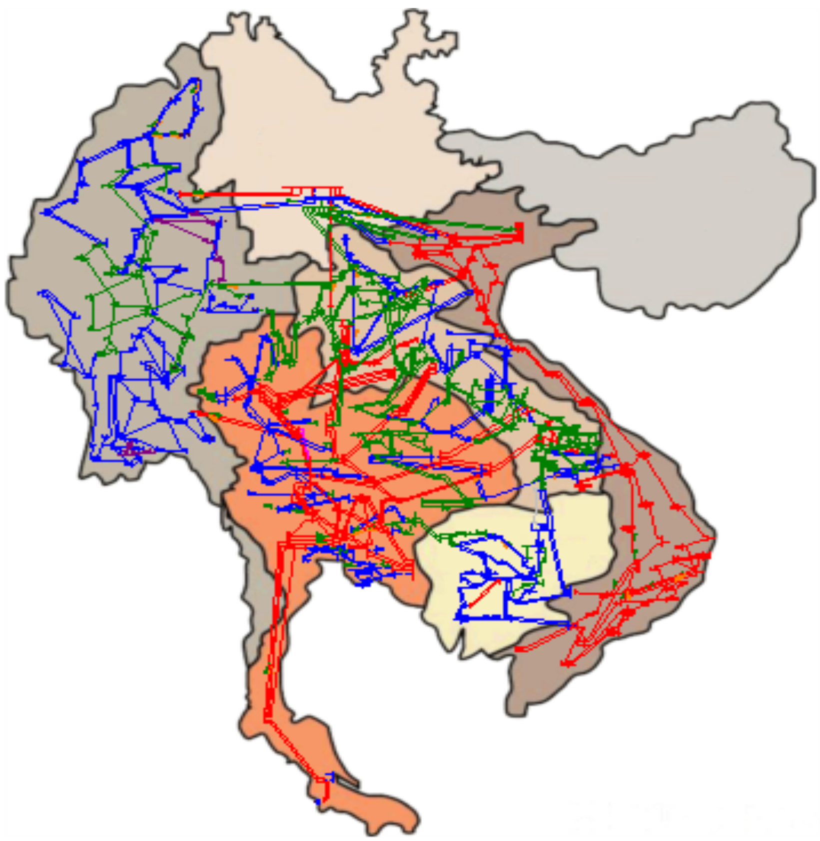

Figure 27: Detailed bulk transmission model of the GMS region

156. The availability of hydro generation is determined by the water inflows to the hydro-electric generation systems. Since detailed hydrological data is not available, the variation of hydro inflows is estimated using the monthly flow rate of the Mekong River as the reference. This accounts for the variation between the wet and the dry seasons.

157. The availability of wind and solar generation is modeled as a fixed schedule for each demand block for each month of the year. This schedule is derived using the annual and daily variation data of wind and solar energy (details provided in Appendix 3: Generation Availability). This information is used to determine the availability of wind and solar generation for each demand block.

158. Thermal generation is modeled by incorporating a typical fuel cost corresponding to the type of fuel used. A list of fuel costs used in the study is given in Table 10. The data is obtained from the references [11], [14], [29] and [30].

Table 10: Fuel cost list

Fuel	Price ($/MWh)
Coal[21]	28
Gas	63
Furnace Oil	55
Diesel	225
Combined Cycle	47
Co-generation	40
Nuclear	7
Oil	55
PRC coal	36

159. The generation investment costs and operating and maintenance (O&M) costs used in this study are shown in Appendix 4: Generation and Transmission Cost Estimations. Outage rates of generation is also considered for each type of generation in the study. Investment cost data is obtained from [31] and [32], O&M cost data is obtained from [33] and outage rate data is obtained from [34], [35] and [36].

B. Considerations for Development of Study Scenarios

160. Various study scenarios considering demand growth, economic, technological and policy factors are incorporated into the OptGen™/SDDP™ study model to obtain a comprehensive set of optimized generation development scenarios. Details of factors considered for scenario development are shown in Table 11. In addition to these, a number of sensitivity scenarios are also studied which are discussed further in Chapter IX.

Table 11: Factors considered for generation scenario development

Demand growth	**Description**
Medium	Medium demand growth scenario
High	High demand growth scenario
Low	Low demand growth scenario
Economic factors	**Description**
Low gas price	Natural gas fuel cost decreased
Low VRE cost	Wind and solar plant capital cost decreased and potential capacity increased
High fossil fuel price	Fossil fuel costs increased
Technological/ policy factors	**Description**
Solar with battery storage	Solar plant availability is increased to include the night, and solar plant investment cost increased
Nuclear development	Nuclear plant candidates are included from 2030
Aggressive cross-border power trade	Additional cross-border power trade options included

[21] The coal fuel prices used for Thailand and PRC are 32 $/MWh and 36 $/MWh, respectively.

C. Study Scenarios

The uncertainties associated with data should be taken into account when developing long term master plans. Therefore, it is important to perform simulations considering a number of different study scenarios. Thirty (30) main study scenarios (In addition to the three (3) base scenarios) are modeled in OptGen™/SDDP™ considering different regional demand growth rates, economic factors as well as technological/policy factors. Furthermore, twelve (12) sensitivity scenarios are developed to cover unforeseen and extreme future situations including COVID-19. Results of the sensitivity scenarios are discussed in Chapter IX.

161. The demand growth of the region is tied to a number of different variables such as economic development, rural electrification policies, etc. Three separate demand growth rates, medium (most likely case), high and low demand growth are studied to consider the uncertainty related to demand growth.

162. Three economic factors considered in this study are as follows:

- Low gas price: A reduction in gas price due to higher production, subsidies, etc. is considered. Gas, combined cycle and co-generation fuel prices are reduced by 20% compared to expected prices.
- Low VRE cost: A reduction of the capital cost in the VRE generation due to the advancements of technology and higher competition is assumed. Investment cost of solar and wind generation is reduced by 20% and the VRE generation capacity available for development is increased by 10%.
- High fossil fuel price: A future state with high fossil fuel prices is considered. All fossil fuel prices (coal, gas, fuel oil, etc.) are increased by 20%.

163. The technological/policy factors that are considered in this study are as follows:

- Battery storage for solar: A portion of the candidate solar plants (50%) are assumed to be equipped with Battery Storage System (BSS), which improves the availability curve (provided in Appendix 3: Generation Availability) of solar plants. The investment cost of solar generation with BSS is assumed to be 25% higher than the typical solar plants without BSS [32].
- Nuclear development: The option of developing nuclear plants to supply large demand centers in Thailand and Viet Nam is considered from 2030 onward. Nuclear generation has a larger capital cost but could be a cost-efficient alternative in the long term.
- Aggressive cross-border power trade: A higher emphasis is put on development of cross-border interconnections with additional cross-border transfer capacity available for development.

164. An identification code is defined to refer to each scenario. The code is of the form, "X_YYY_ZZZ" where each term 'X', 'YYY' and 'ZZZ' corresponds to a demand growth scenario, economic factor and a technological/policy factor, respectively. The specific factors used for scenario development and their abbreviated term used in the syntax are described in Table 12.

Table 12: Description of the Study Scenario Identification Code

Demand growth	**Economic factor**	**Technological/Policy factor**
X (M/H/L)	**YYY** (BASE /GAS/VRE/HIF)	**ZZZ** (BASE/BSS/NUC/INT)
M: Medium demand growth	BASE: Base[22]	BASE: Base
H: High demand growth	GAS: Low gas price	BSS: Solar with battery storage
L: Low demand growth	VRE: Low VRE cost	NUC: Nuclear development
-	HIF: High fossil fuel price	INT: Aggressive cross-border power trade

165. A reference scenario is developed for each of the three demand growth conditions for cost comparison purposes. These reference scenarios represent the planned and proposed regional generation and transmission developments based on individual country plans and already committed cross-border transmission development projects[23]. A description of the study scenarios is listed in Table 13.

Table 13: Study Scenarios

No.	Scenario	Demand Growth	Economic Factor	Technological/Policy Factor
RM	M_REFERENCE	Medium	Base	Base
BM	**M_BASE_BASE**	**Medium**	**Base**	**Base**
S1	M_GAS_BASE	Medium	Gas fuel price reduced	Base
S2	M_VRE_BASE	Medium	VRE technology cost reduced	Base
S3	M_HIF_BASE	Medium	High fossil fuel price	Base
S4	M_BASE_BSS	Medium	Base	Solar-battery storage
S5	M_VRE_BSS	Medium	VRE technology cost reduced	Solar-battery storage
S6	M_BASE_NUC	Medium	Base	Candidate nuclear generation
S7	M_HIF_NUC	Medium	High fossil fuel price	Candidate nuclear generation
S8	M_BASE_INT	Medium	Base	Aggressive cross-border power trade
S9	M_HIF_INT	Medium	High fossil fuel price	Aggressive cross-border power trade
S10	M_VRE_INT	Medium	VRE technology cost reduced	Aggressive cross-border power trade
RH	H_REFERENCE	High	Base	Base

[22] If the status of the economic or technological factor is "Base" (BASE) in a study scenario, it indicates that the economic/technological situation modelled in the scenario is based on the most likely regional generation and transmission developments and the credible variations of economic/technological factors are not considered.
[23] Reference scenarios is similar to scenario S1 (base). However, future cross-border transmission development is limited to already committed generation and transmission development projects.

No.	Scenario	Demand Growth	Economic Factor	Technological/Policy Factor
BH	**H_BASE_BASE**	**High**	**Base**	**Base**
S11	H_GAS_BASE	High	Gas fuel price reduced	Base
S12	H_VRE_BASE	High	VRE technology cost reduced	Base
S13	H_HIF_BASE	High	High fossil fuel price	Base
S14	H_BASE_BSS	High	Base	Solar-battery storage
S15	H_VRE_BSS	High	VRE technology cost reduced	Solar-battery storage
S16	H_BASE_NUC	High	Base	Candidate nuclear generation
S17	H_HIF_NUC	High	High fossil fuel price	Candidate nuclear generation
S18	H_BASE_INT	High	Base	Aggressive cross-border power trade
S19	H_HIF_INT	High	High fossil fuel price	Aggressive cross-border power trade
S20	H_VRE_INT	High	VRE technology cost reduced	Aggressive cross-border power trade
RL	L_REFERENCE	Low	Base	Base
BL	**L_BASE_BASE**	**Low**	**Base**	**Base**
S21	L_GAS_BASE	Low	Gas fuel price reduced	Base
S22	L_VRE_BASE	Low	VRE technology cost reduced	Base
S23	L_HIF_BASE	Low	High fossil fuel price	Base
S24	L_BASE_BSS	Low	Base	Solar-battery storage
S25	L_VRE_BSS	Low	VRE technology cost reduced	Solar-battery storage
S26	L_BASE_NUC	Low	Base	Candidate nuclear generation
S27	L_HIF_NUC	Low	High fossil fuel price	Candidate nuclear generation
S28	L_BASE_INT	Low	Base	Aggressive cross-border power trade
S29	L_HIF_INT	Low	High fossil fuel price	Aggressive cross-border power trade
S30	L_VRE_INT	Low	VRE technology cost reduced	Aggressive cross-border power trade

VI. Results

166. A number of study scenarios are developed in OptGen™/SDDP™ for optimal generation and transmission planning simulations. The generation and cross-border transmission plans have been developed for Thirty six (36) study scenarios considering various future development directions. Descriptions of these scenarios are provided in the previous section (section IV), '*Methodology*
167.
168. *In* order to develop the regional master plan for GMS region, most beneficial regional generation and transmission scenarios are needed to be identified considering the variation of a number of technical and economic factors. The regional generation plan is developed for the 2022-2035 period and the regional transmission plan is developed for 2022-2032 period. A comprehensive study model is developed by incorporating the demand, generation and transmission data for the study period based on the power development plans of individual countries, independent study reports and other public domain data. This study model is used to optimize the generation and transmission scenarios for the region.

169. A number of regional generation and transmission development scenarios are developed to include the uncertainty and variations associated with the data inputs in the study model. Figure ***23*** provides an overview of the aspects considered in deriving the planning scenarios. Exact demand in the region cannot be precisely predicted for a long period of time and hence, multiple demand growth scenarios needed to be considered. In addition, as a number of economic and technological/policy factors may affect the generation and transmission development in the region, a number of scenarios are developed to include the impact of such factors. These factors include variations in fuel cost, variation of VRE development costs, etc. OptGenTM/SDDPTM is used for the analysis, which is a tool for determining the least-cost expansion of a hydrothermal system with VRE generation.

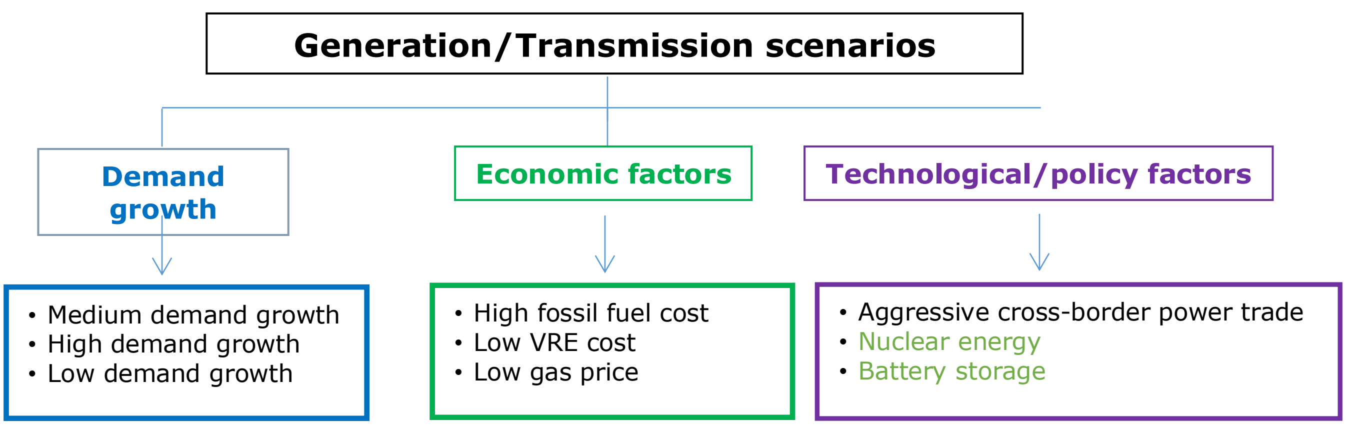

Figure 23: Various aspects considered for generation scenario development

170. The study model developed using the least-cost expansion tool is used to minimize the total cost of the GMS regional power system for the study period including the capital and operational expenditure.

171. The main component of the total cost is the operational cost of energy generation (generation OPEX) which largely consists of the fuel cost. Capital expenditure for generation and transmission

(generation CAPEX and transmission CAPEX) are significantly smaller compared to the generation OPEX.

172. Generation OPEX and hence the total cost, can be reduced by investing on lower cost generation and building transmission lines (i.e. by increasing the generation and transmission CAPEX) to effectively utilize the existing and planned generation. However, if there are excessive generation and transmission investments or if they become less lucrative, the incremental CAPEX may negate the cost advantage gained by reducing generation OPEX and hence, increase the total cost. This is further illustrated in Figure 24.

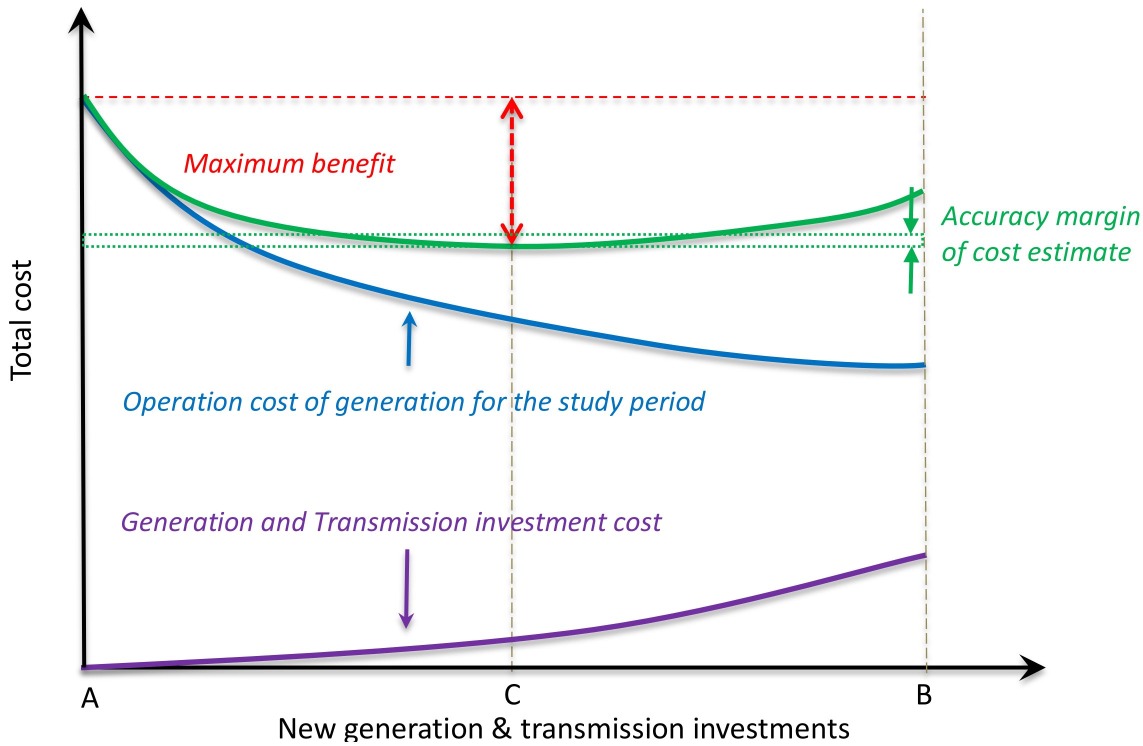

Figure 24: Total cost variation with generation & transmission development

173. Therefore, the amount, type and time (staging) for investments on generation and transmission to minimize the total cost is an optimization problem. This optimization problem is solved for the GMS regional power system for a number of scenarios (to account for the variation of technical and economic factors) using the developed study model.

174. OptGenTM/SDDPTM study model used for the analysis mainly considers the costs related to generation and cross-border transmission developments. However, the cost of upgrading the transmission network of individual countries is also essential to realize the regional generation and transmission plans. Therefore, the detailed bulk transmission network of the GMS region is developed using PSS®E software to capture the complete 500 kV network and the relevant 230/220 kV and 110/115 kV networks. This model is used to identify the major transmission upgrades in individual countries for different planning scenarios and the cost of these upgrades are included for the regional plans.

175. Figure 25 illustrates the summary process flow diagram of the regional master plan development including inputs, outputs and major steps during the process.

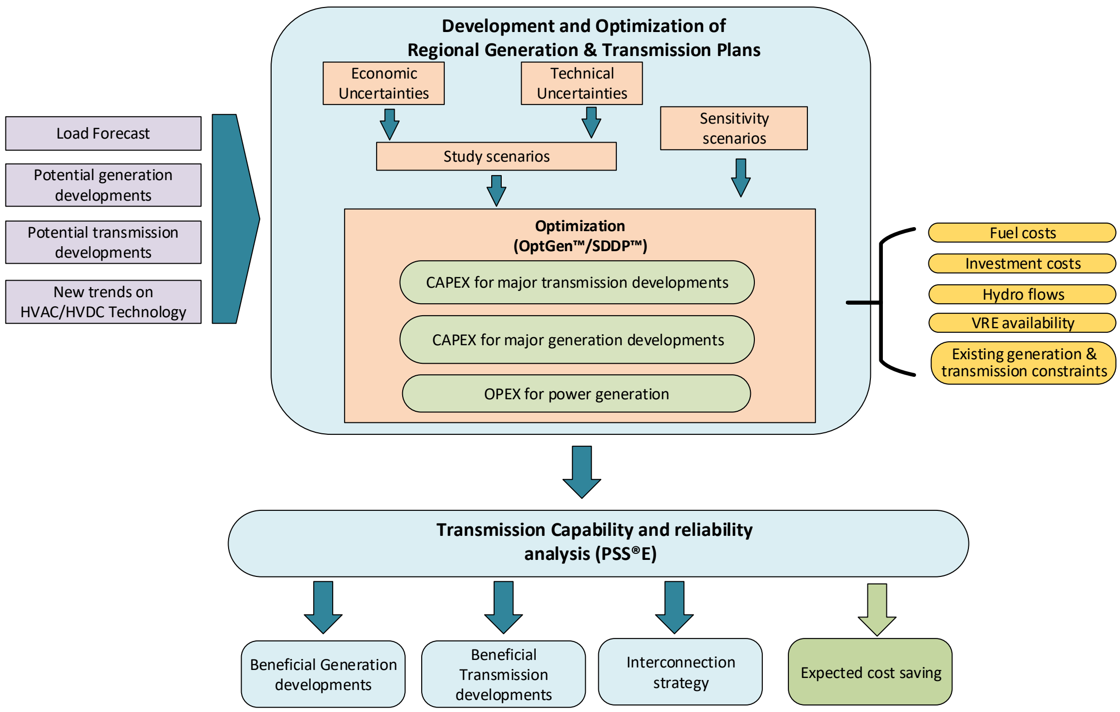

Figure 25: Process flow diagram for the GMS master plan development

176. Once each of the above steps are complete, a refined set of generation and transmission planning scenarios is identified to be included in the regional generation and transmission master plan. These scenarios are expected to yield financial benefits to both the region as a whole and to the individual countries.

A. Assumptions

177. The following global assumptions are required for the completion of the study model and to perform the technical and economic studies. They are general assumptions applied to the study model for representing power systems in the GMS region. Other specific assumptions and modelling details are explained in Chapter IV, Study Model development.

B. GMS Power System Data Related Assumptions

178. Demand forecasts for several countries do not extend to the end of the study period (2035). The demand forecast data is extended to 2035 assuming the available demand growth rates.

179. Hydrology data of the Mekong River is used to determine the variation of hydro inflows of all hydro-electric dams included in the model [28].

180. Solar variation patterns are derived from available monthly variation and daily variation data [12], [21].

181. Wind variation patterns are derived from available monthly variation and daily variation data [12], [21].

C. Cost Related Assumptions

182. The cost of each type of fuel is assumed uniform across the entire GMS region.

183. Capital investment cost for new generation development is assumed uniform throughout the entire GMS region (Appendix 4: Generation and Transmission Cost Estimations).

184. The investment costs for High Voltage Alternating Current (HVAC) transmission are calculated using assumed costs for the line (per km), transformers and substation bay upgrades (Appendix 4: Generation and Transmission Cost Estimations).

185. The investment costs for High Voltage Direct Current (HVDC) links are calculated using assumed costs for the line (per km), and converter stations (Appendix 4: Generation and Transmission Cost Estimations).

186. Study Model Development'. The study results related to generation developments, transmission developments and cost benefit for all study scenarios are presented below.

D. Generation Development

1. Regional Generation Development

187. A summary of the total generation developments in each country of the GMS region is shown in Table 14 for each scenario.

Table 14: Total Generation developments for study scenarios (2022-2035)

Optimized Generation (GW)							
Scenario		Country					Total
No.	Name	Thailand	Viet Nam	Lao PDR	Cambodia	Myanmar	
Medium demand growth scenarios							
RM	M_REFERENCE	14.7	32.1	0.5	20.1	6.7	74.0
BM	**M_BASE_BASE**	7.4	34.8	3.6	16.0	12.2	74.1
S1	M_GAS_BASE	7.5	35.3	4.2	13.0	9.3	69.4
S2	M_VRE_BASE	18.9	36.3	2.0	15.3	8.8	81.4
S3	M_HIF_BASE	18.8	35.6	1.8	14.4	9.2	79.8
S4	M_BASE_BSS	7.0	32.9	4.1	14.2	10.7	68.9
S5	M_VRE_BSS	18.6	36.7	3.6	15.5	8.3	82.7
S6	M_BASE_NUC	7.3	33.3	3.5	13.3	11.3	68.7
S7	M_HIF_NUC	18.6	35.8	3.5	17.3	10.4	85.7
S8	M_BASE_INT	17.2	27.4	4.4	14.2	13.7	76.9
S9	M_HIF_INT	16.1	27.5	6.0	14.9	14.3	78.8
S10	M_VRE_INT	16.8	28.4	5.4	14.1	14.8	79.4
High demand growth scenarios							
RH	H_REFERENCE	23.3	44.1	0.5	26.3	16.2	110.3
BH	**H_BASE_BASE**	23.3	45.8	5.1	22.5	16.0	112.7
S11	H_GAS_BASE	19.5	44.8	4.6	22.1	17.2	108.2
S12	H_VRE_BASE	24.4	47.1	4.4	22.7	16.1	114.7
S13	H_HIF_BASE	23.3	43.7	2.7	23.1	20.2	112.9
S14	H_BASE_BSS	22.6	40.9	4.3	22.2	16.4	106.5
S15	H_VRE_BSS	24.4	47.8	2.3	22.4	17.9	114.8
S16	H_BASE_NUC	21.6	44.4	3.7	22.3	16.0	108.0
S17	H_HIF_NUC	23.8	45.1	4.0	22.5	16.4	111.8
S18	H_BASE_INT	22.6	40.5	7.6	13.3	21.6	105.6
S19	H_HIF_INT	23.3	40.0	10.5	14.2	18.3	106.3
S20	H_VRE_INT	24.4	41.3	9.6	14.0	21.1	110.4
Low demand growth scenarios							
RL	L_REFERENCE	5.4	20.3	0.5	18.0	3.4	47.5
BL	**L_BASE_BASE**	1.8	15.7	4.4	13.2	6.1	41.2
S21	L_GAS_BASE	3.7	20.4	4.4	10.6	4.4	43.6
S22	L_VRE_BASE	14.6	21.6	5.5	12.2	10.3	64.2

Optimized Generation (GW)							
Scenario		Country					Total
No.	Name	Thailand	Viet Nam	Lao PDR	Cambodia	Myanmar	
S23	L_HIF_BASE	14.2	22.2	2.4	13.7	6.8	59.2
S24	L_BASE_BSS	3.1	20.8	1.4	12.1	6.0	43.5
S25	L_VRE_BSS	13.2	22.5	1.1	12.5	7.8	57.1
S26	L_BASE_NUC	3.1	17.6	3.7	12.2	6.0	42.6
S27	L_HIF_NUC	14.2	21.0	2.3	13.1	6.5	57.1
S28	L_BASE_INT	8.4	13.5	4.9	7.2	10.2	44.2
S29	L_HIF_INT	14.2	18.7	4.3	4.7	10.5	52.4
S30	L_VRE_INT	14.1	17.8	3.8	6.5	10.7	53.0

2. Individual Country Generation Development

188. A summary of the generation developments by type for each country in each scenario are shown in Table 15 to Table 19.

Table 15: Generation developments for study scenarios (2022-2035) in Thailand

Optimized Generation Installed Capacity (GW)						
Scenario		Generation Type				
No.	Name	Coal	Gas	Nuclear	Wind	Solar
Medium demand growth scenarios						
RM	M_REFERENCE	3.1	6.6	0.0	0.0	5.0
BM	**M_BASE_BASE**	3.1	4.3	0.0	0.0	0.0
S1	M_GAS_BASE	0.0	7.9	0.0	0.0	0.0
S2	M_VRE_BASE	3.1	2.9	0.0	0.8	12.1
S3	M_HIF_BASE	3.1	4.0	0.0	0.7	11.0
S4	M_BASE_BSS	3.1	3.8	0.0	0.0	0.1
S5	M_VRE_BSS	3.1	2.5	0.0	0.8	12.1
S6	M_BASE_NUC	3.1	4.1	0.0	0.0	0.0
S7	M_HIF_NUC	3.1	0.0	4.5	0.0	11.0
S8	M_BASE_INT	3.1	3.0	0.0	0.0	11.0
S9	M_HIF_INT	3.1	2.0	0.0	0.0	11.0
S10	M_VRE_INT	3.1	1.5	0.0	0.0	12.1
High demand growth scenarios						
RH	H_REFERENCE	3.1	8.4	0.0	0.7	11.0
BH	**H_BASE_BASE**	3.1	8.4	0.0	0.7	11.0
S11	H_GAS_BASE	3.1	8.4	0.0	0.7	7.3
S12	H_VRE_BASE	3.1	8.4	0.0	0.8	12.1
S13	H_HIF_BASE	3.1	8.4	0.0	0.7	11.0
S14	H_BASE_BSS	3.1	8.4	0.0	0.0	11.0
S15	H_VRE_BSS	3.1	8.4	0.0	0.8	12.1
S16	H_BASE_NUC	3.1	8.4	1.4	0.0	8.7

Optimized Generation Installed Capacity (GW)						
Scenario		Generation Type				
No.	Name	Coal	Gas	Nuclear	Wind	Solar
S17	H_HIF_NUC	3.1	0.9	8.0	0.7	11.0
S18	H_BASE_INT	3.1	8.4	0.0	0.0	11.0
S19	H_HIF_INT	3.1	8.4	0.0	0.7	11.0
S20	H_VRE_INT	3.1	8.4	0.0	0.8	12.1
Low demand growth scenarios						
RL	L_REFERENCE	3.1	2.3	0.0	0.0	0.0
BL	**L_BASE_BASE**	1.8	0.0	0.0	0.0	0.0
S21	L_GAS_BASE	0.0	3.7	0.0	0.0	0.0
S22	L_VRE_BASE	2.5	0.0	0.0	0.0	12.1
S23	L_HIF_BASE	3.1	0.0	0.0	0.0	11.0
S24	L_BASE_BSS	3.1	0.0	0.0	0.0	0.0
S25	L_VRE_BSS	1.0	0.0	0.0	0.0	12.1
S26	L_BASE_NUC	3.1	0.0	0.0	0.0	0.0
S27	L_HIF_NUC	3.1	0.0	0.0	0.0	11.0
S28	L_BASE_INT	3.1	0.0	0.0	0.0	5.3
S29	L_HIF_INT	3.1	0.0	0.0	0.0	11.0
S30	L_VRE_INT	2.0	0.0	0.0	0.0	12.1

Table 16: Generation developments for study scenarios (2022-2035) in Viet Nam

Optimized Generation Installed Capacity (GW)							
Scenario		Generation Type					
No.	Name	Coal	Gas	Combined Cycle	Hydro	Wind	Solar
Medium demand growth scenarios							
RM	M_REFERENCE	20.8	1.5	2.3	1.5	6.1	0.0
BM	**M_BASE_BASE**	16.7	1.5	2.3	0.7	6.1	7.6
S1	M_GAS_BASE	16.8	1.5	2.3	1.2	6.1	7.6
S2	M_VRE_BASE	15.9	1.5	2.3	1.7	6.7	8.4
S3	M_HIF_BASE	16.9	1.5	2.3	1.2	6.1	7.6
S4	M_BASE_BSS	16.4	1.5	2.3	1.6	6.1	5.1
S5	M_VRE_BSS	15.3	1.5	2.3	1.2	7.4	9.2
S6	M_BASE_NUC	16.6	1.5	2.3	1.4	6.1	5.4
S7	M_HIF_NUC	17.2	1.5	2.3	1.2	6.1	7.6
S8	M_BASE_INT	8.0	1.5	2.3	2.0	6.1	7.6
S9	M_HIF_INT	8.1	1.5	2.3	2.0	6.1	7.6
S10	M_VRE_INT	8.1	1.5	2.3	1.4	6.7	8.4
Medium demand growth scenarios							
RH	H_REFERENCE	30.3	1.5	2.3	2.9	6.1	1.0
BH	**H_BASE_BASE**	27.2	1.5	2.3	1.2	6.1	7.6
S11	H_GAS_BASE	25.6	1.5	2.3	1.8	6.1	7.6
S12	H_VRE_BASE	26.8	1.5	2.3	1.5	6.7	8.4

Optimized Generation Installed Capacity (GW)							
Scenario		Generation Type					
No.	Name	Coal	Gas	Combined Cycle	Hydro	Wind	Solar
S13	H_HIF_BASE	25.3	1.5	2.3	1.0	6.1	7.6
S14	H_BASE_BSS	26.4	1.5	2.3	0.9	6.1	3.8
S15	H_VRE_BSS	25.9	1.5	2.3	1.5	7.4	9.2
S16	H_BASE_NUC	26.1	1.5	2.3	0.9	6.1	7.6
S17	H_HIF_NUC	25.9	1.5	2.3	1.8	6.1	7.6
S18	H_BASE_INT	22.4	1.5	2.3	0.7	6.1	7.6
S19	H_HIF_INT	21.4	1.5	2.3	1.2	6.1	7.6
S20	H_VRE_INT	20.9	1.5	2.3	1.6	6.7	8.4
Medium demand growth scenarios							
RL	L_REFERENCE	9.4	1.5	2.3	1.0	6.1	0.0
BL	**L_BASE_BASE**	2.9	1.5	2.3	1.0	6.1	2.1
S21	L_GAS_BASE	2.0	1.5	2.3	1.0	6.1	7.6
S22	L_VRE_BASE	1.5	1.5	2.3	1.4	6.7	8.4
S23	L_HIF_BASE	2.2	1.5	2.3	2.6	6.1	7.6
S24	L_BASE_BSS	1.6	1.5	2.3	1.8	6.1	7.6
S25	L_VRE_BSS	0.4	1.5	2.3	1.8	7.4	9.2
S26	L_BASE_NUC	3.8	1.5	2.3	1.3	6.1	2.6
S27	L_HIF_NUC	2.0	1.5	2.3	1.6	6.1	7.6
S28	L_BASE_INT	0.0	1.5	2.3	1.4	0.8	7.6
S29	L_HIF_INT	0.0	1.5	2.3	1.3	6.1	7.6
S30	L_VRE_INT	0.0	0.0	2.3	0.5	6.7	8.4

Table 17: Generation developments for study scenarios (2022-2035) in Lao PDR

Optimized Generation Installed Capacity (GW)					
Scenario		Generation Type			
No.	Name	Coal	Hydro	Wind	Solar
Medium demand growth scenarios					
RM	M_REFERENCE	0.0	0.5	0.0	0.0
BM	**M_BASE_BASE**	0.0	3.1	0.5	0.0
S1	M_GAS_BASE	0.0	1.9	0.5	0.0
S2	M_VRE_BASE	0.0	1.4	0.6	0.0
S3	M_HIF_BASE	0.0	1.3	0.5	0.0
S4	M_BASE_BSS	0.0	3.6	0.5	0.0
S5	M_VRE_BSS	0.0	3.1	0.6	0.0
S6	M_BASE_NUC	0.0	3.0	0.5	0.0
S7	M_HIF_NUC	0.0	3.0	0.5	0.0
S8	M_BASE_INT	0.0	3.9	0.5	0.0
S9	M_HIF_INT	0.0	4.7	0.5	0.9
S10	M_VRE_INT	0.0	3.9	0.6	1.0
High demand growth scenarios					
RH	H_REFERENCE	0.0	0.5	0.0	0.0

Optimized Generation Installed Capacity (GW)					
Scenario		**Generation Type**			
No.	**Name**	**Coal**	**Hydro**	**Wind**	**Solar**
BH	**H_BASE_BASE**	0.0	4.6	0.5	0.0
S11	H_GAS_BASE	0.0	4.1	0.5	0.0
S12	H_VRE_BASE	0.0	3.8	0.6	0.0
S13	H_HIF_BASE	0.0	2.2	0.5	0.0
S14	H_BASE_BSS	0.0	3.8	0.5	0.0
S15	H_VRE_BSS	0.0	1.7	0.6	0.0
S16	H_BASE_NUC	0.0	3.2	0.5	0.0
S17	H_HIF_NUC	0.0	3.5	0.5	0.0
S18	H_BASE_INT	3.2	3.9	0.5	0.0
S19	H_HIF_INT	5.1	4.0	0.5	0.9
S20	H_VRE_INT	3.3	4.8	0.6	1.0
Low demand growth scenarios					
RL	L_REFERENCE	0.0	0.5	0.0	0.0
BL	**L_BASE_BASE**	0.0	3.9	0.5	0.0
S21	L_GAS_BASE	0.0	3.9	0.5	0.0
S22	L_VRE_BASE	0.0	4.9	0.6	0.0
S23	L_HIF_BASE	0.0	1.9	0.5	0.0
S24	L_BASE_BSS	0.0	0.9	0.5	0.0
S25	L_VRE_BSS	0.0	0.6	0.6	0.0
S26	L_BASE_NUC	0.0	3.2	0.5	0.0
S27	L_HIF_NUC	0.0	1.8	0.5	0.0
S28	L_BASE_INT	0.0	4.4	0.5	0.0
S29	L_HIF_INT	0.0	3.8	0.5	0.0
S30	L_VRE_INT	0.0	3.3	0.6	0.0

Table 18: Generation developments for study scenarios (2022-2035) in Cambodia

Optimized Generation Installed Capacity (GW)					
Scenario		**Generation Type**			
No.	**Name**	**Gas**	**Hydro**	**Wind**	**Solar**
Medium demand growth scenarios					
RM	M_REFERENCE	11.8	5.5	0.1	2.6
BM	**M_BASE_BASE**	9.0	4.3	0.1	2.6
S1	M_GAS_BASE	9.0	4.1	0.1	2.6
S2	M_VRE_BASE	9.0	3.4	0.1	2.8
S3	M_HIF_BASE	9.0	2.7	0.1	2.6
S4	M_BASE_BSS	9.2	2.5	0.1	2.3
S5	M_VRE_BSS	9.0	3.8	0.1	2.6
S6	M_BASE_NUC	9.2	1.4	0.1	2.6
S7	M_HIF_NUC	9.0	5.6	0.1	2.6
S8	M_BASE_INT	9.0	2.5	0.1	2.6
S9	M_HIF_INT	9.0	3.2	0.1	2.6

Optimized Generation Installed Capacity (GW)					
Scenario		Generation Type			
No.	Name	Gas	Hydro	Wind	Solar
S10	M_VRE_INT	9.0	2.1	0.1	2.8
High demand growth scenarios					
RH	H_REFERENCE	18.0	5.6	0.1	2.6
BH	**H_BASE_BASE**	14.2	5.6	0.1	2.6
S11	H_GAS_BASE	14.8	4.6	0.1	2.6
S12	H_VRE_BASE	14.1	5.6	0.1	2.8
S13	H_HIF_BASE	14.7	5.6	0.1	2.6
S14	H_BASE_BSS	14.2	5.6	0.1	2.3
S15	H_VRE_BSS	14.1	5.6	0.1	2.6
S16	H_BASE_NUC	13.9	5.6	0.1	2.6
S17	H_HIF_NUC	14.2	5.6	0.1	2.6
S18	H_BASE_INT	9.0	1.6	0.1	2.6
S19	H_HIF_INT	9.0	2.5	0.1	2.6
S20	H_VRE_INT	9.0	2.0	0.1	2.8
Low demand growth scenarios					
RL	L_REFERENCE	9.6	5.6	0.1	2.6
BL	**L_BASE_BASE**	8.1	2.5	0.1	2.6
S21	L_GAS_BASE	9.0	1.6	0.0	0.0
S22	L_VRE_BASE	7.3	1.9	0.1	2.8
S23	L_HIF_BASE	8.0	2.9	0.1	2.6
S24	L_BASE_BSS	7.8	1.9	0.1	2.3
S25	L_VRE_BSS	7.6	2.2	0.1	2.6
S26	L_BASE_NUC	6.8	2.6	0.1	2.6
S27	L_HIF_NUC	7.5	2.9	0.1	2.6
S28	L_BASE_INT	2.8	1.7	0.1	2.6
S29	L_HIF_INT	0.2	1.8	0.1	2.6
S30	L_VRE_INT	1.8	1.8	0.1	2.8

Table 19: Generation developments for study scenarios (2022-2035) in Myanmar

Optimized Generation Installed Capacity (GW)						
Scenario		Generation Type				
No.	Name	Coal	Gas	Hydro	Wind	Solar
Medium demand growth scenarios						
RM	M_REFERENCE	0.0	0.0	6.7	0.0	0.0
BM	**M_BASE_BASE**	0.0	0.0	12.2	0.0	0.0
S1	M_GAS_BASE	0.0	0.0	10.2	0.0	0.0
S2	M_VRE_BASE	0.0	0.0	8.8	0.0	0.0
S3	M_HIF_BASE	0.0	0.0	9.2	0.0	0.0
S4	M_BASE_BSS	0.0	0.0	10.7	0.0	0.0
S5	M_VRE_BSS	0.0	0.0	8.3	0.0	0.0

Optimized Generation Installed Capacity (GW)						
Scenario		Generation Type				
No.	Name	Coal	Gas	Hydro	Wind	Solar
S6	M_BASE_NUC	0.0	0.0	11.3	0.0	0.0
S7	M_HIF_NUC	0.0	0.0	10.4	0.0	0.0
S8	M_BASE_INT	0.0	0.0	10.8	2.9	0.0
S9	M_HIF_INT	0.0	0.0	11.4	2.9	0.0
S10	M_VRE_INT	0.0	0.0	11.6	3.2	0.0
High demand growth scenarios						
RH	H_REFERENCE	0.0	2.1	11.3	2.9	0.0
BH	**H_BASE_BASE**	0.0	0.6	12.5	2.9	0.0
S11	H_GAS_BASE	0.0	1.8	12.5	2.9	0.0
S12	H_VRE_BASE	0.0	0.0	12.9	3.2	0.0
S13	H_HIF_BASE	0.0	2.7	14.7	2.9	0.0
S14	H_BASE_BSS	0.0	0.4	12.9	2.9	0.2
S15	H_VRE_BSS	0.0	2.7	12.0	3.2	0.0
S16	H_BASE_NUC	0.0	0.0	13.1	2.9	0.0
S17	H_HIF_NUC	0.0	0.0	13.1	2.9	0.4
S18	H_BASE_INT	1.8	2.7	13.9	2.9	0.4
S19	H_HIF_INT	0.0	0.0	15.0	2.9	0.4
S20	H_VRE_INT	0.0	2.7	14.8	3.2	0.5
Low demand growth scenarios						
RL	L_REFERENCE	0.0	0.0	3.4	0.0	0.0
BL	**L_BASE_BASE**	0.0	0.0	6.1	0.0	0.0
S21	L_GAS_BASE	0.0	0.0	4.4	0.0	0.0
S22	L_VRE_BASE	0.0	0.0	10.3	0.0	0.0
S23	L_HIF_BASE	0.0	0.0	6.8	0.0	0.0
S24	L_BASE_BSS	0.0	0.0	6.0	0.0	0.0
S25	L_VRE_BSS	0.0	0.0	7.8	0.0	0.0
S26	L_BASE_NUC	0.0	0.0	6.0	0.0	0.0
S27	L_HIF_NUC	0.0	0.0	6.5	0.0	0.0
S28	L_BASE_INT	0.0	0.0	10.2	0.0	0.0
S29	L_HIF_INT	0.0	0.0	10.5	0.0	0.0
S30	L_VRE_INT	0.0	0.0	7.5	3.2	0.0

189. A full list of generation expansions is provided in Appendix 2: Generation and Transmission Plan. Following observations are made based on the generation developments in the study scenarios:

a. Comparisons of base scenarios for medium, high and low demand conditions with the corresponding reference scenarios (scenarios RM&BM, RH&BH and RL&BL) show that the development of new cross-border interconnections results in about 8-12 GW reduction of new thermal generation development in the GMS region during 2022-2035 period. Development of large scale coal and gas plants in Thailand and Viet Nam can be avoided or delayed with the use

of potential cross-border interconnections. In contrast, hydro generation in Myanmar and Lao PDR is increased after enabling cross-border interconnection optimization.

b. In high demand growth scenarios with cross-border interconnections (BH and S11-S20), most of the prospective VRE generation in the region (about 31 GW) is developed. In Viet Nam, at least 8 GW of prospective VRE generation is built and utilized for most of the scenarios except the reference scenarios (scenarios RM, RH and RL).
c. Solar generation with Battery Storage Systems (BSS) are built and utilized in most scenarios with solar with BSS. The total generation developed in these scenarios is slightly reduced compared to the base scenarios due to the energy storage contribution from the Battery Storage Systems.

E. Transmission Development

190. A summary of the cross-border transmission developments for each scenario is shown in Table 20.

Table 20: cross-border transmission developments

Optimized Interconnection capacity (GW) for 2022-2032 period											
Scenario		**Interface**									**Total**
No.	**Name**	**TH-KH**	**LA-TH**	**LA-VN**	**LA-KH**	**LA-MM**	**KH-VN**	**MM-TH**	**CH-LA**	**CH-MM**	
Medium demand growth scenarios											
RM	M_REFERNCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BM	**M_BASE_BASE**	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S1	M_GAS_BASE	0.0	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.1
S2	M_VRE_BASE	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S3	M_HIF_BASE	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S4	M_BASE_BSS	0.0	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.1
S5	M_VRE_BSS	0.0	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.0
S6	M_BASE_NUC	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S7	M_HIF_NUC	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S8	M_BASE_INT	4.5	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.3
S9	M_HIF_INT	4.8	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.6
S10	M_VRE_INT	4.5	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.3
High demand growth scenarios											
RH	H_REFERENCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BH	**H_BASE_BASE**	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S11	H_GAS_BASE	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S12	H_VRE_BASE	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S13	H_HIF_BASE	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S14	H_BASE_BSS	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S15	H_VRE_BSS	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S16	H_BASE_NUC	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S17	H_HIF_NUC	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S18	H_BASE_INT	4.5	0.0	4.5	5.5	3.0	6.0	6.4	0.0	0.6	30.5
S19	H_HIF_INT	4.5	3.0	5.5	5.5	4.5	6.0	6.4	0.0	0.6	36.0
S20	H_VRE_INT	4.5	0.0	4.5	5.5	3.0	6.0	6.0	0.0	0.6	30.1
Low demand growth scenarios											
RL	L_REFERENCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BL	**L_BASE_BASE**	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S21	L_GAS_BASE	0.0	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.0
S22	L_VRE_BASE	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S23	L_HIF_BASE	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S24	L_BASE_BSS	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S25	L_VRE_BSS	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S26	L_BASE_NUC	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3

Optimized Interconnection capacity (GW) for 2022-2032 period											
Scenario		Interface									Total
No.	Name	TH-KH	LA-TH	LA-VN	LA-KH	LA-MM	KH-VN	MM-TH	CH-LA	CH-MM	
S27	L_HIF_NUC	0.3	3.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	15.3
S28	L_BASE_INT	4.8	0.0	3.0	5.5	4.5	5.5	6.0	0.7	0.0	30.0
S29	L_HIF_INT	4.8	0.0	4.5	5.5	3.0	5.5	6.4	0.7	0.6	30.9
S30	L_VRE_INT	4.8	0.0	1.5	5.5	4.5	5.5	7.9	0.7	0.6	30.9

191. The complete lists of cross-border transmission expansions are provided in Appendix 2: Generation and Transmission Plan[24]. Following observations are made based on the transmission developments in the study scenarios:

A. [24] Complete lists of transmission expansions in Appendix 1: Full Generation List per Country

1. The following tables show the existing, planned, and candidate hydro, thermal and renewable generation used in this study.

1. Cambodia Generation

2. For Cambodia generation, generation plan of [40] is used. Additional candidate generation is added for the period 2031-2035.

Table 34: Generation list for Cambodia

Year	Fuel Oil	Solar	Hydro	Coal	Gas	Biomass	Wind
2022	629	615	531	1190	0	130	0
2023	629	615	563	1540	0	130	0
2024	581	615	563	1890	0	130	80
2025	536	615	563	2240	0	130	80
2026	536	715	691	2240	0	130	80
2027	536	815	691	2240	600	130	80
2028	536	1015	839	2240	1200	130	80
2029	536	1415	1034	2240	1800	130	80
2030	536	1615	1613	2240	3600	130	80
Additional	0	1590	3000	0	5400	43	85

2. Lao PDR Generators

3. The list of existing generators and the generators under construction in Lao PDR are shown in the following tables [38].

Table 35: Existing and under-construction hydro generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Dong	North	Luangprabang	Run of River	1	1970	existing
Xelabam	South	Champasak	Run of River	5	1970	existing
Nam Ngum 1	C1	Vientiane Pro	Reservoir	155	1971	existing
Xeset 1	South	Saravan	Run of River	45	1990	existing
Nam Ko	North	Oudomxay	Run of River	2	1996	existing
Theun-Hinboun	C2	Khammouan	Reservoir	22	1998	existing
Theun-Hinboun (To Thailand)	C2	Khammouan	Reservoir	418	1998	existing
Houay Ho	South	Attapeu	Reservoir	2	1999	existing
Houay Ho (To Thailand)	South	Attapeu	Reservoir	150	1999	existing
Nam Luek	North	Saysomboun	Reservoir	60	2000	existing
Nam Mang 3	C1	Vientiane Pro	Reservoir	40	2004	existing
Xeset 2	South	Saravan	Run of River	76	2009	existing
Nam Tha 3	North	Luangnamtha	Run of River	1	2010	existing
Nam lik 1/2	C1	Vientiane Pro	Reservoir	100	2010	existing
Nam Theun 2	C2	Khammouan	Reservoir	75	2010	existing
Nam Theun 2 (To Thailand)	C2	Khammouan	Reservoir	1,000	2010	existing
Nam Nhon	North	Borkeo	Run of River	2	2011	existing
Nam Song	C1	Vientiane Pro	Reservoir	6	2011	existing
Nam Ngum 2	North	Saysomboun	Reservoir	615	2012	existing
Nam Ngum 5	C1	Vientiane Pro	Reservoir	120	2012	existing
Nam Gnoug 8	C2	Borikhamxai	Reservoir	60	2012	existing
Nam Phao	C2	Borikhamxai	Run of River	2	2012	existing
Nam Long	North	Luangnamtha	Run of River	5	2013	existing
Tadsalen	C2	Savannakhet	Run of River	3	2013	existing
Xekaman 3	South	Sekong	Reservoir	25	2013	existing
Xekaman 3 (To Viet Nam)	South	Sekong	Reservoir	225	2013	existing
Nam Sien Tad Lang	North	Xieng Khuang	Run of River	5	2014	existing
Nam Ngiep 3A	North	Xieng Khuang	Reservoir	44	2014	existing
Nam Sana	C1	Vientiane Pro	Run of River	14	2014	existing
Xenamnoy 1	South	Sekong	Run of River	15	2014	existing
Nam Khan 2	North	Luangprabang	Reservoir	130	2015	existing
Nam San 3B	North	Saysomboun	Reservoir	45	2015	existing
Nam Ngiep 2	North	Xieng khuang	Reservoir	180	2015	existing
Houaylamphanh Gnai	South	Sekong	Reservoir	88	2015	existing
Nam Ou 2	North	Luangprabang	Reservoir	120	2016	existing
Nam Khan 3	North	Luangprabang	Reservoir	60	2016	existing
Nam Beng	North	Oudomxay	Reservoir	36	2016	existing
Nam Ou 5	North	Phongsaly	Reservoir	240	2016	existing
Nam Ou 6	North	Phongsaly	Reservoir	180	2016	existing
Nam Sor	North	Saysomboun	Run of River	3	2016	existing
Nam San 3A	North	Xieng Khuang	Reservoir	69	2016	existing
Nam Mang 1	C2	Borikhamxai	Reservoir	64	2016	existing

Xeset 3	South	Champasak	Reservoir	23	2016	existing
Xenamnoy 6	South	Champasak	Run of River	5	2016	existing
Nam Peun 2	North	Houaphanh	Run of River	12	2017	existing
Nam Nga 2	North	Oudomxay	Run of River	15	2017	existing
Nam Phai	North	Saysomboun	Reservoir	86	2017	existing
Nam Ngiep 2C	North	Xieng Khuang	Run of River	15	2017	existing
Xekaman 1	South	Attapeu	Reservoir	32	2017	existing
Xekaman 1 (To Thailand)	South	Attapeu	Reservoir	258	2017	existing
Nam Kong 2	South	Attapeu	Reservoir	66	2017	existing
Xenamnoy 2 - Xekatam 1	South	Champasak	Run of River	13	2017	existing
Houay por	South	Saravan	Run of River	15	2017	existing
Nam Ngum 1 (Extension Phase 1)	C1	Vientiane Pro	Reservoir	80	2018	existing
Xekaman – Xanxai (to Viet Nam)	North	Attapeu	Reservoir	32	2019	under construction
Nam Tha 1	North	Borkeo	Reservoir	168	2019	under construction
Xepien - Xenamnoy	North	Champasak	Reservoir	40	2019	under construction
Xepien - Xenamnoy (to Thailand)	North	Champasak	Reservoir	370	2019	under construction
Nam Peun 1	North	Houaphanh	Run of River	15	2019	under construction
Nam Sim	North	Houaphanh	Run of River	9	2019	under construction
Nam Hao	North	Houaphanh	Run of River	15	2019	under construction
Nam Mon 1	North	Houaphanh	Run of River	10	2019	under construction
Xeset – Kengxan	North	Saravan	Run of River	13	2019	under construction
Nam Chiene	North	Saysomboun	Reservoir	104	2019	under construction
Nam Ngiep 2A	North	Xieng Khuang	Run of River	13	2019	under construction
Nam Ngiep 2B	North	Xieng Khuang	Run of River	9	2019	under construction
Nam The	North	Xieng khuang	Run of River	15	2019	under construction
Nam PhaGnai	C1	Saysomboun	Reservoir	15	2019	under construction
Nam Lik 1	C1	Vientiane Pro	Run of River	64	2019	under construction
MK. Xayaboury	C1	Xayaboury	Run of River	60	2019	under construction
Nam Ngiep 1 (to Thailand)	C2	Borikhamxai	Reservoir	294	2019	under construction
Nam Ngiep Regulation	C2	Borikhamxai	Run of River	18	2019	under construction
Nam Hinboun	C2	Khammouan	Reservoir	30	2019	under construction
MK. Xayaboury (to Thailand)	C2	Xayaboury	Run of River	1,225	2019	under construction
Nam Houng Down	C2	Xayaboury	Run of River	13	2019	under construction
Nam Aow (Nam Pot)	C2	Xieng Khuang	Reservoir	15	2019	under construction
Nam Sor (Borikhamxai)	North	Borikhamxai	Run of River	4.8	2020	under construction
Nam Ngao	North	Borkeo	Reservoir	15	2020	under construction
Nam Tha 2 (B. Hat Mouak)	North	Borkeo	Run of River	15	2020	under construction

Nam Ou 3	South	Luangprabang	Run of River	210	2020	under construction
Nam Ou 1	South	Luangprabang	Run of River	180	2020	under construction
Nam Ou 7	South	Phongsaly	Reservoir	210	2020	under construction
Nam Kong 3	North	Attapeu	Reservoir	45	2021	under construction
Nam Kong 1	North	Attapeu	Reservoir	160	2021	under construction
Houay palai	North	Champasak	Reservoir	26	2021	under construction
Houay Yoi – Houaykod	North	Champasak	Run of River	15	2021	under construction
Nam Long New	North	Houaphanh	Run of River	13	2021	under construction
Xelanong 1	North	Savannakhet	Reservoir	70	2021	under construction
Nam Ngum 4	North	Xieng Khuang	Reservoir	240	2021	under construction
MK. Donsahong	C2	Champasak	Run of River	195	2021	under construction
MK. Donsahong (to Combosia)	C2	Champasak	Run of River	480	2021	under construction
Nam Mo 2	C2	Xieng khuang	Reservoir	120	2022	under construction
Nam Theun 1	South	Borikhamxai	Reservoir	130	2022	under construction
Nam Theun 1 (to Thailand)	South	Borikhamxai	Reservoir	520	2022	under construction
Nam Ngum Keng Kaun	South	Xieng khuang	Run of River	1	2022	under construction
Houy palai down	North	Champasak	Run of River	4	2022	under construction
Houykapheu 1	North	Saravan	Run of River	5	2022	under construction
Nam Karp	North	Saysomboun	Run of River	12	2023	under construction
Houaylamphan Gai (Downstream)	South	Sekong	Run of River	15	2025	under construction

Table 36: Existing and under-construction thermal generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Hongsa Lignite	North	Xayaboury	Thermal	100	2015	existing
Hongsa Lignite (To Thailand)	North	Xayaboury	Thermal	1,778	2015	existing
Huaphan Coal Power Plan (Lignite)	North	Houaphanh	Thermal	600	2026	under construction

Table 37: Existing and under-construction renewable generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status

Nam Ngiep 1 (Off take) (To Thailand)	C2	Borikhamxai	Reservoir	294	2019	PDA
Nam Xam 3	North	Houaphanh	Reservoir	156	2020	PDA
Nam Xam 1	North	Houaphanh	Reservoir	75	2020	PDA
Dakcha Liew 2	South	Sekong	Run of River	13	2020	PDA
Dakcha Liew 1	South	Sekong	Run of River	11	2020	PDA
Xekong (Downstream) A	South	Attapeu	Run of River	76	2020	PDA
Xekatam	South	Champasak	Run of River	81	2020	PDA
Nam PaGnoun	South	Sekong	Run of River	15	2020	PDA
Houay Pa Gnoo Down	South	Sekong	Run of River	15	2020	PDA
Nam Mone	C1	Vientiane	Run of River	6	2020	PDA
Nam Samuay	C1	Vientiane Pro	Run of River	5	2020	PDA
Nam Ta Lan 2	North	Luangnamtha	Run of River	5	2021	PDA
Nam Seung 1	North	Luangprabang	Run of River	30	2021	PDA
Nam Chee 1	North	Saysomboun	Run of River	5	2021	PDA
Nam Chee 2	North	Saysomboun	Run of River	8	2021	PDA
Nam Mat (Xieng kuang)	North	Xieng khuang	Run of River	15	2021	PDA
Nam Mat 1	North	Xieng khuang	Run of River	15	2021	PDA
MK. Donsahong (to Cambodia)	South	Champasak	Run of River	195	2021	PDA
Nam Kong 3 (for Export)	South	Attapeu	Reservoir	45	2021	PDA
Nam Kong 1 (for Export)	South	Attapeu	Reservoir	160	2021	PDA
Houay Yoi - Houaykod	South	Champasak	Run of River	15	2021	PDA
Houay Phok	South	Attapeu	Run of River	12	2021	PDA
Nam Phak	South	Champasak	Reservoir	150	2021	PDA
Houaylay	South	Saravan	Run of River	3	2021	PDA
Kengseuaten	C2	Borikhamxai	Reservoir	54	2021	PDA
Tadsakhoy	C2	Savannakhet	Reservoir	30	2021	PDA
Xebanghieng 2A Tatsakhoy	C2	Savannakhet	Run of River	30	2021	PDA
Nam Mo 2 (To Viet Nam)	North	Xieng khuang	Reservoir	120	2022	PDA
Nam Pha	North	Luangnamtha	Reservoir	180	2022	PDA
Nam Tep 1	North	Houaphanh	Reservoir	15	2022	PDA
Nam Tep 2	North	Houaphanh	Reservoir	15	2022	PDA

Nam Young 2B	North	Houaphanh	Run of River	15	2023	PDA
Nam Xam 4	North	Houaphanh	Reservoir	150	2023	PDA
Nam Phouan	North	Saysomboun	Reservoir	102	2023	PDA
Nam Bak 1	North	Saysomboun	Reservoir	160	2023	PDA
Nam Poui	North	Xayaboury	Reservoir	60	2023	PDA
Xekaman 4	South	Attapeu	Reservoir	0	2023	PDA
Xenamnoy 5	South	Champasak	Run of River	5	2023	PDA
Houay Champi	South	Champasak	Run of River	5	2023	PDA
Nam Young 3A	North	Houaphanh	Run of River	15	2024	PDA
Nam Young 2A	North	Houaphanh	Run of River	15	2024	PDA
Nam Neun 2	North	Houaphanh	Reservoir	60	2024	PDA
Nam Leng	North	Phongsaly	Reservoir	60	2024	PDA
Nam Houay	North	Xieng khuang	Run of River	7	2024	PDA
Nam Mat 2	North	Xieng khuang	Run of River	15	2024	PDA
Nam Neun 1	North	Xieng khuang	Reservoir	124	2024	PDA
Nam Angtabeng	South	Attapeu	Reservoir	41	2024	PDA
Xepon 3 (Up)	South	Saravan	Reservoir	47	2024	PDA
Dak Emuen	South	Sekong	Reservoir	135	2024	PDA
Xekong 3A (Upstream)	South	Sekong	Run of River	0	2024	PDA
Nam Young 1B	North	Houaphanh	Run of River	10	2025	PDA
Nam Young 3B	North	Houaphanh	Run of River	14	2025	PDA
Nam Young 1A	North	Houaphanh	Run of River	15	2025	PDA
Nam Nga 1	North	Luangprabang	Reservoir	62	2025	PDA
Nam Phak 1	North	Oudomxay	Run of River	28	2025	PDA
Nam Phak 2	North	Oudomxay	Run of River	28	2025	PDA
Nam Phak 3	North	Oudomxay	Run of River	40	2025	PDA
Houay Pa Gnoo Up	South	Sekong	Run of River	6	2025	PDA
Xekong 3B (Downst)	South	Sekong	Reservoir	0	2025	PDA
MK. Sanakham (For Export)	C1	Vientiane Pro	Run of River	660	2025	PDA
Nam Khao 1	North	Xieng khuang	Run of River	5	2026	PDA
Nam Khao 2	North	Xieng khuang	Run of River	5	2026	PDA

Nam Houng Ton Neua	North	Xayaboury	Run of River	5	2021	F/S
Nam Ham 2	North	Xayaboury	Reservoir	5	2021	F/S
Nam Ngorn 1	South	Sekong	Reservoir	45	2021	F/S
Nam Ngorn 2	South	Sekong	Reservoir	35	2021	F/S
Donsom	South	Champasak	Run of River	5	2021	F/S
Nam Xan 2	C2	Borikhamxai	Run of River	15	2021	F/S
Nam Meuk 1	North	Phongsaly	Run of River	10	2022	F/S
Nam Ban	North	Phongsaly	Run of River	12	2022	F/S
Nam Houn 1	North	Phongsaly	Run of River	15	2022	F/S
Nam Houn 2	North	Phongsaly	Run of River	15	2022	F/S
Nam Ngiep (Mengmai)	North	Saysomboun	Reservoir	25	2022	F/S
Nam Mang (Upstream)	North	Saysomboun	Run of River	50	2022	F/S
Nam Dick 2	North	Houaphanh	Run of River	15	2022	F/S
Nam Xam 3A	North	Houaphanh	Run of River	45	2022	F/S
Nam Boun 2	North	Phongsaly	Run of River	15	2022	F/S
Selabam Extensien	South	Champasak	Run of River	8	2022	F/S
Sekong 5	South	Sekong	Reservoir	330	2022	F/S
Xepien-Huaysoi	South	Attapeu	Reservoir	45	2022	F/S
Nam Phak (Down)	South	Champasak	Run of River	12	2022	F/S
Xekong 4A	South	Sekong	Reservoir	175	2022	F/S
Xekong 4B	South	Sekong	Reservoir	165	2022	F/S
Nam Lik (B. Keng Luang)	C1	Vientiane Pro	Run of River	15	2022	F/S
Nam Lik 1/2A	C1	Vientiane Pro	Run of River	15	2022	F/S
Nam Feung 1	C1	Vientiane Pro	Reservoir	45	2022	F/S
Nam Them	C1	Vientiane Pro	Run of River	4	2022	F/S
Xelanong 3 (Ban. Tang Eun)	C2	Savannakhet	Run of River	60	2022	F/S
Nam Ngao 1	North	Oudomxay	Run of River	12	2023	F/S
Nam Pheir	North	Phongsaly	Run of River	13	2023	F/S
Nam Siem	North	Xieng khuang	Reservoir	5	2023	F/S
Nam Khien	North	Xieng khuang	Run of River	9	2023	F/S
Nam Khao	North	Xieng khuang	Run of River	[illegible]	2023	F/S

Xebanghieng 2	C2	Savannakhet	Reservoir	90	2023	F/S
Nam Kan (B. Kon Ngoua)	North	Houaphanh	Run of River	15	2024	F/S
Nam Ma 2A	North	Houaphanh	Run of River	18	2024	F/S
Nam Ma 1A	North	Houaphanh	Reservoir	32	2024	F/S
Nam Ta Lan	North	Luangnamtha	Run of River	15	2024	F/S
Nam Noua	North	Phongsaly	Run of River	15	2024	F/S
Nam Mouk 2	North	Phongsaly	Reservoir	44	2024	F/S
Nam Seung 4	North	Luangprabang	Run of River	47	2024	F/S
Nam Ngum-Nam Ken	North	Xayaboury	Reservoir	44	2024	F/S
Nam Ngum- Xayabouly	North	Xayaboury	Run of River	44	2024	F/S
Xekong (Down B)	South	Attapeu	Reservoir	50	2024	F/S
Houaychampy Oudomsouk	South	Champasak	Run of River	5	2024	F/S
Xe don 2, 3	South	Saravan	Reservoir	20	2024	F/S
Nam Ngum - Nanin	C1	Vientiane Pro	Run of River	15	2024	F/S
Nam Cha Gnai	C1	Vientiane Pro	Run of River	3	2024	F/S
Nam Kay	C1	Vientiane Pro	Run of River	3	2024	F/S
Nam Sa Nean	C1	Vientiane Pro	Run of River	7	2024	F/S
Xe Neua	C2	Khammouan	Reservoir	53	2024	F/S
Nam Bak 2	North	Saysomboun	Reservoir	120	2025	F/S
Nam Dick 3	North	Houaphanh	Run of River	10	2025	F/S
Nam Ma 2	North	Houaphanh	Run of River	30	2025	F/S
Nam Et 3	North	Houaphanh	Reservoir	107	2025	F/S
Nam Hoi	North	Phongsaly	Run of River	15	2025	F/S
Nam Houn 3	North	Phongsaly	Run of River	15	2025	F/S
Nam Ma 3	North	Houaphanh	Run of River	18	2025	F/S
Nam Neun 3	North	Houaphanh	Reservoir	80	2025	F/S
Nam khan 4	North	Luangprabang	Run of River	60	2025	F/S
Nam Seung 5	North	Luangprabang	Run of River	72	2025	F/S
MK. Luangprabang	North	Luangprabang	Run of River	200	2025	F/S
MK. Luangprabang (for Export)	North	Luangprabang	Run of River	1,000	2025	F/S
Nam Ou 8	North	Phongsaly	Run of River	15	2025	F/S

Houaychanpy Khamnor Zep	South	Champasak	Run of River	5	2026	F/S
Houaysalay	South	Saravan	Run of River	10	2026	F/S
Houay Avien	South	Saravan	Run of River	5	2026	F/S
Houaykantong	South	Saravan	Run of River	5	2026	F/S
Nam Mon	C1	Vientiane Pro	Run of River	6	2026	F/S
Nam Houeng	C2	Borikhamxai	Run of River	13	2026	F/S
Nam Teung	C2	Borikhamxai	Run of River	13	2026	F/S
Houaysaynamkhong	C2	Borikhamxai	Run of River	14	2026	F/S
Nam Muan - Ban Vangdeun	C2	Borikhamxai	Reservoir	66	2026	F/S
Nam Sun 1	C2	Borikhamxai	Reservoir	70	2026	F/S
Xenam Kok Point 2	C2	Savannakhet	Run of River	5	2026	F/S
Xenam Kok Point 1	C2	Savannakhet	Run of River	6	2026	F/S
Xebanghieng Up	C2	Savannakhet	Run of River	10	2026	F/S
XeSaNge Point 3	C2	Savannakhet	Run of River	11	2026	F/S
Houay kalabai 2-3	South	Attapeu	Run of River	20	2027	F/S
Xelanong Point III	South	Saravan	Run of River	12	2027	F/S
Nam Xan (Hat To)	C2	Borikhamxai	Run of River	15	2027	F/S
MK. Phu Ngoy (Ladseua)	South	Champasak	Run of River	686	2028	F/S
MK. Ban Koum	South	Champasak	Run of River	1,872	2028	F/S
Nam Hong	C2	Borikhamxai	Run of River	32		F/S

Table 39: Planned and candidate thermal generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Xiengkhuang	North	Xieng khuang	Thermal	220	2022	PDA
Kalum Lignite, Unit 1	South	Sekong	Thermal	300	2020	F/S
Kalum Lignite, Unit 2	South	Sekong	Thermal	300	2020	F/S
Kalum Lignite, Unit 3	South	Sekong	Thermal	300	2021	F/S
Bualapha Coal	C2	Khammouan	Thermal	200	2025	F/S
Bualapha Coal (for Export)	C2	Khammouan	Thermal	1800	2025	F/S
Coal Fire Power Plant (Sekong)	South	Sekong	Thermal	900	2026	F/S

Wind Power Khammouan	C2	Khammouan	Renewable			F/S
Wind Power Savannakheth	C2	Savannakhet	Renewable			F/S

3. Myanmar Generators

4. The list of existing generators and the generators under construction in Myanmar are shown in the following tables.

Table 41: Existing and under-construction hydro generators in Myanmar

Name	Capacity (MW)
Dee Doke	66
Kyee ON Kyee	74
Middle Paung Laung	100
Thatay Chaun	111
Upper Bu	150
Keng Tawng	54
Kinda	56
Ngot Chaung	16.6
Upper Yeywa	280
Zawgi (1)	18
Zawgi (2)	12
Manton	225
Mong Wa 1	50
Sedawgyi	25
Shweli (1)	600
Shweli (2)	520
Shweli (3)	1050
Tapein	140
Tapein 1	240

Kun	60
Phyu	40
Shwegyin	75
Yenwe	25
Zaungtu	20
Thaukyaekhat	120

Table 42: Existing and under-construction thermal generators in Myanmar

Name	Capacity (MW)	Fuel
Kyawannhkyaungg	54.3	Gas
Mann	36.9	Gas
Shwedaung	55.35	Gas
Myanaaung	34.7	Gas
Sahtone	50.95	Gas
Hlawga	99.9	Gas
Ywama	36.9	Gas
Ywama (NEDO)	24	Gas
Ywama (240)	240	Gas
Ahlone	99.9	Gas
Tharkheta	57	Gas
Selawar	50	Gas
Toyo Thai	27	Gas
Myanmar Lighting	78	Gas
UREC	36	Gas
Sembcorp	82	Gas
Hlawga	54.3	Gas
Ywama nedo	9.4	Gas
Ahlone	54.3	Gas

Kyun Chaung	20	Gas
Ahlone	120	Gas
Kyauk Phyu	150	Gas
Thanlyin	350	Gas
Tharketa	400	Gas

Table 43: Existing and under-construction renewable generators in Myanmar

Name	Capacity (MW)	Type
Mainnbhuu	40	Solar
Minbu	170	Solar

Table 44: Planned and candidate hydro generators in Myanmar

Name	Capacity (MW)	Year
Middle Yeywa	320	2023
Naopha	1200	2025
Upper Thanlwin (Kunlong)	1400	2025
Upper Sedawgyi	64	candidate
Dun Ban	130	candidate
He Kou	100	candidate
Henna	45	candidate
Keng Yang	40	candidate
Mong Young	45	candidate
Nam Kha	200	candidate
Nam Khot	50	candidate
Nam Li	165	candidate
So Lue	160	candidate
Wan Ta Pin	50	candidate
Gawlan	100	candidate

Bewlake	180	candidate
Hseng Ne	45	candidate
Htu Kyan (Tuzhing)	105	candidate
Palaung	105	candidate
The Hkwa	150	candidate
Upper Thanlwin (Mongton)	7110	candidate
Yawathit (Thanlwin)	4000	candidate
Chipwi	6000	candidate
Hpizaw (Pisa)	2000	candidate
Kaunglangphu	2700	candidate
Laza	1900	candidate
Manipur	380	candidate
Myitsone	6000	candidate
Renam (Yenam)	1200	candidate
Wu Zhongzhe	60	candidate
Wutsok	1800	candidate
Hutgy Dam	1190	candidate
Sinedin	76.5	candidate
Tamanthi	1200	candidate

Table 45: Planned and candidate thermal generators in Myanmar

Name	Capacity (MW)	Fuel
Kyauk Tan Township, Chaungwa Village	500	Coal
Kyause	100	Gas
Myin Guam	250	Gas
Kale District, Kalewa Township	540	Coal
Ayeyarwaddy/Yangon	500	Gas
Dawei	400	Coal

Yangon (Virtue Land)	300	Coal

Table 46: Planned and candidate renewable generators in Myanmar

Name	Capacity (MW)	Tech Type	Commission year
Nabuaing_Sol	150	Solar	candidate
Wundwin_Sol	150	Solar	candidate
His-Hsone_Wnd	220	Wind	candidate
Pekon_Wnd	950	Wind	candidate
Dawei_Wnd	220	Wind	candidate
Kawkareik_Wnd	580	Wind	candidate
Mudone_Wnd	510	Wind	candidate
Pharpon_Wnd	290	Wind	candidate
Zinkyauk_Wnd	160	Wind	candidate

4. Thailand Generators

5. The list of existing generators and the generators under construction in Thailand are shown in the following tables.

Table 47: Existing and under-construction hydro generators in Thailand

Name	Capacity (MW)	Retirement year
Bang Lang Dam	76	-
Bang Lang Dam	8	-
Bhumibol Dam	779.2	-

Pasak Jolasid	6.7	-
Pha Chuk Dam	14	-
Rajprabha Dam	240	-
Sirikit Dam	500	-
Sirindhorn Dam	36	-
Srinakarin	720	-
Tha Thung Na Dam	39	-
Ubolrat Dam	25.2	-
Vajiralongkorn Dam	300	-

Table 48: Existing and under-construction thermal generators in Thailand

Name	Capacity (MW)	Fuel code	Retirement year
Mae Mo 4-7	560	Coal	-
Mae Mo 4-7 New	600	Coal	-
SPP Coal	177	Coal	-
SPP Coal	245	Coal	-
BLCP Coal 1	673.3	Coal	2032
BLCP Coal 2	673.3	Coal	2032
Gheco Coal	660	Coal	2037
Ban Thon	8	Diesel	-
Bo Thong	10	Diesel	-
Su-ngai Kolok	8	Diesel	-
Mae Hong Son	4.4	Diesel	2025
SPP FO	4.5	FO	-
Krabi	315	FO	2034

Khanom	930	Gas	-
Nth Bangkok 2	828	Gas	-
South Bangkok new 1	610	Gas	-
South Bangkok new 2	610	Gas	-
SPP gas C1	1225	Gas	-
SPP gas C2	1827	Gas	-
SPP gas C3	1316	Gas	-
SPP gas N2	450	Gas	-
SPP gas S2	524	Gas	-
Wang Noi 4	750	Gas	-
EPEC gas	350	Gas	2023
Wang Noi 3	686	Gas	2023
GPSC Gas	700	Gas	2025
Nam Pong 1	325	Gas	2025
Nam Pong 2	325	Gas	2025
Ratchaburi 1	720	Gas	2025
Ratchaburi 2	720	Gas	2025
Bang Pakong 1	576	Gas	2027
Ratchaburi 3	685	Gas	2027
Ratchaburi 4	675	Gas	2027
Ratchaburi 5	681	Gas	2027
Bang Pakong 2	576	Gas	2028
Glow IPP 1	356.5	Gas	2028
Glow IPP 2	356.5	Gas	2028
Gulf PGC 1	734	Gas	2032
Gulf PGC 2	734	Gas	2033

SPP Biomass 2	347	Biomass	-
SPP Garbage	73	Biomass	-
Geothermal	0.3	General	-
SPP Other	13.7	General	-
SPP Hydro	12.2	SH/PCH	-
Sirindhorn Dam Sol	0.25	Solar	-
Sirindhorn HPP sol	45	Solar	-
Solar	6.6	Solar	-
SPP Solar	436	Solar	-
SPP Wind	556	Wind	-
Takong Wind	24	Wind	-
Wind	2.69	Wind	-

Table 50: Planned and candidate hydro generators in Thailand

Name	Capacity (MW)	Commission year
Ban Chan Day Hydro	18	2023

Table 51: Planned and candidate thermal generators in Thailand

Name	Capacity (MW)	Fuel code	Commission year
Mae Mo 8-9 New	600	Coal	candidate
National Power Sup 1	270	Coal	candidate
National Power Sup 2	270	Coal	candidate
New PP East 2	1000	Coal	candidate
New PP South 2	1000	Coal	candidate
Gulf PD S1 1	625	Gas	2023

New PP Upper Central 1	1400	Gas	candidate
North Bangkok add 1	700	Gas	candidate
North Bangkok add 2	700	Gas	candidate
South Bangkok add	1400	Gas	candidate
South Bangkok inc	700	Gas	candidate
Surat Thani 1	700	Gas	candidate
Surat Thani 2	700	Gas	candidate
TH_bulk_gas	50000	Gas	candidate

Table 52: Renewable Generators under Construction in Thailand

Name	Capacity (MW)	Tech Type	Commission year
Ubolratana HPP Sol	24	Solar	2023
Bang Lang HPP Sol	78	Solar	candidate
Bumibol HPP Sol 1	158	Solar	candidate
Bumibol HPP Sol 2	300	Solar	candidate
Bumibol HPP Sol 3	320	Solar	candidate
Chulabhorn HPP Sol	40	Solar	candidate
Ratchaprapa HPP Sol 1	140	Solar	candidate
Ratchaprapa HPP Sol 2	100	Solar	candidate
Sirikit HPP Sol 1	325	Solar	candidate
Sirikit HPP Sol 2	175	Solar	candidate
Srinakarin HPP Sol 1	140	Solar	candidate
Srinakarin HPP Sol 2	280	Solar	candidate
Srinakarin HPP Sol 3	300	Solar	candidate
Wachira Lang HPP Sol 1	50	Solar	candidate
Wachira Lang HPP Sol 2	250	Solar	candidate

Ban Ve	Nghe An	Hydropower	320	-	existing
Ban Chat	Lai Chau	Hydropower	220	-	existing
Huoi Quang	Lai Chau	Hydropower	260	-	existing
Lai Chau	Lai Chau	Hydropower	400	-	existing
A Luoi	Thua Thien Hue	Hydropower	170	-	existing
Quang Tri	Quang Tri	Hydropower	64	-	existing
A Vuong	Quang Nam	Hydropower	210	-	existing
Vinh Son	Thanh Hoa	Hydropower	66	-	existing
Song Hinh	Thanh Hoa	Hydropower	70	-	existing
Plei Krong	Kon Tum	Hydropower	100	-	existing
Ialy	Gia Lai	Hydropower	720	-	existing
Se San 3	Gia Lai	Hydropower	260	-	existing
Se San 4	Gia Lai	Hydropower	360	-	existing
Se San 3A	Gia Lai	Hydropower	108	-	existing
Buon Tua Srah	Dak Lak	Hydropower	86	-	existing
Song Tranh 2	Quang Nam	Hydropower	190	-	existing
Srepok 3	Dak Lak	Hydropower	220	-	existing
An Khe - Kanak	Gia Lai	Hydropower	173	-	existing
Buon Kuop	Dak Lak	Hydropower	280	-	existing
Song Ba Ha	Phu Yen	Hydropower	220	-	existing
Dong Nai 3	Dak Nong	Hydropower	180	-	existing
Dong Nai 4	Dak Nong	Hydropower	340	-	existing
Tri An	Dong Nai	Hydropower	400	-	existing
Da Nhim	Lam Dong	Hydropower	160	-	existing
Thac Mo	Binh Phuoc	Hydropower	150	-	existing
Ham Thuan	Binh Thuan	Hydropower	300	-	existing
Da Mi	Binh Thuan	Hydropower	175	-	existing

Van Chan	Yen Bai	Hydropower	57	-	existing
Ta Thang	Lao Cai	Hydropower	60	-	existing
Song Bac	Ha Giang	Hydropower	42	-	existing
Ngoi Phat	Lao Cai	Hydropower	72	-	existing
Ngoi Hut	Yen Bai	Hydropower	48	-	existing
Nam Na	Lai Chau	Hydropower	66	-	existing
Nam Muc 2	Dien Bien	Hydropower	44	-	existing
Huong Son	Ha Tinh	Hydropower	34	-	existing
Thai An	Ha Giang	Hydropower	82	-	existing
Binh Dien	Thua Thien Hue	Hydropower	44	-	existing
Song Con	Quang Nam	Hydropower	63	-	existing
Song Bung 5	Quang Nam	Hydropower	57	-	existing
Song Bung 4A	Quang Nam	Hydropower	49	-	existing
Se San 4A	Gia Lai	Hydropower	63	-	existing
Krong H'nang	Lai Chau	Hydropower	64	-	existing
Srepok 4	Dak Lak	Hydropower	80	-	existing
Srepok 4A	Dak Lak	Hydropower	64	-	existing
Dam Bri	Lam Dong	Hydropower	75	-	existing
Huong Dien	Thua Thien Hue	Hydropower	81	-	existing
Dak R'tih	Dak Lak	Hydropower	144	-	existing
Dak Mi 4	Quang Nam	Hydropower	195	-	existing
Song Bung 4A	Quang Nam	Hydropower	156	-	existing
Song Giang 2	Khan Hoa	Hydropower	37	-	existing
Dak Drinh	Quang Ngai	Hydropower	125	-	existing
Dong Nai 2	Dak Nong	Hydropower	73	-	existing
Bac Binh	Binh Thuan	Hydropower	33	-	existing
Dong Nai 5	Dak Nong	Hydropower	150	-	existing

Nhan Hac	Nghe An	Hydropower	59	2016	Planned
Song Bung 2	Quang Nam	Hydropower	100	2016	Planned
Song Tranh 4	Quang Nam	Hydropower	48	2016	Planned
Dak Mi 2	Quang Nam	Hydropower	98	2016	Planned
Dak Mi 3	Quang Nam	Hydropower	45	2016	Planned
Chi Khe	Nghe An	Hydropower	41	2017	Planned
Long Tao	Dien Bien	Hydropower	42	2017	Planned
Trung Son Unit 3 & 4	Thanh Hoa	Hydropower	2x65	2017	Planned
Yen Son	Tuyen Quang	Hydropower	70	2017	Planned
Tra Khuc 1	Quang Ngai	Hydropower	36	2017	Planned
Thac Mo Expansion	Binh Phuoc	Hydropower	75	2017	Planned
Song Lo 6	Ha Giang	Hydropower	44	2018	Planned
Hoi Xuan	Thanh Hoa	Hydropower	102	2018	Planned
Song Mien 4	Ha Giang	Hydropower	38	2018	Planned
La Ngau	Binh Thuan	Hydropower	36	2018	Planned
Dak Mi 1	Quang Nam	Hydropower	54	2018	Planned
Da Nhim Expansion	Lam Dong	Hydropower	100	2018	Planned
A Lin	Thua Thien Hue	Hydropower	62	2018	Planned
Bao Lam 3	Lam Dong	Hydropower	46	2019	Planned
Pac Ma	Lai Chau	Hydropower	140	2019	Planned
Upper Kon Unit 1 & 2	Kon Tum	Hydropower	2x110	2019	Planned
Nam Cum 1, 4, 5	Dien Bien	Hydropower	65	2019	Planned
Nam Pan 5	Son La	Hydropower	35	2020	Planned
Nam Mo (Viet Nam)	Lai Chau	Hydropower	95	2020	Planned
Ialy Expansion	Gia Lai	Hydropower	360	2020	Planned
Nam Cum 2, 3, 6	Dien Bien	Hydropower	54	2020	Planned
My Ly	Lai Chau	Hydropower	250	2021	Planned

Table 54: Existing and planned thermal generators in Viet Nam

Name	Province	Type	Capacity (MW)	Year	Status
Pha Lai 1	Hai Duong	Coal	440	-	existing
Pha Lai 2	Hai Duong	Coal	600	-	existing
Uong Bi	Quang Ninh	Coal	630	-	existing
Ninh Binh	Ninh Binh	Coal	100	-	existing
Hai Phong	Hai Phong	Coal	1200	-	existing
Quang Ninh	Quang Ninh	Coal	1200	-	existing
Nghi Son	Thanh Hoa	Coal	600	-	existing
Vinh Tan	Binh Thuan	Coal	1245	-	existing
Duyen Hai 1	Tra Vinh	Coal	1244	-	existing
Mon Duong 1	Quang Ninh	Coal	1200	-	existing
Thu Duc	HCM	Oil	169.5	-	existing
Can Tho	Can Tho	Oil	37	-	existing
O Mon	Can Tho	Oil	660	-	existing
Ba Ria	Ba Ria- Vung Tau	Combined Cycle	388	-	existing
Phu My 2	Ba Ria- Vung Tau	Combined Cycle	949	-	existing
Phu My 1	Ba Ria- Vung Tau	Combined Cycle	1140	-	existing
Phu My 4	Ba Ria- Vung Tau	Combined Cycle	468	-	existing
Thu Duc	HCM	Combined Cycle	114	-	existing
Can Tho	Can Tho	Combined Cycle	150	-	existing
Na Duong	Lang Son	Coal	110	-	existing
Cao Ngan	Thai Nguyen	Coal	115	-	existing
Cam Pha	Quang Ninh	Coal	660	-	existing
Son Dong	Bac Giang	Coal	220	-	existing
Mao Khe	Quang Ninh	Coal	440	-	existing

Dam Phu My	Ba Ria- Vung Tau	Gas	21	-	existing
Formosa Ha Tinh Unit 2	Ha Tinh	Coal	150	2016	Planned
Formosa Ha Tinh Unit 3 & 4	Ha Tinh	Gas	2x100	2016	Planned
Formosa Ha Tinh Unit 5	Ha Tinh	Coal	150	2016	Planned
Formosa Dong Nai Unit 3	Dong Nai	Coal	150	2016	Planned
Ve Dan	Dong Nai	Coal	60	2016	Planned
Duyen Hai III Unit 1	Tra Vinh	Coal	600	2016	Planned
Thai Binh I Unit 1 & 2	Thai Binh	Coal	2x300	2017	Planned
Thai Binh II Unit1	Thai Binh	Coal	600	2017	Planned
Duyen Hai III Unit 2	Tra Vinh	Coal	600	2017	Planned
Long Son Unit 1	Ba Ria- Vung Tau	Oil	75	2017	Planned
Thang Long Unit 1	Quang Ninh	Coal	300	2018	Planned
Thai Binh II Unit 2	Thai Binh	Coal	600	2018	Planned
Vinh Tan IV Unit 1 & 2	Binh Thuan	Coal	2x600	2018	Planned
Long Phu I Unit 1	Soc Trang	Coal	600	2018	Planned
Long Son Unit 2 & 3	Ba Ria- Vung Tau	Oil	2x75	2018	Planned
Thang Long Unit 2	Quang Ninh	Coal	300	2019	Planned
Hai Ha 1 cogeneration plant	Quang Ninh	Coal	3x50	2019	Planned
Na Duong II	Lang Son	Coal	110	2019	Planned
Long Phu I Unit 2	Soc Trang	Coal	600	2019	Planned
Song Hau I Unit 1 & 2	Hau Giang	Coal	2x600	2019	Planned
Duyen Hai III Expansion	Tra Vinh	Coal	660	2019	Planned
Vinh Tan I Unit 1 & 2	Binh Thuan	Coal	2x600	2019	Planned
Vinh Tan IV Expansion	Binh Thuan	Coal	600	2019	Planned
Formosa Ha Tinh Unit 6 & 7	Ha Tinh	Coal	2x150	2020	Planned
Formosa Ha Tinh Unit 8 & 9	Ha Tinh	Gas	2x100	2020	Planned
Formosa Ha Tinh Unit 10	Ha Tinh	Coal	150	2020	Planned

Long Phu II Unit 1	Soc Trang	Coal	660	2021	Planned
Long Phu III Unit 1	Soc Trang	Coal	600	2021	Planned
Uong Bi (Ceasing)	Quang Ninh	Coal	-105	2021	Planned
Hai Ha 2 cogeneration	Quang Ninh	Coal	5x150	2022	Planned
Luc Nam Unit 1	Bac Giang	Coal	50	2022	Planned
Quynh Lap I Unit 1	Nghe An	Coal	600	2022	Planned
Vung Ang II Unit 2	Ha Tinh	Coal	600	2022	Planned
Nghi Son II Unit 2	Thanh Hoa	Coal	600	2022	Planned
Nam Dinh I Unit 2	Nam Dinh	Coal	600	2022	Planned
Quang Trach I Unit 2	Thanh Hoa	Coal	600	2022	Planned
Vinh Tan III Unit 1	Binh Thuan	Coal	660	2022	Planned
Song Hau II Unit 2	Hau Giang	Coal	1000	2022	Planned
Long Phu II Unit 2	Soc Trang	Coal	660	2022	Planned
Long Phu III Unit 2 & 3	Soc Trang	Coal	2x600	2022	Planned
Van Phong I Unit 1	Khanh Hoa	Coal	660	2022	Planned
Kien Giang II	Kien Giang	Combined Cycle	750	2022	Planned
Quynh Lap I Unit 2	Nghe An	Coal	600	2023	Planned
Luc Nam Unit 2	Bac Giang	Coal	50	2023	Planned
Quang Tri Unit 1	Quang Tri	Coal	600	2023	Planned
Mien Trung I	Khanh Hoa	Combined Cycle	750	2023	Planned
Dung Quat I	Quang Ngai	Combined Cycle	750	2023	Planned
Vinh Tan III Unit 2 & 3	Binh Thuan	Coal	2x660	2023	Planned
Van Phong I Unit 2	Khanh Hoa	Coal	660	2023	Planned
Son My II Unit 1	Binh Thuan	Combined Cycle	750	2023	Planned
Vung Ang III Unit 1	Ha Tinh	Coal	600	2024	Planned
Quang Tri Unit 2	Quang Tri	Coal	600	2024	Planned
Mien Trung II	Khanh Hoa	Combined Cycle	750	2024	Planned

O Mon II	Can Tho	Gas	750	2026	Planned
Son My I Unit 1	Binh Thuan	Gas	750	2026	Planned
Quynh Lap II Unit 2	Nghe An	Coal	600	2027	Planned
Son My I Unit 2	Binh Thuan	Combined Cycle	750	2027	Planned
Long An II Unit 2	Long An	Coal	800	2027	Planned
Tan Phuoc I Unit 1	Tien Giang	Coal	600	2027	Planned
Hai Ha 4 cogeneration plant	Quang Ninh	Coal	2x300	2028	Planned
Quang Trach II Unit 1	Thanh Hoa	Coal	600	2028	Planned
Tan Phuoc I Unit 2	Tien Giang	Coal	600	2028	Planned
Tan Phuoc II Unit 1	Tien Giang	Coal	600	2028	Planned
Son My I Unit 3	Binh Thuan	Combined Cycle	750	2028	Planned
Quang Ninh III Unit 1	Quang Ninh	Coal	600	2029	Planned
Vung Ang III Unit 3	Ha Tinh	Coal	600	2029	Planned
Quang Trach II Unit 2	Thanh Hoa	Coal	600	2029	Planned
Tan Phuoc II Unit 2	Tien Giang	Coal	600	2029	Planned
Bac Lieu I Unit 1	Bac Lieu	Coal	600	2029	Planned
Quang Ninh III Unit 2	Quang Ninh	Coal	600	2030	Planned
Vung Ang III Unit 4	Ha Tinh	Coal	600	2030	Planned
Bac Lieu I Unit 2	Bac Lieu	Coal	600	2030	Planned

Table 55: Existing and under-construction renewable generators in Viet Nam

Name	Capacity (MW)	Tech Type	Retirement year
An Khe Biomass	110	Biomass	-
KCP Biomass	60	Biomass	-
Lee&Man Biomass	125	Biomass	-
Adani Phước Minh_Sol	50	Solar	-
AMI_Sol	50	Solar	-

CMX Renewable Energy Việt Nam_Sol	168	Solar	-
Cư Jut_Sol	62	Solar	-
Đá Bạc 1-4_Sol	222	Solar	-
Đa Mi Floating_Sol	48	Solar	-
Đa Mi_Sol	47.5	Solar	-
Đầm Trà Ổ_Sol	50	Solar	-
Dầu Tiếng 1, 2 _Sol	420	Solar	-
Điện lực miền Trung_Sol	50	Solar	-
Dohwa Lệ Thủy_Sol	49.5	Solar	-
Đức Huệ 1,2_Sol	99	Solar	-
Đức Minh_Sol	19.2	Solar	-
Eco Seido_Sol	40	Solar	-
Europlas, Phú Yên_Sol	50	Solar	-
EuroPlast, Long An_Sol	50	Solar	-
Fujiwara_Sol	50	Solar	-
Gelex Ninh Thuận_Sol	50	Solar	-
Hà Đô (Hồng Phong 4)_Sol	48	Solar	-
Hacom Solar_Sol	50	Solar	-
Hàm Kiệm_Sol	48	Solar	-
Hàm Phú II_Sol	69	Solar	-
Hậu Giang_Sol	29	Solar	-
HCG Tây Ninh_Sol	50	Solar	-
Hồ Bầu Ngứ_Sol	50	Solar	-
Hòa Hội_Sol	215	Solar	-
Hoàng Thái Gia_Sol	50	Solar	-
Hồng Phong 1A-1B,4,5.2_Sol	346	Solar	-

MT 1, MT2_Sol	60	Solar	-
Mũi Né_Sol	40	Solar	-
Mỹ Sơn 1,2_Sol	100	Solar	-
Mỹ Sơn- Hoàn Lộc Việt_Sol	50	Solar	-
Nam Cum SHP	119	Solar	-
Ngọc Lặc_Sol	45	Solar	-
Nhị Hà_Sol	50	Solar	-
Ninh Phước 6.1, 6.2_Sol	57	Solar	-
Ninh Sim_Sol	40	Solar	-
Phan Lâm 1,2_Sol	85.72	Solar	-
Phong Điền 2_Sol	50	Solar	-
Phong Hòa_Sol	50	Solar	-
Phong Phú_Sol	42	Solar	-
Phú Yên_Sol	257	Solar	-
Phước Hữu – Điện lực 1_Sol	30	Solar	-
Phước Hữu_Sol	65	Solar	-
Phước Ninh_Sol	45	Solar	-
Phước Thái Furtue_Sol	150	Solar	-
Phước Thái_Sol	50	Solar	-
Phuoc Trung Solar	46	Solar	-
Phước Trung_Sol	50	Solar	-
Quang Minh_Sol	50	Solar	-
Sao Mai Future_Sol	106	Solar	-
Sao Mai_Sol	104	Solar	-
Se San 4 Solar	98	Solar	-
Sê San 4_Sol	49	Solar	-

Thiên Tân_Sol	50	Solar	-
Thịnh Long AAA_Sol	50	Solar	-
Thuận Minh 2_Sol	50	Solar	-
Thuận Nam 12_Sol	49.9	Solar	-
Thuận Nam 19_Sol	61	Solar	-
Tri An Solar	126	Solar	-
Trí Việt 1_Sol	30	Solar	-
Trung Nam Ninh Thuận_Sol	257	Solar	-
Trung Sơn_Sol	30	Solar	-
TTC 1,2_Sol	119	Solar	-
TTC Đức Huệ 1_Sol	50	Solar	-
TTC Krong Pa_Sol	69	Solar	-
TTC Phong Điền_Sol	48	Solar	-
TTC- Trúc Sơn_Sol	44.4	Solar	-
TTĐL Vĩnh Tân GĐ 1_Sol	6.2	Solar	-
Tuấn Ân_Sol	10	Solar	-
Vĩnh Hảo 4,6_Sol	86	Solar	-
Vĩnh Long_Sol	49.3	Solar	-
Vĩnh Tân 1,2_Sol	40	Solar	-
VSP Bình Thuận II_Sol	37.6	Solar	-
Vùng hồ Dầu Tiếng Future_Sol	1650	Solar	-
Vùng hồ Dầu Tiếng_Sol	350	Solar	-
Xuân Thiện Thuận Bắc - 1,2_Sol	200	Solar	-
Xuân Thọ 1,2_Sol	100	Solar	-
Yên Định_Sol	30	Solar	-
Bạc Liêu (phase I-III)_Wnd	241.2	Wind	-

Khai Long_Wnd	100	Wind	-
Lạc Hòa_Wnd	30	Wind	-
Lai Hòa (phase I)_Wnd	30	Wind	-
Mũi Dinh_Wnd	37.6	Wind	-
Phú Lạc_Wnd	50	Wind	-
Phú Quý_Wnd	6	Wind	-
Phương Mai 3_Wnd	21	Wind	-
Trà Vinh 1_Wnd	48	Wind	-
Trung Nam Ninh Thuan phase 1,2_Wnd	104	Wind	-
Trung Nam_Wnd	90	Wind	-
Tuy Phong 1,2_Wnd	120	Wind	-

Table 56: Planned and candidate small hydro in Viet Nam

Name	Capacity (MW)	Commission year
SHP_2023	100	2023
SHP_2024	120	2024
SHP_2025	180	2025
SHP_can	1519	candidate

Table 57: Additional candidate thermal generators in Viet Nam

Name	Capacity (MW)	Fuel code	Commission year
VN_coal_can	19464	Coal	candidate
VN_bulk_gas	50000	Gas	candidate

Table 58: Planned and candidate renewable generators in Viet Nam

a. In most of the study scenarios, the total optimized interconnection capacity is about 12-13 GW.

UPC-Quang Binh_Wnd	250	Wind	2023
Binh Thuan_Wnd	120	Wind	2024
Dam Nai 2,4_Wnd	99.2	Wind	2024
Ham Cuong 1,2_Wnd	35	Wind	2024
Ham Kiem 1,2_Wnd	30	Wind	2024
Hoa Minh_Wnd	15	Wind	2024
Hoa Thang 1.1_Wnd	85.5	Wind	2024
Nhon Hoi_Wnd	61.1	Wind	2024
Phuong Mai 1_Wnd	30	Wind	2024
Hong Phong 1,2_Wnd	60	Wind	2025
Ke Ga_Wnd	600	Wind	2025
Tien Thanh 1-3_Wnd	55	Wind	2025
Cong Ly Soc Trang 1-3_Wnd	98	Wind	candidate
Gio Ben Tre 1-11_Wnd	1230	Wind	candidate
Hoa Thang 1.3_Wnd	20	Wind	candidate
Hoa Thang 2,4_Wnd	70	Wind	candidate
Khai Long 2,3_Wnd	200	Wind	candidate
Phan Ri Thanh_Wnd	30	Wind	candidate
Phong Dien 1 - Binh Thuan_Wnd	120	Wind	candidate
Phuoc The_Wnd	28	Wind	candidate
PV Power - IMPSA_Wnd	600	Wind	candidate
Saigon - Binh Thuan_Wnd	200	Wind	candidate
Tan An 1_Wnd	25	Wind	candidate
Tan Thuan_Wnd	25	Wind	candidate
Thái Hòa_Wnd	90	Wind	candidate
Thien Nghiep_Wnd	40	Wind	candidate
Thuan Nhien Phong_Wnd	32	Wind	candidate
V1-1-6_Wnd	270	Wind	candidate
Vinh Chau 1-3_Wnd	1480	Wind	candidate
wind_can	1518	Wind	candidate

contains the transmission developments for 2033-2035 period in addition to the 2022-2032 period.

b. Scenarios with aggressive cross border interconnection development have the highest development of transmission capacity (up to 36 GW).
c. In scenarios with nuclear option and high fossil fuel price, new interconnection capacity is increased due to the reduced gas and coal generation in Thailand and Viet Nam.

F. Operating and Capital Costs

192. The operating costs and capital costs for the period resulting from the study model (Net present value in 2022 $ billion) are given in Table 21. The cost savings for each scenario are compared with the reference scenario. Reference scenario for each demand growth scenario (scenarios RM, RH and RL for medium, high and low demand growth scenarios, respectively) represents the planned and proposed regional generation and transmission developments based on individual country plans and already committed cross-border transmission development projects. Base scenario is the most likely future regional development scenario[25] which also includes development of candidate transmission developments.

Table 21: Operating and Capital Costs for the study period (in $ billion - 2022 NPV)

Scenario		Capital Cost	Operating Cost	Total Cost	Cost Savings
No.	Name				
Medium demand growth scenarios					
RM	M_REFERENCE	23	212	235	0
BM	**M_BASE_BASE**	25	190	215	20
S1	M_GAS_BASE	24	173	197	38
S2	M_VRE_BASE	34	181	214	20
S3	M_HIF_BASE	41	207	248	-13
S4	M_BASE_BSS	27	189	216	19
S5	M_VRE_BSS	32	183	215	20
S6	M_BASE_NUC	26	190	216	19
S7	M_HIF_NUC	42	205	248	-13
S8	M_BASE_INT	27	177	204	31
S9	M_HIF_INT	42	192	234	1
S10	M_VRE_INT	35	169	203	31
High demand growth scenarios					
RH	H_REFERENCE	38	262	300	0
BH	**H_BASE_BASE**	40	216	256	45
S11	H_GAS_BASE	35	199	233	67
S12	H_VRE_BASE	47	207	254	46
S13	H_HIF_BASE	52	241	293	7
S14	H_BASE_BSS	38	217	255	45
S15	H_VRE_BSS	44	210	254	46

[25] This is the most likely future development scenario if GMS countries are willing to establish an interconnected regional power system with bilateral and multilateral cross-border interconnections.

Scenario		Capital Cost	Operating Cost	Total Cost	Cost Savings
No.	Name				
S16	H_BASE_NUC	38	218	255	45
S17	H_HIF_NUC	56	237	293	8
S18	H_BASE_INT	39	202	241	59
S19	H_HIF_INT	50	225	276	25
S20	H_VRE_INT	45	194	240	61
Low demand growth scenarios					
RL	L_REFERENCE	12	187	199	0
BL	**L_BASE_BASE**	15	168	183	16
S21	L_GAS_BASE	13	154	167	32
S22	L_VRE_BASE	23	159	182	17
S23	L_HIF_BASE	31	180	211	-12
S24	L_BASE_BSS	15	168	183	16
S25	L_VRE_BSS	20	162	182	17
S26	L_BASE_NUC	16	166	183	16
S27	L_HIF_NUC	32	179	211	-12
S28	L_BASE_INT	17	155	172	27
S29	L_HIF_INT	31	167	198	1
S30	L_VRE_INT	24	147	171	28

193. The medium demand growth scenarios, low gas price scenario (scenario S1) and aggressive interconnection development scenario (scenario S8) show significant cost savings compared to the base scenario (scenario BM) cost savings. Scenarios with high fossil fuel price cause significantly lower cost advantages due to the increased operating cost.

194. The cost advantage of scenarios corresponding to high demand growth are significantly higher (approximately $25 billion) compared to medium demand growth scenarios. Similarly, cost advantage of low demand growth scenarios are consistently lower (approximately $3 billion) compared to medium demand growth scenarios. However, similar cost advantage trends are observed for medium, high and low demand growth conditions.

195. The total cost of each scenario is mostly composed of the operating cost (82% to 95%). The components of the total cost and their impact are analyzed further in section VII.A.

196. The total value of investment to develop transmission and generation assets (Net present value in 2022 $ billion) are given in Table 22. The increment of investment cost for each scenario compared to the reference scenario is provided.

Table 22: Total Investment (in $ billion - 2022 NPV)

Scenario		Investment cost			Increment in investment cost	Cost savings during the period
No.	Name	Transmission	Generation	Total		
Medium demand growth						
RM	M_REFERENCE	2	50	52	0	0

Scenario		Investment cost			Increment in investment cost	Cost savings during the period
No.	Name	Transmission	Generation	Total		
BM	**M_BASE_BASE**	4	51	55	3	20
S1	M_GAS_BASE	4	46	50	-2	38
S2	M_VRE_BASE	4	55	60	8	20
S3	M_HIF_BASE	5	62	67	15	-13
S4	M_BASE_BSS	4	51	55	3	19
S5	M_VRE_BSS	4	55	60	8	20
S6	M_BASE_NUC	4	48	53	1	19
S7	M_HIF_NUC	5	72	77	25	-13
S8	M_BASE_INT	5	51	56	4	31
S9	M_HIF_INT	6	63	68	17	1
S10	M_VRE_INT	5	54	60	8	31
High demand growth						
RH	H_REFERENCE	2	80	82	0	0
BH	**H_BASE_BASE**	5	80	85	3	45
S11	H_GAS_BASE	5	74	78	-3	67
S12	H_VRE_BASE	5	83	88	6	46
S13	H_HIF_BASE	5	88	93	12	7
S14	H_BASE_BSS	5	77	82	0	45
S15	H_VRE_BSS	5	80	85	3	46
S16	H_BASE_NUC	5	77	82	0	45
S17	H_HIF_NUC	5	101	105	24	8
S18	H_BASE_INT	5	73	78	-3	59
S19	H_HIF_INT	6	83	88	7	25
S20	H_VRE_INT	5	77	82	0	61
Low demand growth						
RL	L_REFERENCE	2	28	30	0	0
BL	**L_BASE_BASE**	4	27	31	1	16
S21	L_GAS_BASE	4	24	28	-2	32
S22	L_VRE_BASE	4	39	43	13	17
S23	L_HIF_BASE	4	45	49	19	-12
S24	L_BASE_BSS	4	27	31	1	16
S25	L_VRE_BSS	4	33	37	7	17
S26	L_BASE_NUC	4	29	34	3	16
S27	L_HIF_NUC	4	44	48	18	-12
S28	L_BASE_INT	5	30	35	5	27
S29	L_HIF_INT	5	44	49	19	1
S30	L_VRE_INT	5	35	40	10	28

197. In most scenarios, the increment of investment cost compared to the reference scenario is less than the total cost savings during the period. This is an indication that the total additional investment due to cross-border transfer could be paid back using the cost benefit accumulated

during the study period. In addition, these investments will continue to provide cost savings after the study period throughout the lifetime.

VII. Results Analysis

A. Cost Benefit

198. The total cost for the study period consists of two components, generation and transmission capital expenditure (CAPEX) and Operating Expenditure (OPEX). The main concept used in optimizing the study scenarios is varying the generation and transmission CAPEX for the study period to minimize the total cost (both OPEX and CAPEX). The capital costs, operating costs, and the total investment cost for reference, base and aggressive power trade scenarios are compared for the medium demand growth condition in Figure 28.

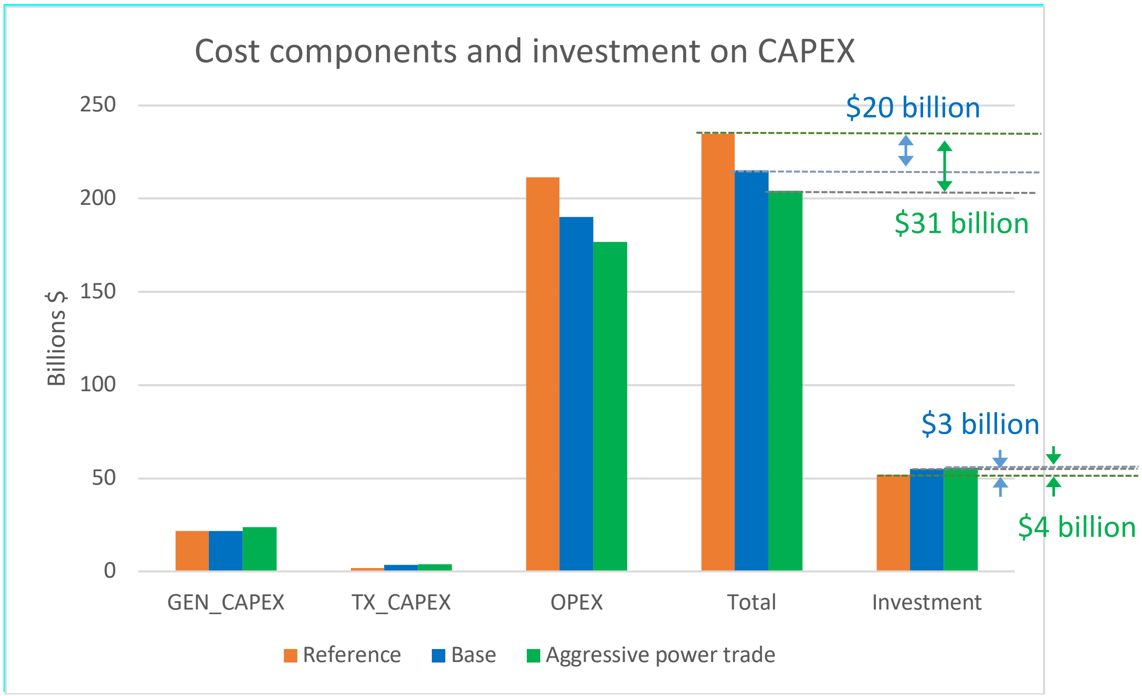

Figure 28: Variation of cost with CAPEX

199. It can be observed that a large share (about 90%) of the total cost is the OPEX cost while generation and transmission CAPEX are relatively small components. However, the OPEX cost is highly sensitive to the variations in CAPEX cost and it is demonstrated that OPEX can be greatly decreased in base and aggressive power trade scenarios by small increments in generation and transmission CAPEX.

200. It can be noticed that the increment of investment cost in base and aggressive power trade scenarios compared to the reference scenario ($3 billion and $4 billion respectively) is less than the total cost savings during the period ($20 billion and $31 billion respectively). This shows that the total additional investment due to cross-border transfer could be paid back using the cost benefit accumulated during the study period.

B. Major Generation/Transmission Trends

201. When analyzing the generation and transmission developments in different study scenarios, several common development trends are observed. These trends provide significant economic benefit under many study scenarios regardless of uncertainties such as variations in load growth, fossil fuel price, etc. These major generation and transmission trends are discussed in the following sections. Further details of these trends and other generation and transmission developments are given in Appendix 2: Generation and Transmission Plan.

1. Cambodia

202. Cambodia has significant hydro potential in the northeast and southwest regions, as well as solar potential mostly in the central region. Common generation development trends in Cambodia for medium demand growth scenarios are as follows:

a. Hydro potential in the northeast and southwest regions of Cambodia (3-6 GW) is developed in all study scenarios.

b. Solar generation is also developed, mostly in the central region (2-3 GW).

c. Due to the high demand growth in Cambodia, large amount of thermal generation (mainly gas) is required to supply the future demand mainly in the later part of the study period (9 GW).

203. A number of cross-border interconnections involving Cambodia are developed, mainly to import power into Cambodia.

a. The candidate Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection connecting Lao PDR, Cambodia and Viet Nam is developed in most study scenarios. Lao PDR has hydro potential in the south region that is exported to Cambodia.

b. The candidate interconnections between Viet Nam and Cambodia (Lower Se San 2 HPP–Pleiku and Kampong Cham – Tay Ninh) are developed in most scenarios. Power is exported from Viet Nam to Cambodia to support the very high demand growth in Cambodia.

c. The candidate interconnection between Thailand and Cambodia (Wangnoi – Kampong Cham) is developed in most study scenarios. This interconnection is used to import power from Thailand, and provides an opportunity for multilateral power trade between Thailand, Cambodia and Viet Nam later in the study period.

2. Lao PDR

204. Lao PDR has a large amount of hydro potential in north and south regions, making it possible to export hydro power to each of its neighboring countries. Common generation development trends in Lao PDR are as follows:

a. Hydro generation development (3-5 GW), mostly in north and south regions.

b. Wind generation in the south region (0.5 GW).

205. Cross-border interconnections are developed between Lao PDR and all of its neighboring countries in most study scenarios. In Lao PDR-Thailand corridor, it is sufficient to upgrade existing generator-grid interconnections into grid-grid interconnections without developing new

cross-border interconnections. New interconnections are developed in all other cross-border transmission corridors involving Lao PDR:

a. Lao PDR has several candidate interconnections with Viet Nam, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection that is also connected to Cambodia. These interconnections are developed in most study scenarios. Since Lao PDR has hydro potential in both the south and north regions, these interconnections could be used to supply demand in different parts of Viet Nam. Hydro developments in Luang Prabang province in northern Lao PDR is exported to northern Viet Nam, which could help supply large load centers near Hanoi, Viet Nam. Hydro development in the Nam Theun River area in central Lao PDR can be exported to central Viet Nam. Hydro development in south Lao PDR in the Attepeu (including Xekaman 4 HPP), Sekong and Champasak provinces is exported to Viet Nam and Cambodia.

b. The candidate line Namo – Kenglatt – Tachileik between Lao PDR and Myanmar is developed in all scenarios. This interconnection would enhance the power export capability and reliability of both countries.

c. The candidate line from Luang Prabang province in Lao PDR to Yunnan province in PRC is developed in most scenarios. This interconnection is used to export hydro power from northern Lao PDR to PRC.

3. Myanmar

206. Myanmar has very high hydro potential, mostly in the north region. There is also some potential to develop wind generation in Myanmar. Common generation development trends in Myanmar are as follows:

a. About 8-12 GW of hydro developments are seen in most scenarios, where majority of the power is exported to Thailand.

b. Wind generation (1-3 GW) is developed in the central and southern regions.

207. Cross-border interconnections are developed between Myanmar and three neighbor countries, Thailand, PRC and Lao PDR.

a. The three candidate interconnections between Myanmar and Thailand are developed in all scenarios. The Mae Khot – Mae Chan interconnection which is intended to be used to connect a thermal power plant in Myanmar to the Thailand grid could be utilized to transfer hydro power in Myanmar central area (including Middle Yeywa hydro power plant), if Myanmar-Thailand grids could be synchronized. The hydro potential in the southern region of Myanmar including the Taninthayi and Hutgyi hydro power plants could potentially be exported to Thailand in the later stages of the study period.

b. The candidate interconnection Mandalay (Myanmar) – Yunnan (PRC) is developed to transfer more hydro power from northern Myanmar (including plants such as Naopha and Kunlong HPPs) to PRC, similar to the existing Shweli 1 and Dapein 1 HPPs.

c. The candidate cross-border interconnection Namo – Kenglatt – Tachileik between Lao PDR and Myanmar is developed in all scenarios. This interconnection would enhance the power export capability and reliability of both countries.

4. Thailand

208. Generation potential in Thailand is mostly thermal generation and solar generation. Common generation development trends in Thailand for medium demand growth scenarios are as follows:

a. Coal generation (about 3 GW) is developed in central and southern regions.
b. Gas generation (about 3 GW) is seen mainly in the central region.
c. Solar generation (about 7 GW) is distributed in the north, central and northeast regions.

209. Cross-border interconnections are developed between Thailand - Myanmar and Thailand – Cambodia. Existing generator-grid interconnections in Lao PDR-Thailand corridor are upgraded into grid-grid interconnections without developing new cross-border interconnections.

a. The three candidate interconnections between Thailand and Myanmar are developed in all scenarios. The Mae Khot – Mae Chan interconnection which is intended to be used to connect a thermal power plant in Myanmar to the Thailand grid could be utilized to transfer hydro power in Myanmar central area (including Middle Yeywa hydro power plant), if Myanmar-Thailand grids could be synchronized. The hydro potential in the southern region of Myanmar including the Taninthayi and Hutgyi hydro power plants could potentially be exported to Thailand in the later stages of the study period.
b. The candidate interconnections between Thailand and Cambodia (Wangnoi – Kampong Cham) is developed in most scenarios. This interconnection could be for export to Cambodia, and provides an opportunity for power trade with Viet Nam later in the study period.

5. Viet Nam

210. Viet Nam has a large amount of candidate coal generation in north and south regions, as well as a large amount of candidate VRE generation in south and central regions. Common generation development trends in Viet Nam for medium demand growth scenarios are as follows:

a. Coal generation (8-17 GW) is developed in Northern and southern regions.
b. Wind generation (6-7 GW) is developed mostly in the southern region and solar generation (5-9 GW) is distributed in southern and central regions.
c. Gas and combined cycle generation (3.5 GW) developed mostly in the south region and also in the central region.
d. Small amount of hydro generation (less than 2 GW) is seen in the central and north regions.

211. Cross-border interconnections between Viet Nam - Lao PDR and Viet Nam – Cambodia are developed in most study scenarios.

a. Viet Nam has several candidate interconnections with Lao PDR, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection that is also connected to Cambodia. These interconnections are developed in most scenarios. Since Lao PDR has hydro potential in both the south and north regions, these interconnections could be used

to supply demand in different parts of Viet Nam. Hydro developments in Luang Prabang province in northern Lao PDR is exported to northern Viet Nam, which could help supply a large load centers near Hanoi, Viet Nam. Hydro development in the Nam Theun River area in central Lao PDR can be exported to central Viet Nam. Hydro development in south Lao PDR in the Attepeu (including Xekaman 4 HPP), Sekong and Champasak provinces is exported to Viet Nam and Cambodia.

b. The candidate interconnections between Viet Nam and Cambodia (Lower Se San 2 HPP–Pleiku and Kampong Cham – Tay Ninh) are developed in most scenarios. Power is exported from Viet Nam to Cambodia to support the very high demand growth in Cambodia.

6. Peoples' Republic of China (PRC)

212. PRC is considered as a potential importer and candidate generation is not modeled in PRC for main scenarios, since PRC may be unlikely export power in the near future[26]. However, possibility of power exporting and power wheeling through PRC are studied under sensitivity scenarios.

213. The candidate interconnection Mandalay (Myanmar) – Yunnan (PRC) is developed in most scenarios. Similar to the existing Shweli 1 and Dapein 1 HPPs, more hydro power from northern Myanmar (including plants such as Naopha and Kunlong HPPs) could be exported to PRC based on mutual agreement.

214. The candidate line from Luang Prabang province in Lao PDR to Yunnan province in PRC is developed in most scenarios. This interconnection is used to export hydro power from northern Lao PDR to PRC.

C. Comparison of Selected Scenarios

215. In this section, three selected scenarios (for medium demand growth) are compared:

- Base scenario – Most likely generation and transmission development options
- Reduced VRE cost scenario – VRE cost is reduced by 20%
- Aggressive cross-border power trade scenario – Increased cross-border transmission options

1. Cost Benefit

216. The total cost and cost benefit of these scenarios is summarized in Table 23.

Table 23: Cost comparison of selected scenarios (Medium demand growth)

Scenario	Total cost ($ billion)	Cost Benefit ($ billion)
Base	215	20
VRE cost reduced	214	20
Aggressive cross-border power trade	204	31

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[26] Based on feedback from representatives of PRC (Appendix 5: Comments Matrix)

217. The aggressive cross-border power trade scenario shows $11 billion savings compared to the base scenario. This is mainly due to the better utilization of hydro and VRE resources in the aggressive cross-border power trade scenario compared to the base scenario.

218. The reduced VRE cost scenario shows a $1 billion increment[27] in savings compared to the base scenario, mainly due to the higher VRE capacity which reduced the operating cost slightly.

2. Hydro Generation

219. The progression of hydro energy generation of the three scenarios is compared in Figure ***29***.

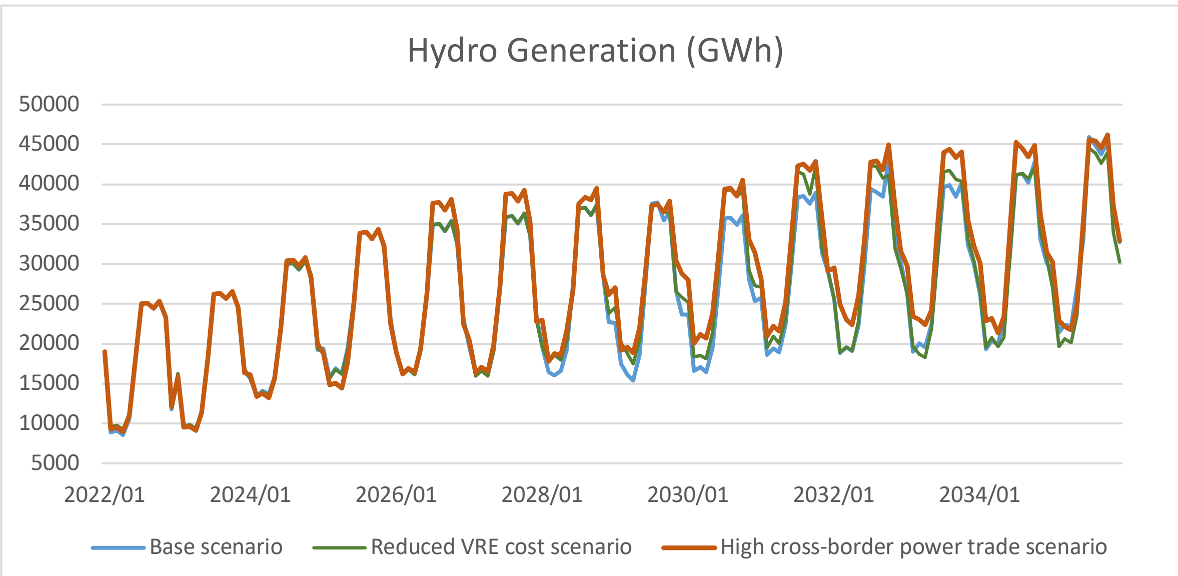


Figure 29: Progression of hydro energy usage

220. There is more hydro energy usage in the aggressive cross-border power trade scenario since there is higher capability to export power through cross-border links. Most of the additional hydro energy development is in Myanmar and Lao PDR.

[27] Medium base scenario and reduced VRE scenario savings are $19.52 billion and $20.47 billion, respectively. Actual difference is $0.95 billion. Table 23 shows roundoff values of $20 billion each for both scenarios.

3. Renewable Generation

221. The progression of renewable energy generation of the three scenarios is compared in Figure 30.

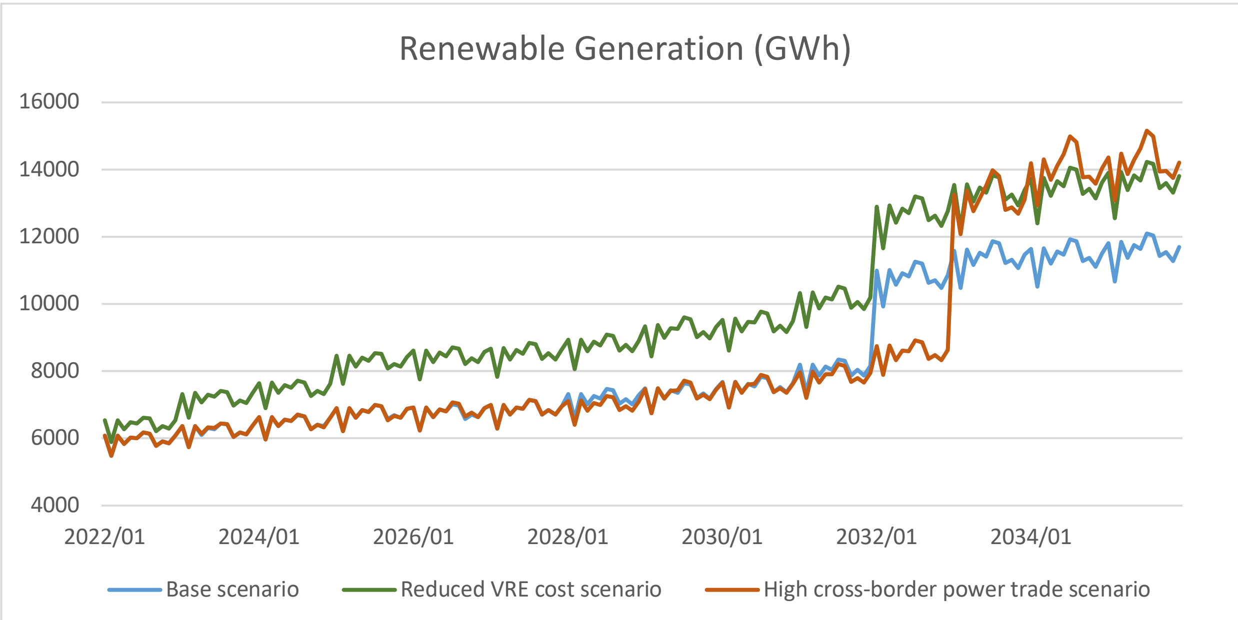


Figure 30: Progression of renewable energy usage

222. There is more VRE energy usage in the reduced VRE cost scenario, due to the lower costs for VRE and higher candidate capacity. Most of the additional renewable energy development is in Thailand and Viet Nam (south and central regions). Due to increased cross-border power trade, the aggressive cross-border power trade scenario also shows high VRE development in the later stages of the study period.

D. Local Network Upgrades

223. Upgrading the transmission network within individual countries is essential to realize the regional generation and transmission plans. Selection and staging of the local network upgrades is a responsibility of individual countries and it will be determined by the planning process of those countries. However, major transmission upgrades and the associated costs are captured for the development of the regional plan. An example of a local network upgrade is shown in Figure 31 where the transmission capacity of the corridor from central to southern Lao PDR is required to be upgraded.

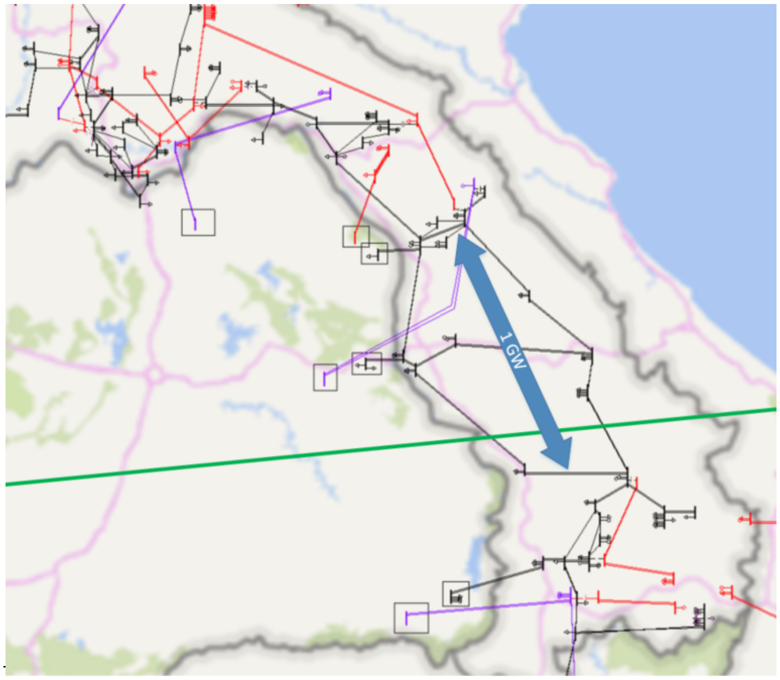


Figure 31: Example network upgrades – central to southern Lao PDR

224. The present transmission capacity in the corridor from central to southern Lao PDR is about 200 MW (four 115 kV lines). An upgrade of transmission capability to about 1 GW from central to southern Lao PDR may be required to realize the generation and transmission planning scenarios in the medium demand growth conditions. A 500 kV transmission line could be used to mitigate this transmission deficiency.

225. Another example is the limited transmission capacity between northwest to central Cambodia as shown in Figure 32.

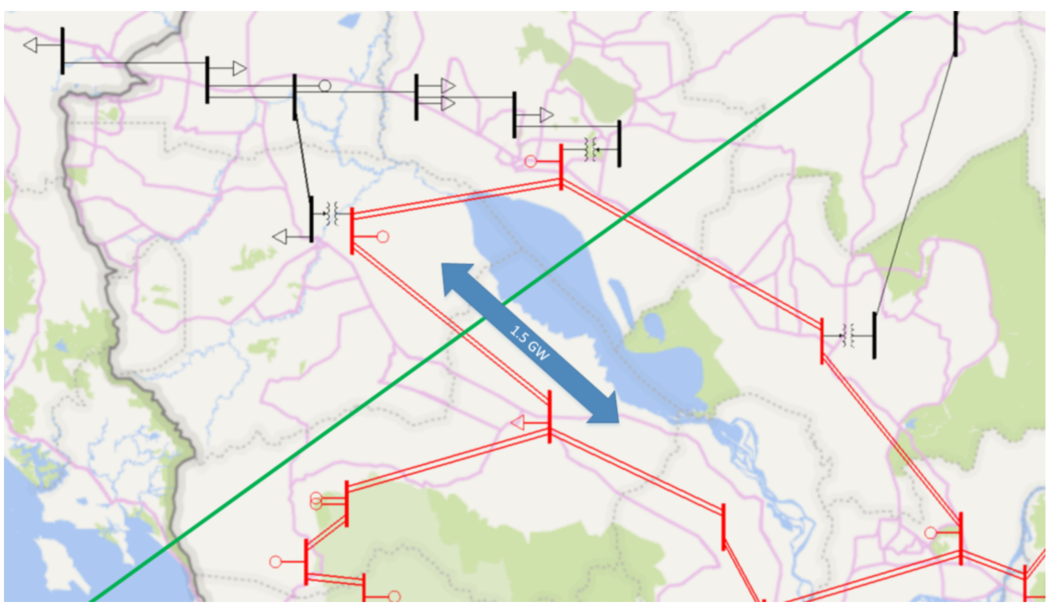


Figure 32: Example network upgrades – Cambodia northwest region to central region

226. The existing transmission capacity from northwest to central Cambodia is about 1000 MW (four 230 kV lines). An upgrade of transmission capability to about 1.5 GW from northwest to central Cambodia may be required for most of the generation and transmission planning scenarios. The candidate project Wangnoi (Thailand) – Banteay Mean Chey – Siem Reap – Kampong Cham (or similar transmission upgrade) would increase the power transfer capacity to the required amount if it is built.

VIII. GMS Grid Interconnection Challenges and Timeline

A. Current Situation

227. There are a number of existing 'cross-border' transmission lines between the GMS countries. However, most of these lines are connected to an isolated generator or load in one country to the transmission grid of the other country (i.e. 'gen-to-grid' or 'load-to-grid' interconnections). Therefore, these transmission lines do not interconnect the two power systems ('grid-to-grid' interconnections).

228. However, there are several synchronous interconnections exist between GMS countries. The only existing high voltage synchronous interconnection is the 230 kV Chau Doc – Takeo – Phnom Penh line between Viet Nam and Cambodia. All other grid-grid interconnections are at medium or low voltage (<132 kV). Figure 33 shows the distribution of cross-border transmission lines in GMS region.

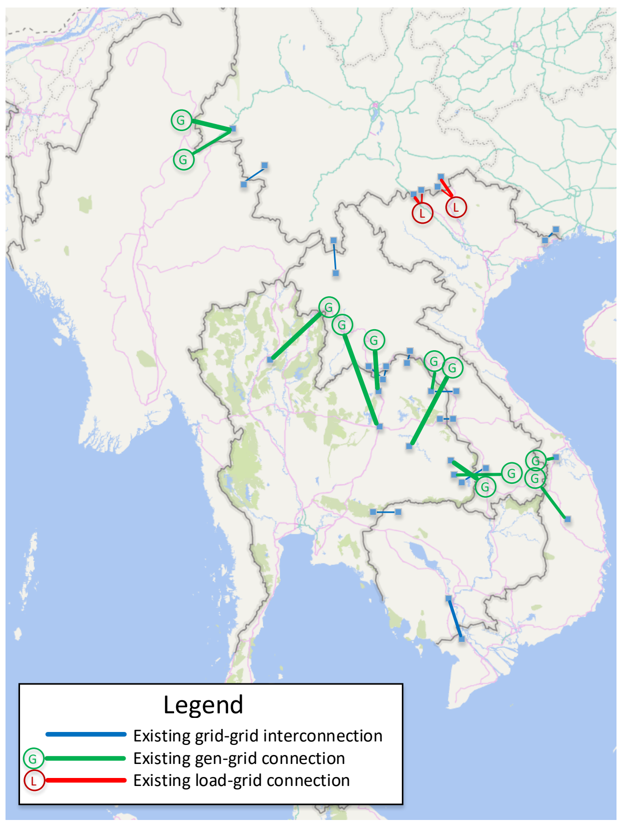


Figure 33: Existing cross-border transmission lines in GMS countries

229. In addition to the transmission lines shown in Figure 33, there are a number of distribution level (22 kV to 35 kV) interconnections between Lao PDR, Cambodia and Viet Nam.

230. Due to the lack of high voltage synchronous interconnections, cross-border power transfer between power systems is limited. There are many challenges for further expansion of synchronous cross-border interconnection in the GMS region, which will be discussed in the next section.

B. Challenges in Grid Interconnection in the GMS Region

231. Synchronous HVAC interconnections are the most common option in interconnecting two isolated power systems. However, in the context of GMS countries, this option becomes challenging due to significant differences in dynamic performance in the different local grids.

232. In the GMS region, Lao PDR, Cambodia and Myanmar neither have comprehensive grid codes nor overall grid code compliance [38]. It is also reported that many generator governors are not controlling the frequency though droop control and there is no AGC (Automatic Generator Control). This results in diminished dynamic performance, reliability and frequent fluctuations of frequency.

233. In comparison, Thailand and Viet Nam have detailed grid codes and reasonable grid code compliance. These two countries are the main load centers in the GMS region and they can benefit from low cost generation imports. However, the above mentioned dynamic performance issues in the power exporting countries have discouraged the development of large scale synchronous interconnections.

234. A high capacity, unreliable interconnection impacts the reserve requirement of the importing country. Generally, it is sufficient to have the spinning reserves equivalent to the largest unit in operation. However, if there is an interconnection with higher capacity which frequently trips, it may be required to increase the spinning reserves and hence the operating cost.

235. In addition to these concerns, benefits of interconnecting could be impacted by the inaccurate demand forecasting and system planning.

C. Potential Solutions and Advantages

236. As described in the previous section, there are many challenges with interconnecting the GMS countries with high capacity synchronous interconnections. However, most of these challenges could be resolved by improving the dynamic performance of the local grids.

237. It is essential to implement a comprehensive regional grid code and maintain compliance with the planning and operational criteria detailed in the grid code to improve the dynamic performance.

238. As a part of the dynamic performance improvements, it is important to implement primary (governor control), secondary (AGC) and tertiary (dispatchable/non-spinning) reserves in the power system. It is important that all or majority of the generating stations participate in this including both utility owned generation and independent power producers (IPPs).

239. Improving the system dynamic performance has a number of benefits which go beyond facilitating cross-border interconnection. These include increasing the quality and reliability of the individual power systems, better utilization of the local generation resources and lower spinning reserve requirements. These benefits could also significantly reduce the energy generation cost as well as generation and transmission investment costs for a given country.

240. However, even with the above advantages, there is a possibility for long delays in developing high capacity synchronous cross-border interconnections in the GMS region. This could be due to the delays in improving system conditions to sustain high capacity synchronous

interconnections. In addition, negotiations between country authorities and with IPPs may contribute to the delays. In such situations, asynchronous (HVDC) cross-border interconnections could be a potential alternative. The next section will further discuss the HVDC alternative for cross-border power transfer.

D. Asynchronous (HVDC) Interconnections

241. If synchronous grid-grid interconnections are significantly delayed, asynchronous HVDC transmission technology can be used as an alternative solution. The HVDC transmission technology is less vulnerable for difference in dynamic performances of local grids and more suited for cross-border interconnections in GMS region at current state. Following are some of the key advantages of HVDC.

- Flexibility in power transfer - Power transfer can be controlled independent of the angle (δ) difference of the two interconnection points.
- Fast control – HVDC can assist in stabilizing frequency.
- Blocking capability - Fault clearance can be implemented faster due to the use of power electronic switches and improve the transient stability. A disturbance of one system is not transferred to another system.
- Minimal short circuit contribution – HVDC interconnection does not significantly impact the short circuit levels of the two systems, hence, no breaker upgrades required in nearby substations
- Better voltage regulation – terminal voltages do not vary based on the loading similar to the HVAC interconnections

242. Although there are many advantages, the cost of HVDC option is higher compared to HVAC option for shorter transmission lines. In addition, there could be future considerations for HVDC development such as the number of terminals (due to complicated nature of multi-terminal HVDC schemes) and system strength of the potential terminals (effective short circuit ratio should be high for LCC type HVDC schemes).

243. There are two HVDC technologies, LCC (Line Commutated Converter) and VSC (Voltage Sourced Converter). LCC technology is well established and there are many LCC based HVDC systems in operation in the world. VSC technology has developed during the last decade primarily as a means of power transfer from offshore generation to onshore grid using undersea cable systems. There are only a limited number of high capacity VSC schemes used for bulk power transfer at present.

244. There are two main types of HVDC schemes, back-to-back (B2B) and point-to-point (P2P). Point-to-point HVDC schemes are commonly used in bulk power transfer applications. However, back-to-back HVDC scheme with a series AC line could also be used for specific applications.

E. Potential Interconnection Timeline

245. As explained in the previous sections, GMS regional power system is required go through various changes to facilitate broad level cross-border power interconnections. However, each country in the GMS region may required different changes to their power systems and these changes may be accomplished at different timelines.

246. Thailand and Viet Nam have detailed grid codes and their power system operation is generally compliant with the grid code. Lao PDR and Cambodia have limited grid codes which need further revising and grid code compliance of the power system need to improve. Myanmar does not have its own grid code. GMS regional grid code and the grid codes of individual countries should be harmonized and they should consider the requirements for cross-border power transfer.

247. In addition to these, a number of other aspects need to change in the GMS region for successful regional interconnection as listed below:

- Frequency control improvements such as governor droop control and AGC
- Bilateral negotiations on price of power export/import
- Accurate forecasting/planning to gauge the benefits of cross-border power transfer
- Agreements between IPPs and power system utilities on frequency, reactive power support and power purchasing

248. Based on the discussed challenges, a timeline for implementing changes required for bulk cross-border power transfer in GMS region is developed and shown in Figure 34.

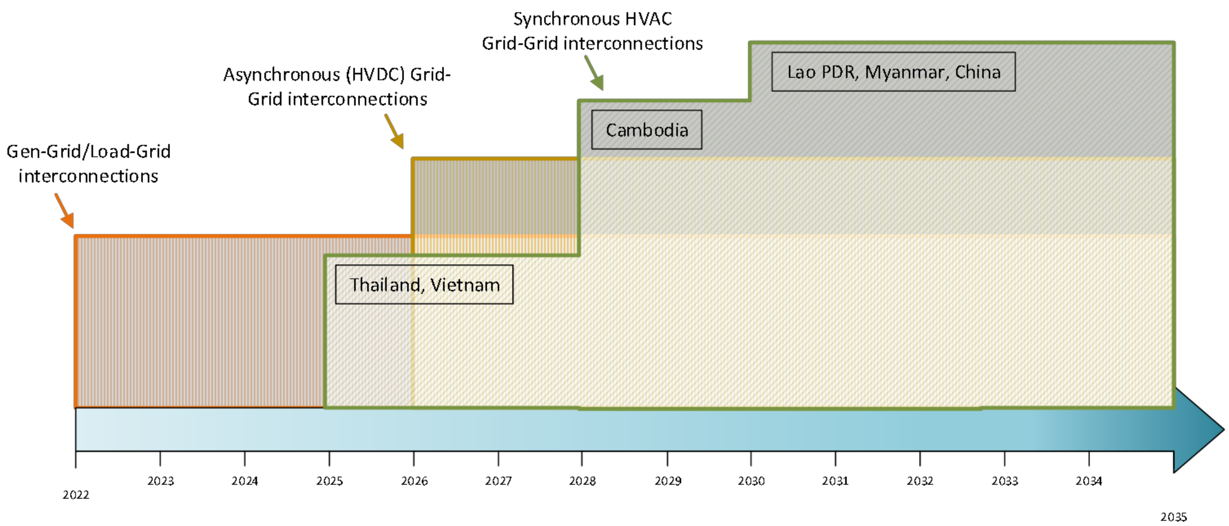
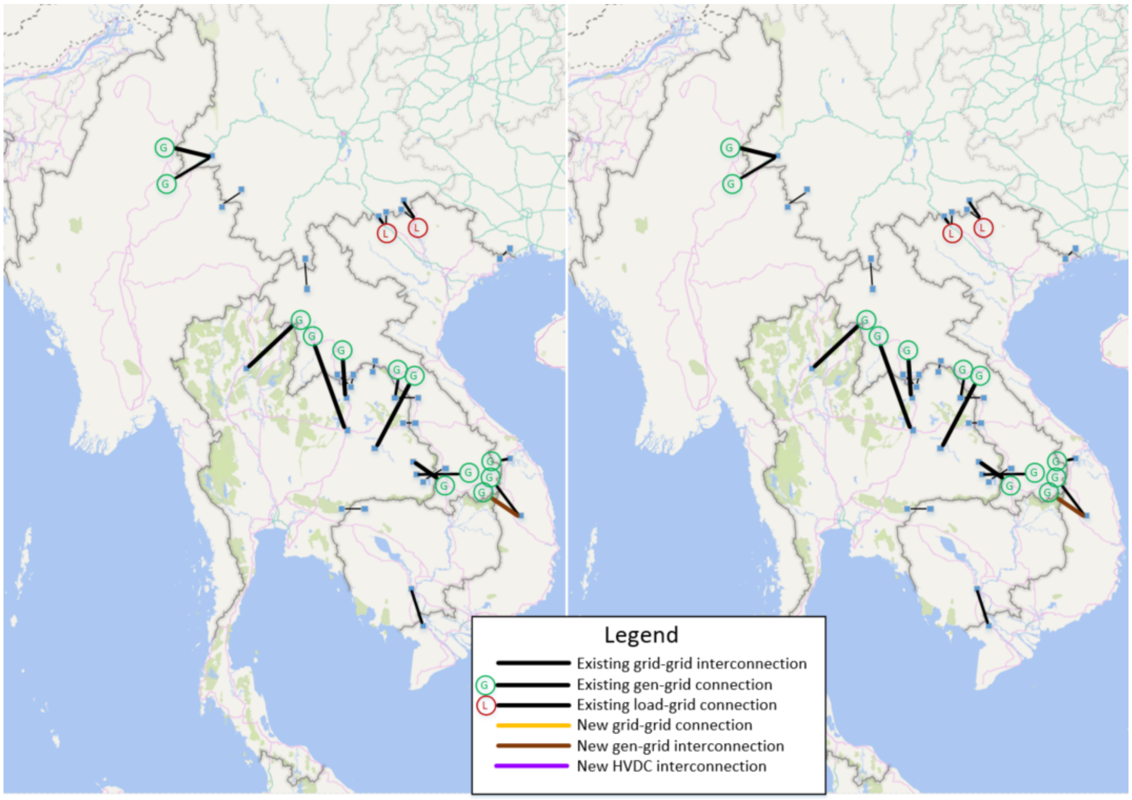


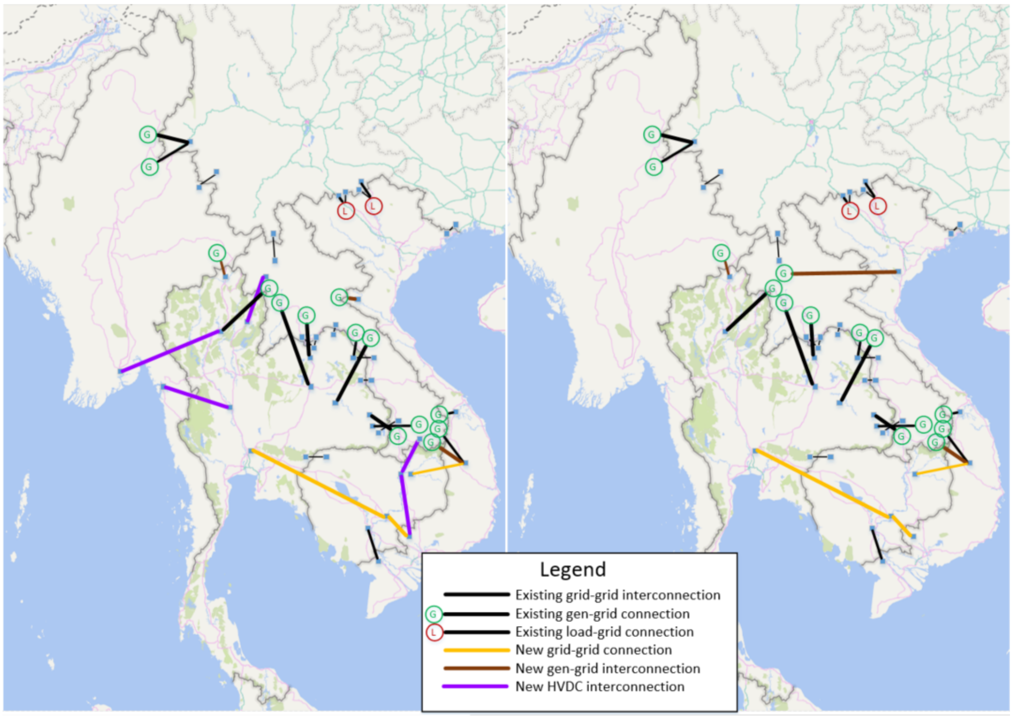
Figure 34: Interconnection timeline (minimum)

249. The timeline shown in Figure 34 is an estimation based on the study reports, country PDPs and public domain data. This timeline could be either expedited or delayed depending on a number of factors such as political will, private and government investments, economic situation of the region and technological advancements.
250. Figure 35 to Figure 37 show Cross-border transmission development situation for medium demand - base study scenario with and without HVDC option by year 2025, 2030 and 2032 respectively while respecting the timeline provided in Figure 34.



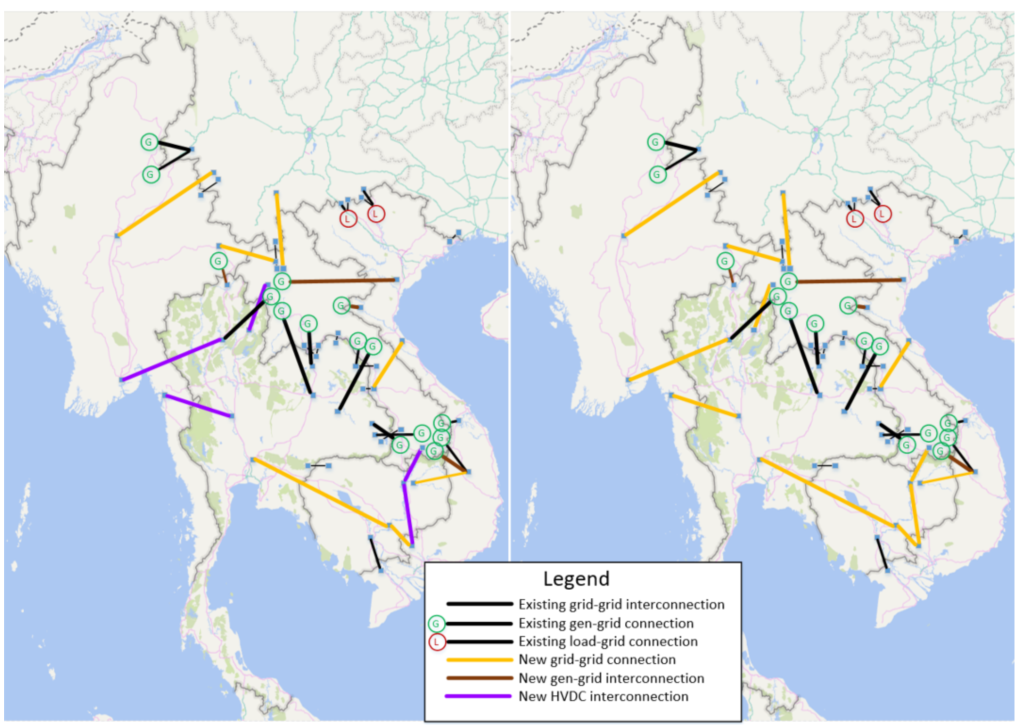
(a) With HVDC option (b) Without HVDC option

Figure 35: Cross-border transmission development situation in 2025 (a) with HVDC option (b) without HVDC option



(b) With HVDC option (b) Without HVDC option

Figure 36: Cross-border transmission development situation in 2030 (a) with HVDC option (b) without HVDC option



(c) With HVDC option (b) Without HVDC option

Figure 37: Cross-border transmission development situation in 2032 (a) with HVDC option (b) without HVDC option

251. The grid-to-grid synchronous interconnections (marked in yellow) involving Lao PDR, Cambodia and Myanmar are built after 2030. However, it could be seen that some of these could be converted to HVDC interconnections (marked in purple) and built during 2026-2030 period.

252. The delays associated with developing synchronous cross-border interconnections for bulk power transfer could increase the total cost of operation for the GMS region. Some of the untapped benefits from cross-border transfer could be extracted by developing HVDC interconnections as summarized in Table 24.

F. Impact of Grid Synchronization Delay

253. The impact of grid synchronization delays on total cost is summarized in Table 24. OPEX and CAPEX costs are compared for No grid synchronization delay (case A), HVDC option used for the period with synchronization delays (case B) and without HVDC option during the period with synchronization delays (case C).

Table 24: Impact of grid synchronization delay, Medium demand - base scenario

Study case	Description	CAPEX ($ billion)			OPEX ($ billion)	Total Cost ($ billion)
		Generation	HVAC transmission	HVDC transmission		
A	No delay for Grid-Grid interconnections	22	4	-	190	215
B	With likely synchronization delays (with HVDC option)	23	3	2	194	222
C	With likely synchronization delays (no HVDC option)	22	3	-	201	226

254. It could be seen that there is significant benefit, even when HVDC option is used (case B) compared to delaying the grid-grid interconnections (case C).With the HVDC option, transmission CAPEX is slightly increased due to higher cost of HVDC lines. However, there is a significant reduction in OPEX cost compared to delaying the grid-grid interconnections (case C) which result in a cost saving of about $4 billion.

255. The impact of synchronization delay can also be observed in the progression of hydro generation, as shown in Figure 38.

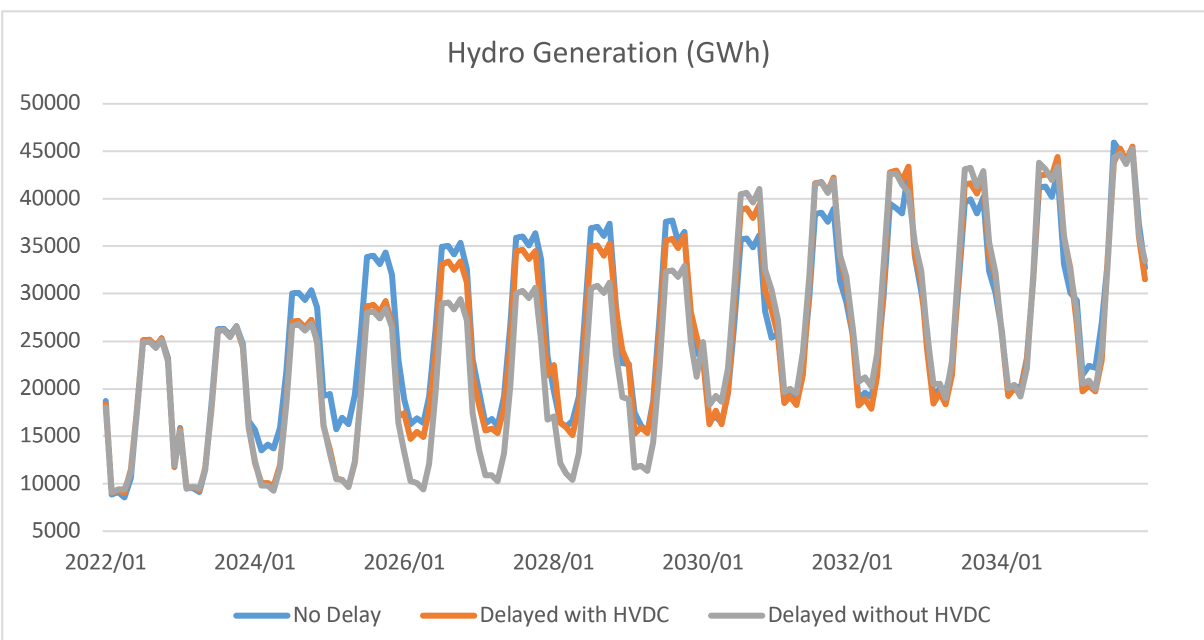


Figure 38: Impact of synchronization on hydro development

256. The delayed cases show much less hydro generation in the early part of the study period, before suddenly increasing when interconnections are finally allowed (2026 for HVDC option, 2030 with no HVDC option).

IX. Sensitivity Analysis

A. Scenarios

257. A total of twelve (12) sensitivity scenarios are studied in order to study possible uncertainties and variations that are not considered under main scenarios and test the resilience of identified major generation and transmission developments. There are four main sensitivity scenarios (scenario number SS1-SS4) and eight additional sensitivity scenarios (scenario number SS5-SS12) studied, as shown in Table 25.

Table 25: Sensitivity scenarios

No.	Scenario[28]	Description
SS1	**COVID-19 demand scenario**	The potential impact of COVID-19 pandemic to future regional demand is studied. The demand is decreased by 8% compared to the low demand growth scenario.
SS2	**Dry future scenario**	Low future hydro availability is studied by reducing the hydro inflows by 20%.
SS3	**Reduced carbon emission**	Adoption of carbon emission reduction policy is studied by implementing an additional cost of 30$/ tCO2 for thermal generation.
SS4	**No import restrictions**	The aggressive cross-border transmission development is studied with the restrictions on imports into Thailand and Viet Nam removed.
SS5	Increased power wheeling to Malaysia	The transfer from the south of Thailand to Malaysia is increased by 1 GW from the existing 300 MW transfer
SS6	Increase of electric vehicles in Thailand	The impact of increasing number of EVs in Thailand is studied. The additional demand for EVs is added to the Thailand demand model.
SS7	PRC power wheeling	The benefits of power wheeling between interconnections with PRC is studied
SS8	Further delayed interconnections	The impact of further delays to grid-grid interconnections is studied.
SS9	PRC export	PRC exports 2 GW after 2030
SS10	PRC import	PRC imports 2 GW after 2030
SS11	PRC hydro export	PRC exports 2 GW hydro from 2025
SS12	Low gas price aggressive cross-border power trade	The medium demand low gas price scenario is studied with aggressive cross-border power trade

B. Results

258. . Detailed generation and transmission plans for the above sensitivity scenarios are given in Appendix 2: Generation and Transmission Plans. Results analysis of the main sensitivity scenarios are analyzed in the following section, followed by a results summary of other sensitivity scenarios.

[28] Most of sensitivity scenarios are based on comments given in Appendix 5: Comments Matrix

1. ‘COVID-19 demand’ Scenario

259. The COVID-19 demand scenario aims to identify the impact of a reduced demand forecast due to COVID-19 pandemic situation. The demand is decreased by 8% from the low demand growth scenario to create the COVID-19 demand scenario. Figure 39 shows a comparison of the CAPEX and OPEX timeline of the COVID-19 demand scenario and the base scenario of the low demand growth condition.

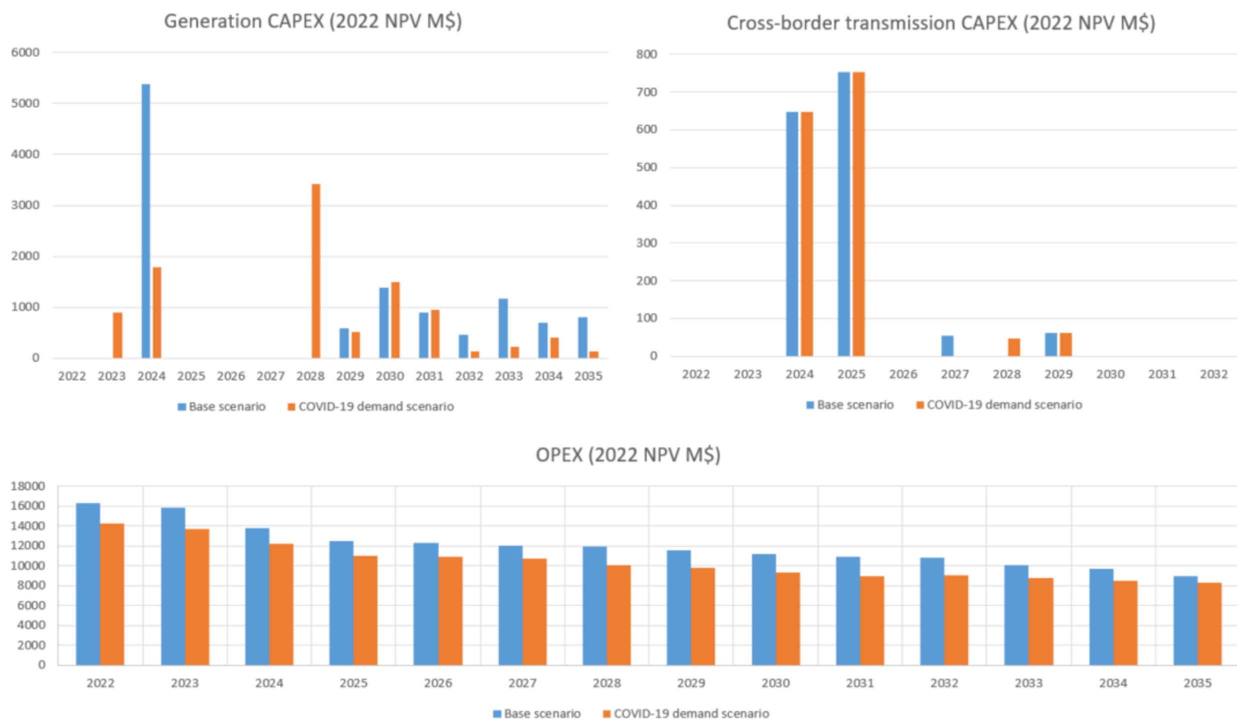


Figure 39: Sensitivity results – COVID-19 demand scenario

260. The generation CAPEX has decreased slightly, and transmission CAPEX is very similar. However, the OPEX component of the cost shows significant decline due to the lower demand. Investment in new thermal generation is delayed which contributes to the decrease in generation CAPEX.

261. The total cost for the COVID-19 sensitivity scenario is $159 billion compared to $183 billion for low demand base scenario due to the lower energy demand. This also contributes to reduce the revenue for power producers and power exporters during the study period.

2. 'Dry future' Scenario

262. The dry future scenario is studied to observe the impact of reduced hydro inflows due to changes in climate. This scenario is created by decreasing the hydro inflows by 20% from the medium demand growth Base scenario. The hydro energy usage for the dry future scenario is compared with the base scenario for medium demand growth condition in Figure 40.

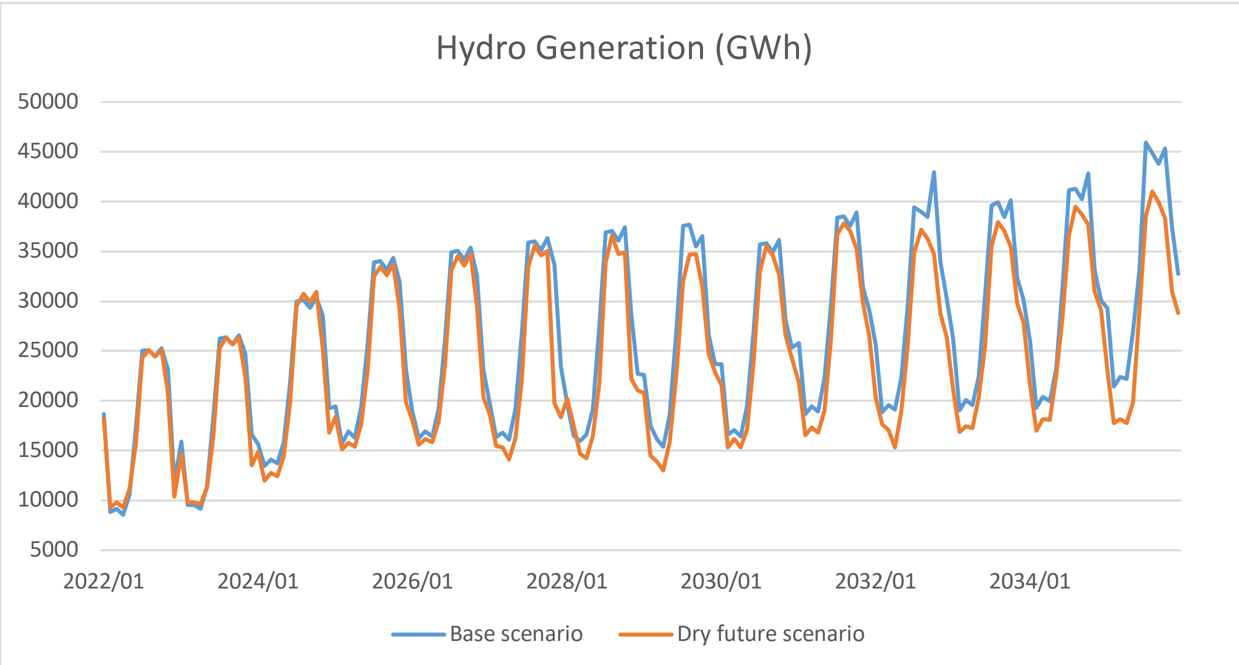


Figure 40: Sensitivity results – Dry future scenario

263. The hydro generation is significantly decreased towards the end of the study period, due to less hydro availability and the reduction in hydro plant development in the dry future scenario. In the dry future scenario, 17 GW of hydro is developed compared to 20 GW for the base scenario.

264. New thermal generation is required to be developed earlier due to low hydro availability. This contributes to higher generation investment and operating costs, increasing the total cost to $225 billion compared to $215 billion for medium demand base scenario.

265. Development of VRE generation is also increased to compensate for the decrease in hydro energy. Importance of VRE generation developments becomes higher in case of a dry future scenario to reduce OPEX costs.

3. 'Reduced carbon emission' Scenario

266. The reduced carbon emission scenario is studied to analyze the adoption of carbon emission reduction policy by GMS region. This scenario is implemented by including a carbon price of $\$30/tCO_2$ for fossil fuel-based generation in the study model. The thermal energy usage of reduced carbon emission scenario is compared with the base scenario (medium demand growth) in Figure 41.

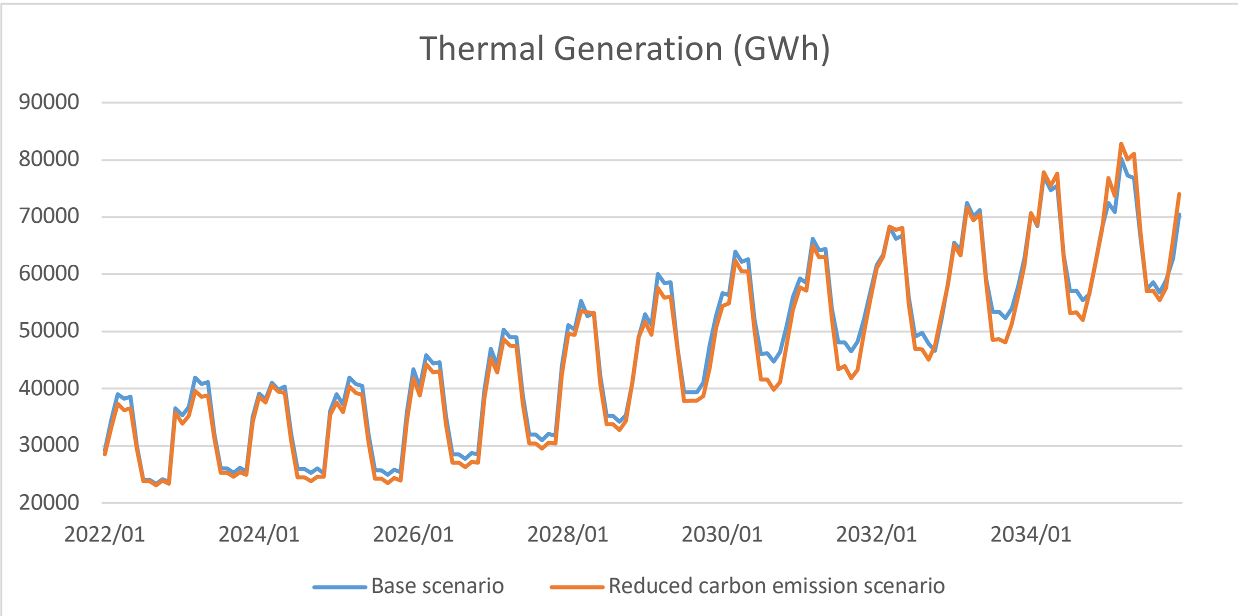


Figure 41: Sensitivity results – Reduced carbon emission scenario

267. Thermal energy usage is reduced over the study period compared to the base scenario. However, the development of thermal generation capacity is similar. This is due to the need for thermal generation capacity to support the peak demand periods.

268. There is much higher VRE capacity developed in the reduced carbon emission scenario, mostly in Thailand, to compensate for the reduced thermal energy generation. Cross-border power trade is developed earlier, enhancing resource sharing in the region.

269. The total cost of the reduced carbon emission scenario is $242 billion compared to $215 billion for medium demand growth Base scenario[29]. This additional cost is due to the policy change of adding a carbon emission price. Funds collected from carbon emission charges can be used to invest in environmentally friendly low carbon emission technology.

[29] Medium demand growth Base scenario does not consider carbon emission charges. Cost of medium demand growth Base scenario will be higher than the reduced carbon emission scenario (> $242 billion) if those charges are applied.

4. 'No import restrictions' Scenario

270. The 'No import restrictions' scenario is studied to observe the impact of the import restrictions for Thailand and Viet Nam. The import restrictions for Thailand and Viet Nam are removed from the medium demand growth aggressive cross-border interconnection scenario to create the 'No import restrictions' scenario. The Thailand imports are compared in Figure 42 for medium demand growth Base scenario and 'No import restrictions' scenario.

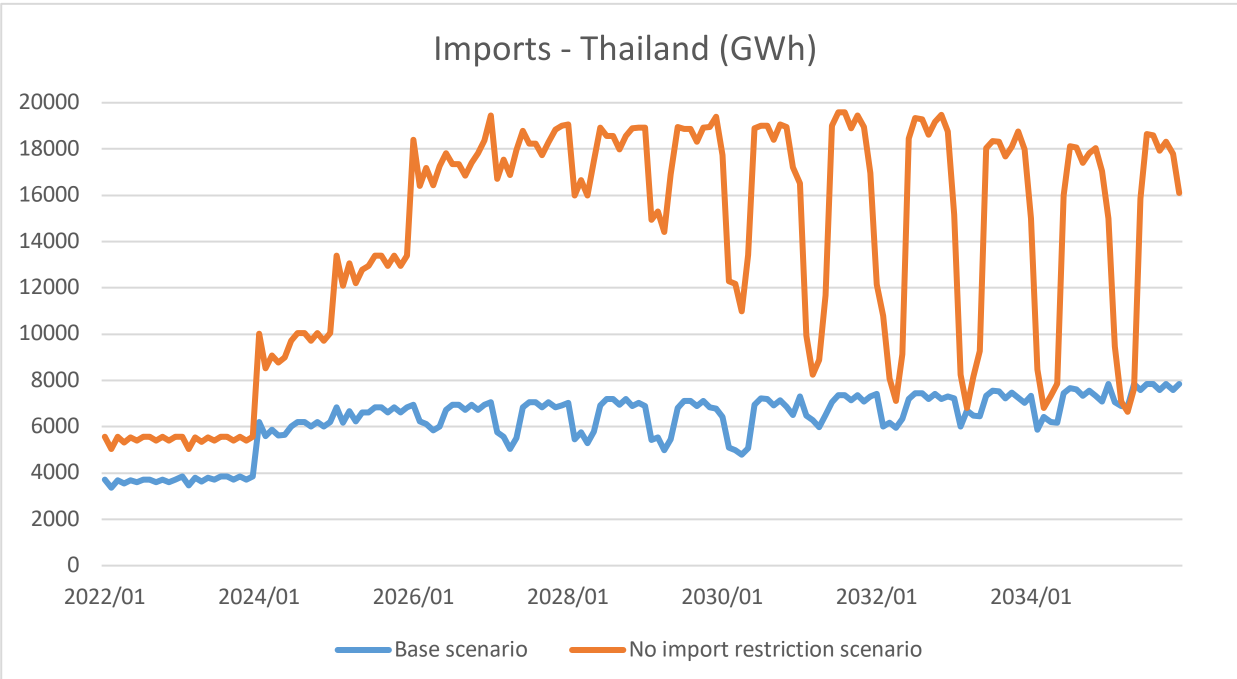


Figure 42: Sensitivity results – No import restrictions scenario

271. The Thailand power import is almost triples in the wet season when the import restrictions are removed. Development of renewable energy is significantly increased with additional hydro capacity development and new VRE generation capacity (32 GW with no import restrictions, compared to 17 GW for Base scenario). Development of thermal generation is delayed, with 11 GW less thermal generation developed during the study period.

272. The total cost of the no import restrictions scenario is significantly reduced ($194 billion) compared to medium demand base scenario ($215 billion). An increase in generation CAPEX ($9 billion) and transmission CAPEX ($0.6 billion) contribute to a significant decrease in operating cost ($31 billion) for the period. These investments would continue to contribute to operating cost savings after the end of the study period.

273. It can be seen that there are significant cost savings to be gained by reducing import restrictions (with revised import policies and power purchase agreements), once the interconnection challenges can be resolved.

5. Other Sensitivity Scenarios

274. The results of other sensitivity scenarios is summarized in this section.

275. Increased power wheeling to Malaysia
    a. Power export to Malaysia from Thailand is increased to 1.3 GW during the study period.
    b. Additional hydro development in Lao PDR is developed and cross-border power trade between Lao PDR and Thailand is increased to support the increased export to Malaysia.
    c. The increased power wheeling to Malaysia is successfully supported with the cross-border interconnections developed in the study model.
    d. Total cost of this scenario is $220 billion, slightly increased from $215 billion in medium demand base scenario.

276. Increase of electric vehicles in Thailand
    a. Thailand demand is increased by 4% by 2035 to model the impact of electric vehicles and the demand curve is modified to represent the power usage pattern of electrical vehicles.
    b. Thermal generation development is increased in Thailand to support the increased demand.
    c. Power import from Lao PDR to Thailand is also increased with marginally high hydro development.
    d. Total cost of this scenario is $220 billion, slightly increased compared to medium demand base scenario due to increased demand in Thailand.

277. PRC power wheeling
    a. HVDC lines from PRC to Thailand and Viet Nam are developed, enhancing regional cross-border power trade.
    b. VRE development is increased by 10 GW due to better resource sharing.
    c. Total cost of this scenario is $213 billion.

278. Further delayed interconnections
    a. All grid-grid interconnections are delayed to 2030.
    b. Total cost of this scenario is $223 billion. Operating cost is significantly increased (by $8 billion compared to medium demand growth Base scenario).
    c. Thermal generation is developed earlier in Cambodia due to the lack of power import.

279. PRC export
    a. 2 GW coal generation is added in PRC for export from 2031.
    b. HVDC lines from PRC to Thailand and Viet Nam are developed.
    c. Operating cost is decreased due to increased resource sharing, similarly to the ‘PRC power wheeling’ scenario.
    d. Total cost of this scenario is $212 billion.

280. PRC import

a. Demand in PRC is increased by 2 GW from 2031.
b. HVDC lines from PRC to Thailand and Viet Nam are developed.
c. Regional generation development is increased to support demand in PRC.
d. Resource sharing enabled by the HVDC lines results in an overall decrease in operating cost over the study period.
e. Total cost of this scenario is $214 billion.

281. PRC hydro export

a. 2 GW hydro generation is added in PRC from 2025.
b. HVDC lines from PRC to Thailand and Viet Nam are developed.
c. Total cost of this scenario is $208 billion. Operating cost is significantly decreased (by $8 billion compared to medium demand growth Base scenario) due to additional hydro capacity available from PRC as well as increased cross-border power trade.

282. Low gas price aggressive cross-border power trade

a. More thermal generation development and less VRE generation development as the medium demand growth aggressive cross-border power trade scenario.
b. Total cost of this scenario is $189 billion. Operating cost is significantly reduced, by $25 billion compared to medium demand growth Base scenario.

283. The major generation and transmission trends identified in the study scenarios are observed in the results of the sensitivity studies, confirming the resilience of these trends.

284. Detailed generation and transmission plans for sensitivity scenarios are provided in Appendix 2: Generation and Transmission Plan.

X. Conclusions

285. Regional power master plan for GMS region is developed for the period 2022 – 2035 and the most beneficial regional generation and transmission scenarios are identified while considering the uncertainty and variation of a number of technical, policy and economic factors.

286. A comprehensive study model is developed by incorporating the demand, generation and transmission data for the study period based on the power development plans of individual countries, independent study reports and public domain data. This study model is optimized using industry standard generation and transmission planning software OptGen™/SDDP™. Optimum solutions are further analyzed using PSS®E transmission reliability software. The regional power master plan was developed for the most likely scenario to identify the key generation and transmission developments. In order to account for the future uncertainties, a number of additional scenarios representing economic, technological and policy variations are also analyzed. Finally, most beneficial developments and general trends are derived and presented. These study outcomes are expected to be useful for regional planners and decision makers.

A. Economic Benefit

287. Table 26 and Table 27 provide summaries of the operating costs, capital costs and cost advantages for medium demand growth scenarios and high/low demand growth scenarios respectively. The cost savings for each scenario are compared with the reference scenario. Reference scenario for each demand growth scenario (scenarios RM, RH, and RL for medium, high and low demand growth scenarios, respectively) represents the planned and proposed regional generation and transmission developments based on individual country plans and already committed cross-border transmission development projects. Base scenario is the most likely future regional development scenario[30] which also includes implementation of candidate transmission developments.

Table 26: Cost savings in medium demand growth scenarios

Scenario No.	Scenario Description	Cost in $ billion - 2022 NPV			
		Capital Cost	Operating Cost	Total Cost	Cost Savings
RM	**Reference scenario**	**23**	**212**	**235**	**0**
BM	**Base scenario (most likely development scenario)**	**25**	**190**	**215**	**20**
S1	Reduced gas price	24	173	197	38
S2	Reduced VRE costs	34	181	214	20
S3	High fossil fuel prices	41	207	248	-13
S4	Battery storage systems (BSS) for Solar	27	189	216	19
S5	Reduced VRE costs and BSS for Solar	32	183	215	20
S6	Nuclear generation option	26	190	216	19
S7	High fossil fuel price with nuclear generation option	42	205	248	-13
S8	**Aggressive cross-border power trade**	**27**	**177**	**204**	**31**

[30] This is the most likely future development scenario if GMS countries are willing to establish an interconnected reginal power system with bilateral and multilateral cross-border interconnections.

Scenario No.	Scenario Description	Cost in $ billion - 2022 NPV			
		Capital Cost	Operating Cost	Total Cost	Cost Savings
S9	High fossil fuel price and aggressive cross-border power trade	42	192	234	1
S10	Reduced VRE costs and aggressive cross-border power trade	35	169	203	31

Table 27: Cost savings in high and low demand growth scenarios

Scenario No.	Scenario Description	Cost in $ billion - 2022 NPV			
		Capital Cost	Operating Cost	Total Cost	Cost Savings
High Demand Scenarios					
RH	Reference scenario	38	262	300	0
BH	Base scenario (most likely development scenario)	40	216	256	**45**
S11	Reduced gas price	35	199	233	67
S12	Reduced VRE costs	47	207	254	46
S13	High fossil fuel prices	52	241	293	7
S14	Battery storage systems (BSS) for Solar	38	217	255	45
S15	Reduced VRE costs and BSS for Solar	44	210	254	46
S16	Nuclear generation option	38	218	255	45
S17	High fossil fuel price with nuclear generation option	56	237	293	8
S18	Aggressive cross-border power trade	39	202	241	59
S19	High fossil fuel price and aggressive cross-border power trade	50	225	276	25
S20	Reduced VRE costs and aggressive cross-border power trade	45	194	240	61
Low Demand Scenarios					
RL	Reference scenario	12	187	199	0
BL	Base scenario (most likely development scenario)	15	168	183	**16**
S21	Reduced gas price	13	154	167	32
S22	Reduced VRE costs	23	159	182	17
S23	High fossil fuel prices	31	180	211	-12
S24	Battery storage systems (BSS) for Solar	15	168	183	16
S25	Reduced VRE costs and BSS for Solar	20	162	182	17
S26	Nuclear generation option	16	166	183	16
S27	High fossil fuel price with nuclear generation option	32	179	211	-12
S28	Aggressive cross-border power trade	17	155	172	27
S29	High fossil fuel price and aggressive cross-border power trade	31	167	198	1
S30	Reduced VRE costs and aggressive cross-border power trade	24	147	171	28

288. In medium demand growth scenarios, low gas price scenario (scenario S1) and aggressive interconnection development scenario (scenario S8) show significant cost savings compared to the base scenario (scenario BM) cost savings. Scenarios with high fossil fuel price cause significantly lower cost advantages due to the increased operating cost.

289. High fossil fuel prices cause increment in total cost (13$ billion) in scenario S3 due to the increased operating cost. However, cost increment can be offset by further increasing the cross-border transmission capacity as demonstrated in scenario S9 (High fossil fuel price and aggressive cross-border power trade) where the cost advantage is $1 billion.

290. For all the scenarios with a high demand growth, cost advantage trends similar to medium demand growth are observed.

291. Cost advantage trends in low demand growth scenarios show the main advantage is coming from the additional cross-border transmission capacity. Other factors such as reduced VRE costs or BSS have negligible impact on cost.

292. The total value of investment to develop transmission and generation assets (Net present value in 2022 $ billion) are given in Table 28. The increment of investment cost for each scenario compared to the reference scenario is also provided.

Table 28: Total Investment (in $ billion - 2022 NPV)

Scenario		Investment cost			Increment in investment cost	Cost savings during the period
No.	Name	Transmission	Generation	Total		
Medium demand growth						
RM	M_REFERENCE	2	50	52	0	0
BM	**M_BASE_BASE**	4	51	55	3	20
S1	M_GAS_BASE	4	46	50	-2	38
S2	M_VRE_BASE	4	55	60	8	20
S3	M_HIF_BASE	5	62	67	15	-13
S4	M_BASE_BSS	4	51	55	3	19
S5	M_VRE_BSS	4	55	60	8	20
S6	M_BASE_NUC	4	48	53	1	19
S7	M_HIF_NUC	5	72	77	25	-13
S8	M_BASE_INT	5	51	56	4	31
S9	M_HIF_INT	6	63	68	17	1
S10	M_VRE_INT	5	54	60	8	31
High demand growth						
RH	H_REFERENCE	2	80	82	0	0
BH	**H_BASE_BASE**	5	80	85	3	45
S11	H_GAS_BASE	5	74	78	-3	67
S12	H_VRE_BASE	5	83	88	6	46
S13	H_HIF_BASE	5	88	93	12	7
S14	H_BASE_BSS	5	77	82	0	45
S15	H_VRE_BSS	5	80	85	3	46
S16	H_BASE_NUC	5	77	82	0	45
S17	H_HIF_NUC	5	101	105	24	8
S18	H_BASE_INT	5	73	78	-3	59
S19	H_HIF_INT	6	83	88	7	25

Scenario		Investment cost			Increment in investment cost	Cost savings during the period
No.	**Name**	**Transmission**	**Generation**	**Total**		
S20	H_VRE_INT	5	77	82	0	61
Low demand growth						
RL	L_REFERENCE	0	28	30	0	0
BL	**L_BASE_BASE**	4	27	31	1	16
S21	L_GAS_BASE	4	24	28	-2	32
S22	L_VRE_BASE	4	39	43	13	17
S23	L_HIF_BASE	4	45	49	19	-12
S24	L_BASE_BSS	4	27	31	1	16
S25	L_VRE_BSS	4	33	37	7	17
S26	L_BASE_NUC	4	29	34	3	16
S27	L_HIF_NUC	4	44	48	18	-12
S28	L_BASE_INT	5	30	35	5	27
S29	L_HIF_INT	5	44	49	19	1
S30	L_VRE_INT	5	35	40	10	28

293. In most scenarios, the increment of investment cost compared to the reference scenario is less than the total cost savings during the period. This is an indication that the total additional investment to facilitate cross-border transfer could be paid back using the cost benefit accumulated during the study period. In addition, these investments will continue to provide cost savings after the study period (throughout the lifetime).

B. Generation Developments

294. A summary of the generation developments identified for each scenario is shown in Table ***29***.

Table 29: Summary of Generation Developments

Optimized Generation (GW): 2022 to 2035						
Scenario No.	**Country**					**Total**
	Thailand	**Viet Nam**	**Lao PDR**	**Cambodia**	**Myanmar**	
RM	14.7	32.1	0.5	20.1	6.7	74.0
BM	7.4	34.8	3.6	16.0	12.2	74.1
S1	7.5	35.3	4.2	13.0	9.3	69.4
S2	18.9	36.3	2.0	15.3	8.8	81.4
S3	18.8	35.6	1.8	14.4	9.2	79.8
S4	7.0	32.9	4.1	14.2	10.7	68.9
S5	18.6	36.7	3.6	15.5	8.3	82.7
S6	7.3	33.3	3.5	13.3	11.3	68.7
S7	18.6	35.8	3.5	17.3	10.4	85.7
S8	17.2	27.4	4.4	14.2	13.7	76.9
S9	16.1	27.5	6.0	14.9	14.3	78.8

Optimized Generation (GW): 2022 to 2035						
Scenario No.	Country					Total
	Thailand	Viet Nam	Lao PDR	Cambodia	Myanmar	
S10	16.8	28.4	5.4	14.1	14.8	79.4
RH	23.3	44.1	0.5	26.3	16.2	110.3
BH	23.3	45.8	5.1	22.5	16.0	112.7
S11	19.5	44.8	4.6	22.1	17.2	108.2
S12	24.4	47.1	4.4	22.7	16.1	114.7
S13	23.3	43.7	2.7	23.1	20.2	112.9
S14	22.6	40.9	4.3	22.2	16.4	106.5
S15	24.4	47.8	2.3	22.4	17.9	114.8
S16	21.6	44.4	3.7	22.3	16.0	108.0
S17	23.8	45.1	4.0	22.5	16.4	111.8
S18	22.6	40.5	7.6	13.3	21.6	105.6
S19	23.3	40.0	10.5	14.2	18.3	106.3
S20	24.4	41.3	9.6	14.0	21.1	110.4
RL	5.4	20.3	0.5	18.0	3.4	47.5
BL	1.8	15.7	4.4	13.2	6.1	41.2
S21	3.7	20.4	4.4	10.6	4.4	43.6
S22	14.6	21.6	5.5	12.2	10.3	64.2
S23	14.2	22.2	2.4	13.7	6.8	59.2
S24	3.1	20.8	1.4	12.1	6.0	43.5
S25	13.2	22.5	1.1	12.5	7.8	57.1
S26	3.1	17.6	3.7	12.2	6.0	42.6
S27	14.2	21.0	2.3	13.1	6.5	57.1
S28	8.4	13.5	4.9	7.2	10.2	44.2
S29	14.2	18.7	4.3	4.7	10.5	52.4
S30	14.1	17.8	3.8	6.5	10.7	53.0

295. Comparisons of base scenarios and reference scenarios (scenarios RM&BM, RH&BH and RL&BL for medium, high and low load growth respectively) show that the optimization of potential cross-border interconnections result in a reduction of 8-12 GW of new generation development in the GMS region. The development of large scale coal and gas plants in Thailand and Viet Nam can be delayed or avoided altogether with the optimized cross-border interconnections.

296. In high demand growth scenarios with cross-border interconnections (BH and S11-S20), most of the prospective VRE generation in the region (about 31 GW) is developed. In Viet Nam, at least 8 GW of prospective VRE generation is built and utilized for most of the scenarios except the reference scenarios (scenarios RM, RH, and RL).

C. Transmission Developments

297. A summary of the transmission developments identified for each scenario is shown in Table ***30***.

Table 30: Summary of Transmission Developments

Optimized Interconnection capacity (GW) for 2022-2032 period										
Scenario No.	Interface									Total
	TH-KH	LA-TH	LA-VN	LA-KH	LA-MM	KH-VN	MM-TH	CH-LA	CH-MM	
RM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BM	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S1	0.0	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.1
S2	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S3	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S4	0.0	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.1
S5	0.0	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.0
S6	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S7	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S8	4.5	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.3
S9	4.8	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.6
S10	4.5	0.0	4.5	5.5	4.5	5.8	7.9	0.0	0.6	33.3
RH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BH	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S11	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S12	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S13	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S14	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S15	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S16	0.3	0.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	12.4
S17	0.3	3.0	4.2	1.0	0.8	1.5	3.4	0.7	0.6	15.4
S18	4.5	0.0	4.5	5.5	3.0	6.0	6.4	0.0	0.6	30.5
S19	4.5	3.0	5.5	5.5	4.5	6.0	6.4	0.0	0.6	36.0
S20	4.5	0.0	4.5	5.5	3.0	6.0	6.0	0.0	0.6	30.1
RL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BL	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S21	0.0	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.0
S22	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S23	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S24	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S25	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S26	0.3	0.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	12.3
S27	0.3	3.0	4.1	1.0	0.8	1.5	3.4	0.7	0.6	15.3
S28	4.8	0.0	3.0	5.5	4.5	5.5	6.0	0.7	0.0	30.0
S29	4.8	0.0	4.5	5.5	3.0	5.5	6.4	0.7	0.6	30.9
S30	4.8	0.0	1.5	5.5	4.5	5.5	7.9	0.7	0.6	30.9

298. In most of the study scenarios, the total optimized interconnection capacity is about 12-13 GW.

299. Scenarios with aggressive cross border interconnection development (S8-S10, S18-S20 and S28-S30) have the highest development of total transmission capacity (up to 36 GW).

300. In scenarios with nuclear option and high fossil fuel price, new interconnection capacity is increased due to the reduced gas and coal generation in Thailand and Viet Nam.

D. Major Generation and Transmission Trends

301. When analyzing the generation and transmission developments in different study scenarios, several common development trends are observed. These developments provide significant economic benefit under many study scenarios regardless of uncertainties such as variations in load growth, fossil fuel price, etc. These major generation and transmission trends are summarized in Table 31.

Table 31: Summary of major generation and transmission trends

Country	Generation development	Transmission development
Cambodia	• Hydro potential in the northeast and southwest regions is developed (3-6 GW) • Solar generation is also developed, mostly in the central region (2-3 GW) • Due to high demand growth in Cambodia, large development of gas generation in central region is required to support the demand in the later part of the study period • There is some power import from Lao PDR, Viet Nam and Thailand (total of about 3 GW)	• Candidate interconnections are developed between Cambodia-Viet Nam, Cambodia-Lao PDR, and Cambodia-Thailand in most study scenarios
Lao PDR	• Lao PDR has a large hydro potential in north and south regions. • Large development of hydro generation in north and south regions (3-5 GW) • Small amount of wind generation is developed in the southern region (0.5 GW)	• Cross-border interconnections are developed between Lao PDR and all of its neighboring countries. Lao PDR-Thailand corridor is upgraded from generator-grid interconnections into grid-grid interconnections without developing new cross-border interconnections: • Lao PDR has several candidate interconnections with Viet Nam, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection that is also connected to Cambodia • One candidate interconnection (Namo – Kenglatt – Tachileik – Kengtung) between north Lao PDR and Myanmar • One candidate interconnection from Northern Lao PDR to Yunnan province, in PRC

Country	Generation development	Transmission development
Myanmar	• Myanmar has a large hydro potential mainly in the northern region • Large development of hydro generation mostly in the north region (8-12 GW) • Wind generation in the central and south regions (1-3 GW)	• Cross-border interconnections are developed between Myanmar and three neighbor countries, Thailand, PRC and Lao PDR. • Three candidate interconnections with Thailand (two in central region and one in north region) • The candidate interconnection Mandalay (Myanmar) – Yunnan (PRC) • The candidate interconnection, Namo – Kenglatt – Tachileik - Kengtung between Lao PDR and north Myanmar
Thailand	• Major generation developments in Thailand are mainly thermal generation and solar generation • Coal generation is observed in central and southern regions (about 3 GW) • Gas generation is seen mainly in the central region (about 3 GW) • Solar generation is distributed in the north, central and northeast regions (about 7 GW) • Large power imports are seen from Myanmar (3 GW)	• Cross-border interconnections are developed between Thailand - Myanmar and Thailand – Cambodia. Existing generator-grid interconnections in Lao PDR-Thailand corridor are upgraded into grid-grid interconnections: • Several candidate interconnections between Thailand and Myanmar are developed including Mae Khot – Mae Chan 230 kV interconnection • The candidate interconnection between central Thailand and Cambodia (Wangnoi – Kampong Cham)
Viet Nam	• Major generation developments in Viet Nam are mainly thermal generation and variable renewable energy (VRE) generation • Coal generation (8-17 GW) is observed in Northern and southern regions • Wind generation (6-7 GW) is mostly in the southern region and solar generation (5-9 GW) is distributed in southern and central regions • Large power imports are seen from Lao PDR (4 GW)	• Cross-border interconnections between Viet Nam - Lao PDR and Viet Nam – Cambodia are developed: • A number of interconnections between Viet Nam and Lao PDR are developed in many scenarios, including the Ban Soc/Ban Hatxan – Stung Treng – Tay Ninh interconnection (also connected to Cambodia) • The candidate interconnections between Viet Nam and Cambodia (Lower Se San 2 HPP– Pleiku and Kampong Cham – Tay Ninh)
PRC	• PRC is considered as a potential importer. • Power imports from Myanmar and Lao PDR (total of about 1 GW)	• The candidate interconnection from Mandalay (Myanmar) – Yunnan (PRC) • The candidate interconnection from Luang Prabang province in Lao PDR to Yunnan province in PRC

E. Interconnection Challenges and Timeline

302. Developing synchronous HVAC interconnections in the GMS region is challenging since there is a significant difference in dynamic performance between different local grid operations. GMS countries (mainly Lao PDR, Cambodia and Myanmar) need to improve compliance of grid operation with the regional grid code which is currently in development. In particular, it is important to implement frequency regulation and control measures such as governor droop control and Automatic Generator Control (AGC).

303. Based on the interconnection challenges, it is estimated that bulk cross-border power transfer in GMS region using synchronous HVAC connections may be realistically possible around year 2030. This estimate is based on study reports, country PDPs and public domain

data. The timeline can be either expedited or delayed depending on factors such as political will, private and government investments, economic situation and technological advancements.

304. If synchronous grid-grid interconnections are significantly delayed, asynchronous (HVDC) cross-border interconnections could be a potential alternative. Although the cost of HVDC is generally higher, there are multiple advantages that make it well suited for cross-border interconnections such as power transfer flexibility, fast control, blocking capability, etc. HVDC have some drawbacks such as higher cost for shorter transmission lines and difficulties with increasing the number of terminals. Table 32 summarizes the impact of grid synchronization delays with and without HVDC option.

Table 32: Impact of grid synchronization delay, Medium demand - base scenario

Study case	Description	CAPEX ($ billion)			OPEX ($ billion)	Total Cost ($ billion)
		Generation	HVAC transmission	HVDC transmission		
A	No delay for Grid-Grid interconnections	22	4	-	190	215
B	With likely synchronization delays (with HVDC option)	23	3	2	194	222
C	With likely synchronization delays (no HVDC option)	22	3	-	201	226

305. The analysis with the HVDC option indicates that there is significant benefit, even when HVDC option is used compared to delaying the grid-grid interconnections.

F. Sensitivity Scenarios

306. A total of twelve (12) sensitivity scenarios are studied, including four main sensitivity scenarios and eight “additional” sensitivity scenarios. Four major sensitivity scenarios and their study outcomes are summarized below.

307. COVID-19 demand scenario - The potential impact of COVID-19 pandemic to future regional demand is studied. The regional demand is decreased by 8% compared to the low demand growth scenario.
    a. The reduction in demand causes a significant reduction in the total cost ($159 billion compared to $183 billion in low demand growth base scenario). The investments in new thermal generation can also be delayed in the initial years.

308. Dry future scenario - Low future hydro availability is studied by reducing the hydro inflows by 20%.
    a. In this scenario, new thermal generation is required to be developed earlier due to low hydro availability. This contributes to higher generation investment and operating costs, increasing the total cost to $225 billion compared to $215 billion for medium demand base scenario.

309. Reduced carbon emission scenario – Adoption of carbon emission reduction policy is studied by implementing an additional cost of 30$/ tCO2 for thermal generation.
    a. In this scenario, a decrease in the thermal energy usage and increased VRE development is observed. Increased VRE generation development increases cross-border power trade which will require development of additional cross-border interconnections.
    b. The total cost of this scenario is $242 billion compared to $215 billion for medium demand growth base scenario. The cost increment is mainly due to the collection of the carbon cost. The funds accumulated from applying a carbon emission cost can be used to reinforce carbon emission reduction policy by investing in technologies with low carbon footprint such as VRE.

310. No import restrictions scenario - The aggressive cross-border transmission development scenario is studied with the restrictions on imports into Thailand and Viet Nam removed.
    a. VRE developments in Thailand and Viet Nam are significantly increased (32 GW with no import restrictions, compared to 17 GW for Base scenario) and the development of thermal generation is reduced with 11 GW less thermal generation developed during the study period. Hydro developments in Lao PDR and Myanmar are increased to support the VRE based generation in Thailand and Viet Nam during the times of reduced availability.
    b. The total cost of the scenario is significantly reduced ($194 billion) compared to medium demand base scenario ($215 billion).

311. There are eight (8) additional sensitivity scenarios studied and the descriptions are given in Table 33.

Table 33: Additional Sensitivity scenarios

Scenario	Description
Increased power wheeling to Malaysia	The transfer from the south of Thailand to Malaysia is increased by 1 GW from the existing 300 MW transfer.
Increase of electric vehicles in Thailand	The impact of increasing number of EVs in Thailand is studied. The additional demand for EVs is added to the Thailand demand model.
PRC power wheeling	The benefits of power wheeling between interconnections with PRC is studied.
Further delayed interconnections	The impact of further delays to grid-grid interconnections is studied.
PRC export	PRC exports 2 GW after 2030.
PRC import	PRC imports 2 GW after 2030.
PRC hydro export	PRC exports 2 GW hydro from 2025.
Low gas price aggressive cross-border power trade	The medium demand low gas price scenario is studied with aggressive cross-border power trade.

312. The major generation and transmission development trends observed in the main scenarios are also observed in the sensitivity scenarios, which confirms that these trends are resilient to changes in the sensitivity factors studied.

G. Major Outcomes and Recommendations

313. Study results clearly show that significant benefits could be gained through cross-border power trade among GMS countries for various future scenarios considering demand, economic, technological and policy factors. Study results indicate that the total additional investment required to facilitate cross-border transfer could be paid back using the cost-benefits accumulated during the study period.

314. Several major power developments trends in the GMS region are identified for the study period.

a. Future hydro generation development in the region is mainly concentrated in Lao PDR and Myanmar. There is some hydro development in Cambodia which is mostly consumed by the local demand.
b. Thailand and Viet Nam are expected to develop a large amount of VRE generation (wind and solar) while some VRE generation developments are observed throughout the region.
c. Cross-border power transfer corridors between Myanmar-Thailand, Lao PDR – Viet Nam, Lao PDR-Cambodia, Viet Nam-Cambodia, and Myanmar-PRC are further enforced under most future scenarios.

315. It is estimated that bulk cross-border power transfer in GMS region using synchronous HVAC connections may be realistically possible around year 2030 due to the large gap in dynamic performance in different local grids.

a. In order to facilitate high voltage synchronous interconnections, GMS countries need to develop comprehensive grid codes and improve grid code compliance. Frequency control measures such as governor droop control and Automatic Generator Control may need to be implemented.
b. Alternatively, asynchronous (HVDC) cross-border interconnections could be developed as an intermediate solution to harness the benefits of cross-border power trade, if the dynamic performance improvements are further delayed.

316. The major generation and transmission development trends observed in the main scenarios are also observed in the sensitivity scenarios, which confirms that these trends are resilient to changes in the sensitivity factors studied.

XII. References

317. The following references are used to gather information on the transmission, generation and demand data for the study.

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XIII. Appendices

A. Appendix 1: Full Generation List per Country

318. The following tables show the existing, planned, and candidate hydro, thermal and renewable generation used in this study.

1. Cambodia Generation

319. For Cambodia generation, generation plan of [40] is used. Additional candidate generation is added for the period 2031-2035.

Table 34: Generation list for Cambodia

Year	Fuel Oil	Solar	Hydro	Coal	Gas	Biomass	Wind
2022	629	615	531	1190	0	130	0
2023	629	615	563	1540	0	130	0
2024	581	615	563	1890	0	130	80
2025	536	615	563	2240	0	130	80
2026	536	715	691	2240	0	130	80
2027	536	815	691	2240	600	130	80
2028	536	1015	839	2240	1200	130	80
2029	536	1415	1034	2240	1800	130	80
2030	536	1615	1613	2240	3600	130	80
Additional	0	1590	3000	0	5400	43	85

2. Lao PDR Generators

320. The list of existing generators and the generators under construction in Lao PDR are shown in the following tables [38].

Table 35: Existing and under-construction hydro generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Dong	North	Luangprabang	Run of River	1	1970	existing
Xelabam	South	Champasak	Run of River	5	1970	existing
Nam Ngum 1	C1	Vientiane Pro	Reservoir	155	1971	existing
Xeset 1	South	Saravan	Run of River	45	1990	existing
Nam Ko	North	Oudomxay	Run of River	2	1996	existing
Theun-Hinboun	C2	Khammouan	Reservoir	22	1998	existing
Theun-Hinboun (To Thailand)	C2	Khammouan	Reservoir	418	1998	existing
Houay Ho	South	Attapeu	Reservoir	2	1999	existing
Houay Ho (To Thailand)	South	Attapeu	Reservoir	150	1999	existing
Nam Luek	North	Saysomboun	Reservoir	60	2000	existing
Nam Mang 3	C1	Vientiane Pro	Reservoir	40	2004	existing
Xeset 2	South	Saravan	Run of River	76	2009	existing

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Tha 3	North	Luangnamtha	Run of River	1	2010	existing
Nam lik 1/2	C1	Vientiane Pro	Reservoir	100	2010	existing
Nam Theun 2	C2	Khammouan	Reservoir	75	2010	existing
Nam Theun 2 (To Thailand)	C2	Khammouan	Reservoir	1,000	2010	existing
Nam Nhon	North	Borkeo	Run of River	2	2011	existing
Nam Song	C1	Vientiane Pro	Reservoir	6	2011	existing
Nam Ngum 2	North	Saysomboun	Reservoir	615	2012	existing
Nam Ngum 5	C1	Vientiane Pro	Reservoir	120	2012	existing
Nam Gnoug 8	C2	Borikhamxai	Reservoir	60	2012	existing
Nam Phao	C2	Borikhamxai	Run of River	2	2012	existing
Nam Long	North	Luangnamtha	Run of River	5	2013	existing
Tadsalen	C2	Savannakhet	Run of River	3	2013	existing
Xekaman 3	South	Sekong	Reservoir	25	2013	existing
Xekaman 3 (To Viet Nam)	South	Sekong	Reservoir	225	2013	existing
Nam Sien Tad Lang	North	Xieng Khuang	Run of River	5	2014	existing
Nam Ngiep 3A	North	Xieng Khuang	Reservoir	44	2014	existing
Nam Sana	C1	Vientiane Pro	Run of River	14	2014	existing
Xenamnoy 1	South	Sekong	Run of River	15	2014	existing
Nam Khan 2	North	Luangprabang	Reservoir	130	2015	existing
Nam San 3B	North	Saysomboun	Reservoir	45	2015	existing
Nam Ngiep 2	North	Xieng khuang	Reservoir	180	2015	existing
Houaylamphanh Gnai	South	Sekong	Reservoir	88	2015	existing
Nam Ou 2	North	Luangprabang	Reservoir	120	2016	existing
Nam Khan 3	North	Luangprabang	Reservoir	60	2016	existing
Nam Beng	North	Oudomxay	Reservoir	36	2016	existing
Nam Ou 5	North	Phongsaly	Reservoir	240	2016	existing
Nam Ou 6	North	Phongsaly	Reservoir	180	2016	existing
Nam Sor	North	Saysomboun	Run of River	3	2016	existing
Nam San 3A	North	Xieng Khuang	Reservoir	69	2016	existing
Nam Mang 1	C2	Borikhamxai	Reservoir	64	2016	existing
Xeset 3	South	Champasak	Reservoir	23	2016	existing
Xenamnoy 6	South	Champasak	Run of River	5	2016	existing
Nam Peun 2	North	Houaphanh	Run of River	12	2017	existing
Nam Nga 2	North	Oudomxay	Run of River	15	2017	existing
Nam Phai	North	Saysomboun	Reservoir	86	2017	existing
Nam Ngiep 2C	North	Xieng Khuang	Run of River	15	2017	existing
Xekaman 1	South	Attapeu	Reservoir	32	2017	existing
Xekaman 1 (To Thailand)	South	Attapeu	Reservoir	258	2017	existing
Nam Kong 2	South	Attapeu	Reservoir	66	2017	existing
Xenamnoy 2 - Xekatam 1	South	Champasak	Run of River	13	2017	existing
Houay por	South	Saravan	Run of River	15	2017	existing
Nam Ngum 1 (Extension Phase 1)	C1	Vientiane Pro	Reservoir	80	2018	existing
Xekaman – Xanxai (to Viet Nam)	North	Attapeu	Reservoir	32	2019	under construction
Nam Tha 1	North	Borkeo	Reservoir	168	2019	under construction
Xepien - Xenamnoy	North	Champasak	Reservoir	40	2019	under construction
Xepien - Xenamnoy (to Thailand)	North	Champasak	Reservoir	370	2019	under construction

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Peun 1	North	Houaphanh	Run of River	15	2019	under construction
Nam Sim	North	Houaphanh	Run of River	9	2019	under construction
Nam Hao	North	Houaphanh	Run of River	15	2019	under construction
Nam Mon 1	North	Houaphanh	Run of River	10	2019	under construction
Xeset – Kengxan	North	Saravan	Run of River	13	2019	under construction
Nam Chiene	North	Saysomboun	Reservoir	104	2019	under construction
Nam Ngiep 2A	North	Xieng Khuang	Run of River	13	2019	under construction
Nam Ngiep 2B	North	Xieng Khuang	Run of River	9	2019	under construction
Nam The	North	Xieng khuang	Run of River	15	2019	under construction
Nam PhaGnai	C1	Saysomboun	Reservoir	15	2019	under construction
Nam Lik 1	C1	Vientiane Pro	Run of River	64	2019	under construction
MK. Xayaboury	C1	Xayaboury	Run of River	60	2019	under construction
Nam Ngiep 1 (to Thailand)	C2	Borikhamxai	Reservoir	294	2019	under construction
Nam Ngiep Regulation	C2	Borikhamxai	Run of River	18	2019	under construction
Nam Hinboun	C2	Khammouan	Reservoir	30	2019	under construction
MK. Xayaboury (to Thailand)	C2	Xayaboury	Run of River	1,225	2019	under construction
Nam Houng Down	C2	Xayaboury	Run of River	13	2019	under construction
Nam Aow (Nam Pot)	C2	Xieng Khuang	Reservoir	15	2019	under construction
Nam Sor (Borikhamxai)	North	Borikhamxai	Run of River	4.8	2020	under construction
Nam Ngao	North	Borkeo	Reservoir	15	2020	under construction
Nam Tha 2 (B. Hat Mouak)	North	Borkeo	Run of River	15	2020	under construction
Houay Chiae	North	Champasak	Run of River	8	2020	under construction
Nam Xam 3 (to Viet Nam)	North	Houaphanh	Reservoir	156	2020	under construction
Nam Hinboun (Down)	North	Khammouan	Run of River	15	2020	under construction
Nam Samoi	North	Vientiane	Run of River	5	2020	under construction
Nam Ngum 1 (Extension Phase 2)	North	Vientiane Pro	Reservoir	40	2020	under construction
Nam Ou 4	C1	Phongsaly	Reservoir	132	2020	under construction
Nam Ngum 3 (for Export)	C1	Saysomboun	Reservoir	480	2020	under construction
Nam Dick 1	South	Houaphanh	Run of River	15	2020	under construction
Nam Ou 3	South	Luangprabang	Run of River	210	2020	under construction
Nam Ou 1	South	Luangprabang	Run of River	180	2020	under construction
Nam Ou 7	South	Phongsaly	Reservoir	210	2020	under construction
Nam Kong 3	North	Attapeu	Reservoir	45	2021	under construction
Nam Kong 1	North	Attapeu	Reservoir	160	2021	under construction
Houay palai	North	Champasak	Reservoir	26	2021	under construction
Houay Yoi – Houaykod	North	Champasak	Run of River	15	2021	under construction
Nam Long New	North	Houaphanh	Run of River	13	2021	under construction
Xelanong 1	North	Savannakhet	Reservoir	70	2021	under construction
Nam Ngum 4	North	Xieng Khuang	Reservoir	240	2021	under construction
MK. Donsahong	C2	Champasak	Run of River	195	2021	under construction
MK. Donsahong (to Combosia)	C2	Champasak	Run of River	480	2021	under construction
Nam Mo 2	C2	Xieng khuang	Reservoir	120	2022	under construction
Nam Theun 1	South	Borikhamxai	Reservoir	130	2022	under construction
Nam Theun 1 (to Thailand)	South	Borikhamxai	Reservoir	520	2022	under construction
Nam Ngum Keng Kaun	South	Xieng khuang	Run of River	1	2022	under construction
Houy palai down	North	Champasak	Run of River	4	2022	under construction

Project	Area	District	Type	Capacity (MW)	COD	Status
Houykapheu 1	North	Saravan	Run of River	5	2022	under construction
Nam Karp	North	Saysomboun	Run of River	12	2023	under construction
Houaylamphan Gai (Downstream)	South	Sekong	Run of River	15	2025	under construction

Table 36: Existing and under-construction thermal generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Hongsa Lignite	North	Xayaboury	Thermal	100	2015	existing
Hongsa Lignite (To Thailand)	North	Xayaboury	Thermal	1,778	2015	existing
Huaphan Coal Power Plan (Lignite)	North	Houaphanh	Thermal	600	2026	under construction

Table 37: Existing and under-construction renewable generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Sugar Mitlao Factory	C2	Savannakhet	Biomass	3	2012	existing
Sugar Factory Attapeu	South	Attapeu	Biomass	20	2013	existing
Ban Chengsavang	C1	Vientiane Cap	Renewable	5	2017	existing
Ban Nabong	C1	Vientiane Cap	Renewable	15	2018	existing
Ban Houakham	C1	Vientiane Cap	Renewable	2	2018	existing
Ban Tad Moun	C1	Vientiane Cap	Renewable	5	2018	existing
Ban Angnam Houm	C1	Vientiane Cap	Renewable	5	2019	under construction

Table 38: Planned and candidate hydro generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Xekaman – Xanxai (for Export)	South	Attapeu	Reservoir	32	2019	PDA
Xeset - Kengxan	South	Saravan	Run of River	13	2019	PDA
Xeset - Houaytapong	South	Saravan	Run of River	13	2019	PDA
Houayka Ouy	South	Attapeu	Reservoir	15	2019	PDA
Nam Ngiep 1 (Off take) (To Thailand)	C2	Borikhamxai	Reservoir	294	2019	PDA
Nam Xam 3	North	Houaphanh	Reservoir	156	2020	PDA
Nam Xam 1	North	Houaphanh	Reservoir	75	2020	PDA
Dakcha Liew 2	South	Sekong	Run of River	13	2020	PDA
Dakcha Liew 1	South	Sekong	Run of River	11	2020	PDA
Xekong (Downstream) A	South	Attapeu	Run of River	76	2020	PDA
Xekatam	South	Champasak	Run of River	81	2020	PDA
Nam PaGnoun	South	Sekong	Run of River	15	2020	PDA
Houay Pa Gnoo Down	South	Sekong	Run of River	15	2020	PDA
Nam Mone	C1	Vientiane	Run of River	6	2020	PDA
Nam Samuay	C1	Vientiane Pro	Run of River	5	2020	PDA
Nam Ta Lan 2	North	Luangnamtha	Run of River	5	2021	PDA
Nam Seung 1	North	Luangprabang	Run of River	30	2021	PDA
Nam Chee 1	North	Saysomboun	Run of River	5	2021	PDA
Nam Chee 2	North	Saysomboun	Run of River	8	2021	PDA
Nam Mat (Xieng kuang)	North	Xieng khuang	Run of River	15	2021	PDA
Nam Mat 1	North	Xieng khuang	Run of River	15	2021	PDA
MK. Donsahong (to Cambodia)	South	Champasak	Run of River	195	2021	PDA

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Kong 3 (for Export)	South	Attapeu	Reservoir	45	2021	PDA
Nam Kong 1 (for Export)	South	Attapeu	Reservoir	160	2021	PDA
Houay Yoi - Houaykod	South	Champasak	Run of River	15	2021	PDA
Houay Phok	South	Attapeu	Run of River	12	2021	PDA
Nam Phak	South	Champasak	Reservoir	150	2021	PDA
Houaylay	South	Saravan	Run of River	3	2021	PDA
Kengseuaten	C2	Borikhamxai	Reservoir	54	2021	PDA
Tadsakhoy	C2	Savannakhet	Reservoir	30	2021	PDA
Xebanghieng 2A Tatsakhoy	C2	Savannakhet	Run of River	30	2021	PDA
Nam Mo 2 (To Viet Nam)	North	Xieng khuang	Reservoir	120	2022	PDA
Nam Pha	North	Luangnamtha	Reservoir	180	2022	PDA
Nam Tep 1	North	Houaphanh	Reservoir	15	2022	PDA
Nam Tep 2	North	Houaphanh	Reservoir	15	2022	PDA
Nam Phoun	North	Xayaboury	Reservoir	60	2022	PDA
Nam Seung 2	North	Luangprabang	Run of River	108	2022	PDA
MK. Pakbeng	North	Oudomxay	Run of River	114	2022	PDA
MK. Pakbeng (for Export)	North	Oudomxay	Run of River	798	2022	PDA
Nam Chat 2	North	Xieng khuang	Run of River	8	2022	PDA
Xelanong 2	South	Saravan	Reservoir	35	2022	PDA
Houay kaphuek Down	South	Saravan	Run of River	7	2022	PDA
Nam Bi 2	South	Sekong	Run of River	68	2022	PDA
Houay La Nge	South	Sekong	Reservoir	60	2022	PDA
Nam Bi 1	South	Sekong	Run of River	50	2022	PDA
Nam Bi 3	South	Sekong	Run of River	15	2022	PDA
Pak Ngum	C1	Vientiane Cap	Run of River	84	2022	PDA
Nam Ken	C1	Vientiane Pro	Run of River	5	2022	PDA
Nam Theun 1	C2	Borikhamxai	Reservoir	130	2022	PDA
Nam Young 2B	North	Houaphanh	Run of River	15	2023	PDA
Nam Xam 4	North	Houaphanh	Reservoir	150	2023	PDA
Nam Phouan	North	Saysomboun	Reservoir	102	2023	PDA
Nam Bak 1	North	Saysomboun	Reservoir	160	2023	PDA
Nam Poui	North	Xayaboury	Reservoir	60	2023	PDA
Xekaman 4	South	Attapeu	Reservoir	0	2023	PDA
Xenamnoy 5	South	Champasak	Run of River	5	2023	PDA
Houay Champi	South	Champasak	Run of River	5	2023	PDA
Nam Young 3A	North	Houaphanh	Run of River	15	2024	PDA
Nam Young 2A	North	Houaphanh	Run of River	15	2024	PDA
Nam Neun 2	North	Houaphanh	Reservoir	60	2024	PDA
Nam Leng	North	Phongsaly	Reservoir	60	2024	PDA
Nam Houay	North	Xieng khuang	Run of River	7	2024	PDA
Nam Mat 2	North	Xieng khuang	Run of River	15	2024	PDA
Nam Neun 1	North	Xieng khuang	Reservoir	124	2024	PDA
Nam Angtabeng	South	Attapeu	Reservoir	41	2024	PDA
Xepon 3 (Up)	South	Saravan	Reservoir	47	2024	PDA
Dak Emuen	South	Sekong	Reservoir	135	2024	PDA
Xekong 3A (Upstream)	South	Sekong	Run of River	0	2024	PDA

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Young 1B	North	Houaphanh	Run of River	10	2025	PDA
Nam Young 3B	North	Houaphanh	Run of River	14	2025	PDA
Nam Young 1A	North	Houaphanh	Run of River	15	2025	PDA
Nam Nga 1	North	Luangprabang	Reservoir	62	2025	PDA
Nam Phak 1	North	Oudomxay	Run of River	28	2025	PDA
Nam Phak 2	North	Oudomxay	Run of River	28	2025	PDA
Nam Phak 3	North	Oudomxay	Run of River	40	2025	PDA
Houay Pa Gnoo Up	South	Sekong	Run of River	6	2025	PDA
Xekong 3B (Downst)	South	Sekong	Reservoir	0	2025	PDA
MK. Sanakham (For Export)	C1	Vientiane Pro	Run of River	660	2025	PDA
Nam Khao 1	North	Xieng khuang	Run of River	5	2026	PDA
Nam Khao 2	North	Xieng khuang	Run of River	5	2026	PDA
Nam Khao 3	North	Xieng khuang	Run of River	5	2026	PDA
Nam Khao 4	North	Xieng khuang	Run of River	5	2026	PDA
Nam Khao 5	North	Xieng khuang	Run of River	5	2026	PDA
Nam Hong (Xieng khuang)	North	Xieng khuang	Run of River	5	2026	PDA
Houaynamsay	South	Saravan	Run of River	5	2026	PDA
Xekamphor (Up)	South	Champasak	Reservoir	18	2019	F/S
Tadsomphamit	South	Champasak	Run of River	5	2019	F/S
Xeset 4	South	Champasak	Run of River	10	2020	F/S
Nam Xan 1	C2	Borikhamxai	Run of River	7	2020	F/S
Nam Theun 4	C2	Borikhamxai	Reservoir	80	2020	F/S
Nam May	North	Luangnamtha	Run of River	5	2021	F/S
Nam Mee	North	Luangnamtha	Run of River	15	2021	F/S
Nam Tha 2 (B. HatGnao)	North	Luangnamtha	Run of River	25	2021	F/S
Nam Bak (B. Phonesai)	North	Luangprabang	Run of River	15	2021	F/S
Nam Houng Ton Neua	North	Xayaboury	Run of River	5	2021	F/S
Nam Ham 2	North	Xayaboury	Reservoir	5	2021	F/S
Nam Ngorn 1	South	Sekong	Reservoir	45	2021	F/S
Nam Ngorn 2	South	Sekong	Reservoir	35	2021	F/S
Donsom	South	Champasak	Run of River	5	2021	F/S
Nam Xan 2	C2	Borikhamxai	Run of River	15	2021	F/S
Nam Meuk 1	North	Phongsaly	Run of River	10	2022	F/S
Nam Ban	North	Phongsaly	Run of River	12	2022	F/S
Nam Houn 1	North	Phongsaly	Run of River	15	2022	F/S
Nam Houn 2	North	Phongsaly	Run of River	15	2022	F/S
Nam Ngiep (Mengmai)	North	Saysomboun	Reservoir	25	2022	F/S
Nam Mang (Upstream)	North	Saysomboun	Run of River	50	2022	F/S
Nam Dick 2	North	Houaphanh	Run of River	15	2022	F/S
Nam Xam 3A	North	Houaphanh	Run of River	45	2022	F/S
Nam Boun 2	North	Phongsaly	Run of River	15	2022	F/S
Selabam Extensien	South	Champasak	Run of River	8	2022	F/S
Sekong 5	South	Sekong	Reservoir	330	2022	F/S
Xepien-Huaysoi	South	Attapeu	Reservoir	45	2022	F/S
Nam Phak (Down)	South	Champasak	Run of River	12	2022	F/S
Xekong 4A	South	Sekong	Reservoir	175	2022	F/S

Project	Area	District	Type	Capacity (MW)	COD	Status
Xekong 4B	South	Sekong	Reservoir	165	2022	F/S
Nam Lik (B. Keng Luang)	C1	Vientiane Pro	Run of River	15	2022	F/S
Nam Lik 1/2A	C1	Vientiane Pro	Run of River	15	2022	F/S
Nam Feung 1	C1	Vientiane Pro	Reservoir	45	2022	F/S
Nam Them	C1	Vientiane Pro	Run of River	4	2022	F/S
Xelanong 3 (Ban. Tang Eun)	C2	Savannakhet	Run of River	60	2022	F/S
Nam Ngao 1	North	Oudomxay	Run of River	12	2023	F/S
Nam Pheir	North	Phongsaly	Run of River	13	2023	F/S
Nam Siem	North	Xieng khuang	Reservoir	5	2023	F/S
Nam Khien	North	Xieng khuang	Run of River	9	2023	F/S
Nam Khao	North	Xieng khuang	Run of River	12	2023	F/S
Nam Vang	North	Xieng khuang	Run of River	12	2023	F/S
Nam Mo1 (Nam Kan) （to Viet Nam）	North	Xieng khuang	Reservoir	60	2023	F/S
Nam Ma 1	North	Houaphanh	Run of River	44	2023	F/S
Nam Seng	North	Luangprabang	Run of River	1	2023	F/S
Nam Mat (Luangprabang)	North	Luangprabang	Run of River	15	2023	F/S
Houay kalabai 4	South	Attapeu	Run of River	10	2023	F/S
Houay kalabai 5	South	Attapeu	Run of River	5	2023	F/S
Xekaman 2B	South	Sekong	Reservoir	185	2023	F/S
Houay kalabai 1	South	Sekong	Reservoir	50	2023	F/S
Xepien - Houay Chot	South	Champasak	Run of River	21	2023	F/S
Nam Sana (Up)	C1	Vientiane Pro	Run of River	10	2023	F/S
Nam Mouan	C2	Borikhamxai	Reservoir	100	2023	F/S
Xetanouan	C2	Savannakhet	Reservoir	35	2023	F/S
Xebanghieng 1	C2	Savannakhet	Reservoir	60	2023	F/S
Xebanghieng 2	C2	Savannakhet	Reservoir	90	2023	F/S
Nam Kan (B. Kon Ngoua)	North	Houaphanh	Run of River	15	2024	F/S
Nam Ma 2A	North	Houaphanh	Run of River	18	2024	F/S
Nam Ma 1A	North	Houaphanh	Reservoir	32	2024	F/S
Nam Ta Lan	North	Luangnamtha	Run of River	15	2024	F/S
Nam Noua	North	Phongsaly	Run of River	15	2024	F/S
Nam Mouk 2	North	Phongsaly	Reservoir	44	2024	F/S
Nam Seung 4	North	Luangprabang	Run of River	47	2024	F/S
Nam Ngum-Nam Ken	North	Xayaboury	Reservoir	44	2024	F/S
Nam Ngum- Xayabouly	North	Xayaboury	Run of River	44	2024	F/S
Xekong (Down B)	South	Attapeu	Reservoir	50	2024	F/S
Houaychampy Oudomsouk	South	Champasak	Run of River	5	2024	F/S
Xe don 2, 3	South	Saravan	Reservoir	20	2024	F/S
Nam Ngum - Nanin	C1	Vientiane Pro	Run of River	15	2024	F/S
Nam Cha Gnai	C1	Vientiane Pro	Run of River	3	2024	F/S
Nam Kay	C1	Vientiane Pro	Run of River	3	2024	F/S
Nam Sa Nean	C1	Vientiane Pro	Run of River	7	2024	F/S
Xe Neua	C2	Khammouan	Reservoir	53	2024	F/S
Nam Bak 2	North	Saysomboun	Reservoir	120	2025	F/S
Nam Dick 3	North	Houaphanh	Run of River	10	2025	F/S
Nam Ma 2	North	Houaphanh	Run of River	30	2025	F/S

Project	Area	District	Type	Capacity (MW)	COD	Status
Nam Et 3	North	Houaphanh	Reservoir	107	2025	F/S
Nam Hoi	North	Phongsaly	Run of River	15	2025	F/S
Nam Houn 3	North	Phongsaly	Run of River	15	2025	F/S
Nam Ma 3	North	Houaphanh	Run of River	18	2025	F/S
Nam Neun 3	North	Houaphanh	Reservoir	80	2025	F/S
Nam khan 4	North	Luangprabang	Run of River	60	2025	F/S
Nam Seung 5	North	Luangprabang	Run of River	72	2025	F/S
MK. Luangprabang	North	Luangprabang	Run of River	200	2025	F/S
MK. Luangprabang (for Export)	North	Luangprabang	Run of River	1,000	2025	F/S
Nam Ou 8	North	Phongsaly	Run of River	15	2025	F/S
MK. PakLay	North	Xayaboury	Run of River	770	2025	F/S
Xebang Nouane 2	South	Saravan	Run of River	80	2025	F/S
Xepon 3 (Down)	South	Saravan	Reservoir	30	2025	F/S
Xekaman 2A	South	Sekong	Reservoir	35	2025	F/S
Nam Sana (Down)	C1	Vientiane Pro	Run of River	3	2025	F/S
Nam Feung (B. Nongsan)	C1	Vientiane Pro	Run of River	15	2025	F/S
Nam Hong (B. Phonedu)	C2	Borikhamxai	Run of River	14	2025	F/S
Nam Sang	C2	Borikhamxai	Run of River	15	2025	F/S
Nam Chard 1	C2	Borikhamxai	Run of River	15	2025	F/S
Nam Chard 2	C2	Borikhamxai	Run of River	15	2025	F/S
Nam Ngom Up	C2	Borikhamxai	Run of River	15	2025	F/S
Nam Ang	South	Attapeu	Reservoir	50	2026	F/S
Houay paluad 1	South	Attapeu	Run of River	12	2026	F/S
Houay paluad 2	South	Attapeu	Run of River	12	2026	F/S
Houaychanpy Khamnor Zep	South	Champasak	Run of River	5	2026	F/S
Houaysalay	South	Saravan	Run of River	10	2026	F/S
Houay Avien	South	Saravan	Run of River	5	2026	F/S
Houaykantong	South	Saravan	Run of River	5	2026	F/S
Nam Mon	C1	Vientiane Pro	Run of River	6	2026	F/S
Nam Houeng	C2	Borikhamxai	Run of River	13	2026	F/S
Nam Teung	C2	Borikhamxai	Run of River	13	2026	F/S
Houaysaynamkhong	C2	Borikhamxai	Run of River	14	2026	F/S
Nam Muan - Ban Vangdeun	C2	Borikhamxai	Reservoir	66	2026	F/S
Nam Sun 1	C2	Borikhamxai	Reservoir	70	2026	F/S
Xenam Kok Point 2	C2	Savannakhet	Run of River	5	2026	F/S
Xenam Kok Point 1	C2	Savannakhet	Run of River	6	2026	F/S
Xebanghieng Up	C2	Savannakhet	Run of River	10	2026	F/S
XeSaNge Point 3	C2	Savannakhet	Run of River	11	2026	F/S
Houay kalabai 2-3	South	Attapeu	Run of River	20	2027	F/S
Xelanong Point III	South	Saravan	Run of River	12	2027	F/S
Nam Xan (Hat To)	C2	Borikhamxai	Run of River	15	2027	F/S
MK. Phu Ngoy (Ladseua)	South	Champasak	Run of River	686	2028	F/S
MK. Ban Koum	South	Champasak	Run of River	1,872	2028	F/S
Nam Hong	C2	Borikhamxai	Run of River	32		F/S

Table 39: Planned and candidate thermal generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Xiengkhuang	North	Xieng khuang	Thermal	220	2022	PDA
Kalum Lignite, Unit 1	South	Sekong	Thermal	300	2020	F/S
Kalum Lignite, Unit 2	South	Sekong	Thermal	300	2020	F/S
Kalum Lignite, Unit 3	South	Sekong	Thermal	300	2021	F/S
Bualapha Coal	C2	Khammouan	Thermal	200	2025	F/S
Bualapha Coal (for Export)	C2	Khammouan	Thermal	1800	2025	F/S
Coal Fire Power Plant (Sekong)	South	Sekong	Thermal	900	2026	F/S
Lamam Lignite	South	Sekong	Thermal	700	2030	F/S
Railway Coal Power	C2	Savannakhet	Thermal			F/S
Coal Fire Power Plant (Phin District)	C2	Savannakhet	Thermal			F/S

Table 40: Planned and candidate renewable generators in Lao PDR

Project	Area	District	Type	Capacity (MW)	COD	Status
Champasak Sugar Factory	South	Champasak	Biomass	20	2019	PDA
Wind Power Sekong	South	Sekong/Attapeu	Renewable	600	2020	PDA
Solar farm Attapeu	South	Attapeu	Renewable	45	2019	F/S
Solar 5	South	Attapeu	Renewable	250		F/S
Solar 6	South	Sekong	Renewable	200		F/S
Solar Power Lak 36	C1	Vientiane Cap	Renewable	20	2026	F/S
Solar 7	C2	Savannakhet	Renewable	300		F/S
Solar 8	C2	Borikhamxai	Renewable	50		F/S
Wind Power Khammouan	C2	Khammouan	Renewable			F/S
Wind Power Savannakheth	C2	Savannakhet	Renewable			F/S

3. Myanmar Generators

321. The list of existing generators and the generators under construction in Myanmar are shown in the following tables.

Table 41: Existing and under-construction hydro generators in Myanmar

Name	Capacity (MW)
Dee Doke	66
Kyee ON Kyee	74
Middle Paung Laung	100
Thatay Chaun	111
Upper Bu	150
Keng Tawng	54
Kinda	56
Ngot Chaung	16.6
Upper Yeywa	280
Zawgi (1)	18
Zawgi (2)	12
Manton	225

Name	Capacity (MW)
Mong Wa 1	50
Sedawgyi	25
Shweli (1)	600
Shweli (2)	520
Shweli (3)	1050
Tapein	140
Tapein 1	240
Thapanzeik	30
Bawgata	160
U Baluchaung	30.4
U Paung Laun	140
Upper Keng Tong	51
Yeywa	790
Mon	75
Nacho	40
Baluchaung 3	52
Baluchaung B	168
Baluchaung1	28
Paunglaung	280
Chibwengae	99
Khapaung	30
Kun	60
Phyu	40
Shwegyin	75
Yenwe	25
Zaungtu	20
Thaukyaekhat	120

Table 42: Existing and under-construction thermal generators in Myanmar

Name	Capacity (MW)	Fuel
Kyawannhkyaungg	54.3	Gas
Mann	36.9	Gas
Shwedaung	55.35	Gas
Myanaaung	34.7	Gas
Sahtone	50.95	Gas
Hlawga	99.9	Gas
Ywama	36.9	Gas
Ywama (NEDO)	24	Gas
Ywama (240)	240	Gas
Ahlone	99.9	Gas
Tharkheta	57	Gas
Selawar	50	Gas
Toyo Thai	27	Gas

Name	Capacity (MW)	Fuel
Myanmar Lighting	78	Gas
UREC	36	Gas
Sembcorp	82	Gas
Hlawga	54.3	Gas
Ywama nedo	9.4	Gas
Ahlone	54.3	Gas
Tharkheta	35	Gas
Kyawwathpyauu(V Power)	90	Gas
Myinnhkyaan(V Power)	133	Gas
Myinnhkyaan(V Power)	90	Gas
Kyawwatsai(Powergen)	145.49	Gas
Ahlone (Toyo Thai)	94	Gas
Hlawga (MCP)	50	Gas
Ywama (UPP)	50	Gas
Tharkheta(Max Power)	50	Gas
Myanmar Lighting	152	Gas
Sembcorp	143	Gas
UREC	70	Gas
Te kyit	120	Coal
Thahton	118.9	Gas
Kyun Chaung	20	Gas
Ahlone	120	Gas
Kyauk Phyu	150	Gas
Thanlyin	350	Gas
Tharketa	400	Gas

Table 43: Existing and under-construction renewable generators in Myanmar

Name	Capacity (MW)	Type
Mainnbhuu	40	Solar
Minbu	170	Solar

Table 44: Planned and candidate hydro generators in Myanmar

Name	Capacity (MW)	Year
Middle Yeywa	320	2023
Naopha	1200	2025
Upper Thanlwin (Kunlong)	1400	2025
Upper Sedawgyi	64	candidate
Dun Ban	130	candidate
He Kou	100	candidate
Henna	45	candidate
Keng Yang	40	candidate
Mong Young	45	candidate
Nam Kha	200	candidate

Name	Capacity (MW)	Year
Nam Khot	50	candidate
Nam Li	165	candidate
So Lue	160	candidate
Wan Ta Pin	50	candidate
Gawlan	100	candidate
Hkan Kawn	160	candidate
Kaingkan	6	candidate
Ken Tong	96	candidate
Lawngdin	600	candidate
Nam Tamhpak	200	candidate
Namtu (Hsipaw)	100	candidate
Tongxingqiao	340	candidate
Taninthayi	600	candidate
Natabat (Kayar)	180	candidate
Mawlight	520	candidate
Natabat (Kachin)	200	candidate
Naung Pha	1000	candidate
Shwesaryae	669	candidate
Lemro	690	candidate
Bewlake	180	candidate
Hseng Ne	45	candidate
Htu Kyan (Tuzhing)	105	candidate
Palaung	105	candidate
The Hkwa	150	candidate
Upper Thanlwin (Mongton)	7110	candidate
Yawathit (Thanlwin)	4000	candidate
Chipwi	6000	candidate
Hpizaw (Pisa)	2000	candidate
Kaunglangphu	2700	candidate
Laza	1900	candidate
Manipur	380	candidate
Myitsone	6000	candidate
Renam (Yenam)	1200	candidate
Wu Zhongzhe	60	candidate
Wutsok	1800	candidate
Hutgy Dam	1190	candidate
Sinedin	76.5	candidate
Tamanthi	1200	candidate

Table 45: Planned and candidate thermal generators in Myanmar

Name	Capacity (MW)	Fuel
Kyauk Tan Township, Chaungwa Village	500	Coal
Kyause	100	Gas

Name	Capacity (MW)	Fuel
Myin Guam	250	Gas
Kale District, Kalewa Township	540	Coal
Ayeyarwaddy/Yangon	500	Gas
Dawei	400	Coal
Hlaingtharyar	500	Gas
Htan Ta Bin	570	Coal
Htan Ta Bin (Shwe Lin Ban)	1050	Coal
Kanpouk (New)	525	Coal
Kawthaung District, Bokpyin Township, Manawlone	500	Coal
Kyaukphyu (new)	50	Gas
Kyun Gyan Gon Township	900	Coal
Myeik Township, Lotlot Village	50	Coal
Ngayok Kaung	600	Coal
Thilawa Industrial Zone	3200	Coal
Kalaywa	600	Coal
Kanbauk	1230	Gas
Mee Laung Gyaing	1390	Gas
Yangon (Huanenglancang)	270	Coal
Yangon (Virtue Land)	300	Coal

Table 46: Planned and candidate renewable generators in Myanmar

Name	Capacity (MW)	Tech Type	Commission year
Nabuaing_Sol	150	Solar	candidate
Wundwin_Sol	150	Solar	candidate
His-Hsone_Wnd	220	Wind	candidate
Pekon_Wnd	950	Wind	candidate
Dawei_Wnd	220	Wind	candidate
Kawkareik_Wnd	580	Wind	candidate
Mudone_Wnd	510	Wind	candidate
Pharpon_Wnd	290	Wind	candidate
Zinkyauk_Wnd	160	Wind	candidate

4. Thailand Generators

322. The list of existing generators and the generators under construction in Thailand are shown in the following tables.

Table 47: Existing and under-construction hydro generators in Thailand

Name	Capacity (MW)	Retirement year
Bang Lang Dam	76	-
Bang Lang Dam	8	-
Bhumibol Dam	779.2	-
Chao Phraya Dam	12	-
Chulabhorn Dam	40	-
Chulabhorn Hydro	1.25	-
Fat Takong unit 3	250	-
Fat Takong unit 4	250	-
Kang Hrachan Dam	19	-
Kiew Khom Dam	5.5	-
Klong Tron Dam	2.5	-
Kwai Noi Madung	30	-
Lam Ta Khong	500	-
Mae Klong Dam	12	-
Pak Maun Dam	136	-
Pasak Jolasid	6.7	-
Pha Chuk Dam	14	-
Rajprabha Dam	240	-
Sirikit Dam	500	-
Sirindhorn Dam	36	-
Srinakarin	720	-
Tha Thung Na Dam	39	-
Ubolrat Dam	25.2	-
Vajiralongkorn Dam	300	-

Table 48: Existing and under-construction thermal generators in Thailand

Name	Capacity (MW)	Fuel code	Retirement year
Mae Mo 4-7	560	Coal	-
Mae Mo 4-7 New	600	Coal	-
SPP Coal	177	Coal	-
SPP Coal	245	Coal	-
BLCP Coal 1	673.3	Coal	2032
BLCP Coal 2	673.3	Coal	2032

Name	Capacity (MW)	Fuel code	Retirement year
Gheco Coal	660	Coal	2037
Ban Thon	8	Diesel	-
Bo Thong	10	Diesel	-
Su-ngai Kolok	8	Diesel	-
Mae Hong Son	4.4	Diesel	2025
SPP FO	4.5	FO	-
Krabi	315	FO	2034
Bang Pakong 3	314	Gas	-
Bang Pakong new 1	693	Gas	-
Bang Pakong new 2	693	Gas	-
Chana 2	766	Gas	-
Gulf JPN 1	800	Gas	-
Gulf JPN 2	800	Gas	-
Gulf JPU 1	800	Gas	-
Gulf JPU 2	800	Gas	-
Gulf SRC S1 1	625	Gas	-
Gulf SRC S1 2	625	Gas	-
Gulf SRC S2 1	625	Gas	-
Gulf SRC S2 2	625	Gas	-
Khanom	930	Gas	-
Nth Bangkok 2	828	Gas	-
South Bangkok new 1	610	Gas	-
South Bangkok new 2	610	Gas	-
SPP gas C1	1225	Gas	-
SPP gas C2	1827	Gas	-
SPP gas C3	1316	Gas	-
SPP gas N2	450	Gas	-
SPP gas S2	524	Gas	-
Wang Noi 4	750	Gas	-
EPEC gas	350	Gas	2023
Wang Noi 3	686	Gas	2023
GPSC Gas	700	Gas	2025
Nam Pong 1	325	Gas	2025
Nam Pong 2	325	Gas	2025
Ratchaburi 1	720	Gas	2025
Ratchaburi 2	720	Gas	2025
Bang Pakong 1	576	Gas	2027
Ratchaburi 3	685	Gas	2027

Name	Capacity (MW)	Fuel code	Retirement year
Ratchaburi 4	675	Gas	2027
Ratchaburi 5	681	Gas	2027
Bang Pakong 2	576	Gas	2028
Glow IPP 1	356.5	Gas	2028
Glow IPP 2	356.5	Gas	2028
Gulf PGC 1	734	Gas	2032
Gulf PGC 2	734	Gas	2033
Ratchaburi PCL 1	700	Gas	2033
Ratchaburi PCL 2	700	Gas	2033
Chana 1	710	Gas	2034
Bang Pakong 5	710	Gas	2035
Sth Bangkok 3	710	Gas	2035
Nth Bangkok 1	670	Gas	2036

Table 49: Existing and under-construction renewable generators in Thailand

Name	Capacity (MW)	Tech Type	Retirement year
Civil State Biomass 1	60	Biomass	-
Civil State Biomass 2	400	Biomass	-
SPP Biomass 1	329.1	Biomass	-
SPP Biomass 2	347	Biomass	-
SPP Garbage	73	Biomass	-
Geothermal	0.3	General	-
SPP Other	13.7	General	-
SPP Hydro	12.2	SH/PCH	-
Sirindhorn Dam Sol	0.25	Solar	-
Sirindhorn HPP sol	45	Solar	-
Solar	6.6	Solar	-
SPP Solar	436	Solar	-
SPP Wind	556	Wind	-
Takong Wind	24	Wind	-
Wind	2.69	Wind	-

Table 50: Planned and candidate hydro generators in Thailand

Name	Capacity (MW)	Commission year
Ban Chan Day Hydro	18	2023

Table 51: Planned and candidate thermal generators in Thailand

Name	Capacity (MW)	Fuel code	Commission year
Mae Mo 8-9 New	600	Coal	candidate
National Power Sup 1	270	Coal	candidate
National Power Sup 2	270	Coal	candidate
New PP East 2	1000	Coal	candidate
New PP South 2	1000	Coal	candidate
Gulf PD S1 1	625	Gas	2023
Gulf PD S1 2	625	Gas	2023
Gulf PD S2 1	625	Gas	2024
Gulf PD S2 2	625	Gas	2024
New PP West 1	700	Gas	2024
New Nam Pong	650	Gas	2025
New PP West 2	700	Gas	2025
New PP East 1	700	Gas	candidate
New PP Nakhon Luang 1	700	Gas	candidate
New PP Nakhon Luang 2	700	Gas	candidate
New PP North East 1	700	Gas	candidate
New PP North East 2	700	Gas	candidate
New PP South 1	700	Gas	candidate
New PP Upper Central 1	1400	Gas	candidate
North Bangkok add 1	700	Gas	candidate
North Bangkok add 2	700	Gas	candidate
South Bangkok add	1400	Gas	candidate
South Bangkok inc	700	Gas	candidate
Surat Thani 1	700	Gas	candidate
Surat Thani 2	700	Gas	candidate
TH_bulk_gas	50000	Gas	candidate

Table 52: Renewable Generators under Construction in Thailand

Name	Capacity (MW)	Tech Type	Commission year
Ubolratana HPP Sol	24	Solar	2023
Bang Lang HPP Sol	78	Solar	candidate
Bumibol HPP Sol 1	158	Solar	candidate
Bumibol HPP Sol 2	300	Solar	candidate
Bumibol HPP Sol 3	320	Solar	candidate
Chulabhorn HPP Sol	40	Solar	candidate
Ratchaprapa HPP Sol 1	140	Solar	candidate
Ratchaprapa HPP Sol 2	100	Solar	candidate

Name	Capacity (MW)	Tech Type	Commission year
Sirikit HPP Sol 1	325	Solar	candidate
Sirikit HPP Sol 2	175	Solar	candidate
Srinakarin HPP Sol 1	140	Solar	candidate
Srinakarin HPP Sol 2	280	Solar	candidate
Srinakarin HPP Sol 3	300	Solar	candidate
Wachira Lang HPP Sol 1	50	Solar	candidate
Wachira Lang HPP Sol 2	250	Solar	candidate

5. Viet Nam Generators

323. The list of existing generators and the generators under construction in Viet Nam are shown in the following tables.

Table 53: Existing and planned hydro generators in Viet Nam

Name	Province	Type	Capacity (MW)	Year	Status
Son La	Son La	Hydropower	2400	-	existing
Hoa Binh	Hoa Binh	Hydropower	1960	-	existing
Thac Ba	Yen Bai	Hydropower	120	-	existing
Tuyen Quang	Tuyen Quang	Hydropower	342	-	existing
Ban Ve	Nghe An	Hydropower	320	-	existing
Ban Chat	Lai Chau	Hydropower	220	-	existing
Huoi Quang	Lai Chau	Hydropower	260	-	existing
Lai Chau	Lai Chau	Hydropower	400	-	existing
A Luoi	Thua Thien Hue	Hydropower	170	-	existing
Quang Tri	Quang Tri	Hydropower	64	-	existing
A Vuong	Quang Nam	Hydropower	210	-	existing
Vinh Son	Thanh Hoa	Hydropower	66	-	existing
Song Hinh	Thanh Hoa	Hydropower	70	-	existing
Plei Krong	Kon Tum	Hydropower	100	-	existing
Ialy	Gia Lai	Hydropower	720	-	existing
Se San 3	Gia Lai	Hydropower	260	-	existing
Se San 4	Gia Lai	Hydropower	360	-	existing
Se San 3A	Gia Lai	Hydropower	108	-	existing
Buon Tua Srah	Dak Lak	Hydropower	86	-	existing
Song Tranh 2	Quang Nam	Hydropower	190	-	existing
Srepok 3	Dak Lak	Hydropower	220	-	existing
An Khe - Kanak	Gia Lai	Hydropower	173	-	existing
Buon Kuop	Dak Lak	Hydropower	280	-	existing
Song Ba Ha	Phu Yen	Hydropower	220	-	existing
Dong Nai 3	Dak Nong	Hydropower	180	-	existing

Name	Province	Type	Capacity (MW)	Year	Status
Dong Nai 4	Dak Nong	Hydropower	340	-	existing
Tri An	Dong Nai	Hydropower	400	-	existing
Da Nhim	Lam Dong	Hydropower	160	-	existing
Thac Mo	Binh Phuoc	Hydropower	150	-	existing
Ham Thuan	Binh Thuan	Hydropower	300	-	existing
Da Mi	Binh Thuan	Hydropower	175	-	existing
Dai Ninh	Binh Thuan	Hydropower	300	-	existing
Khe Bo	Nghe An	Hydropower	100	-	existing
Nam Chien 2	Son La	Hydropower	32	-	existing
Bac Ha	Lao Cai	Hydropower	90	-	existing
Nho Que	Ha Giang	Hydropower	110	-	existing
Cua Dat	Thanh Hoa	Hydropower	97	-	existing
Chiem Hoa	Tuyen Quang	Hydropower	48	-	existing
Su Pan	Lao Cai	Hydropower	34.5	-	existing
Nam Phang	Lao Cai	Hydropower	36	-	existing
Muong Hum	Lao Cai	Hydropower	32	-	existing
Ba Thuoc	Thanh Hoa	Hydropower	80	-	existing
Hua Na	Nghe An	Hydropower	180	-	existing
Nam Chien 1	Son La	Hydropower	200	-	existing
Van Chan	Yen Bai	Hydropower	57	-	existing
Ta Thang	Lao Cai	Hydropower	60	-	existing
Song Bac	Ha Giang	Hydropower	42	-	existing
Ngoi Phat	Lao Cai	Hydropower	72	-	existing
Ngoi Hut	Yen Bai	Hydropower	48	-	existing
Nam Na	Lai Chau	Hydropower	66	-	existing
Nam Muc 2	Dien Bien	Hydropower	44	-	existing
Huong Son	Ha Tinh	Hydropower	34	-	existing
Thai An	Ha Giang	Hydropower	82	-	existing
Binh Dien	Thua Thien Hue	Hydropower	44	-	existing
Song Con	Quang Nam	Hydropower	63	-	existing
Song Bung 5	Quang Nam	Hydropower	57	-	existing
Song Bung 4A	Quang Nam	Hydropower	49	-	existing
Se San 4A	Gia Lai	Hydropower	63	-	existing
Krong H'nang	Lai Chau	Hydropower	64	-	existing
Srepok 4	Dak Lak	Hydropower	80	-	existing
Srepok 4A	Dak Lak	Hydropower	64	-	existing
Dam Bri	Lam Dong	Hydropower	75	-	existing
Huong Dien	Thua Thien Hue	Hydropower	81	-	existing
Dak R'tih	Dak Lak	Hydropower	144	-	existing
Dak Mi 4	Quang Nam	Hydropower	195	-	existing

Name	Province	Type	Capacity (MW)	Year	Status
Song Bung 4A	Quang Nam	Hydropower	156	-	existing
Song Giang 2	Khan Hoa	Hydropower	37	-	existing
Dak Drinh	Quang Ngai	Hydropower	125	-	existing
Dong Nai 2	Dak Nong	Hydropower	73	-	existing
Bac Binh	Binh Thuan	Hydropower	33	-	existing
Dong Nai 5	Dak Nong	Hydropower	150	-	existing
Da Dang 2	Lam Dong	Hydropower	34	-	existing
Can Don	Binh Phuoc	Hydropower	78	-	existing
Srok Phu Mieng	Binh Phuoc	Hydropower	51	-	existing
Nho Que 2	Ha Giang	Hydropower	48	2016	Planned
Nho Que 1	Ha Giang	Hydropower	32	2016	Planned
Nam Na 3	Lai Chau	Hydropower	84	2016	Planned
Nam Toong	Lao Cai	Hydropower	34	2016	Planned
Bac Me	Ha Giang	Hydropower	45	2016	Planned
Ba Thuoc 1	Thanh Hoa	Hydropower	60	2016	Planned
Song Tranh 3	Quang Nam	Hydropower	62	2016	Planned
Huoi Quang Unit2	Lai Chau	Hydropower	260	2016	Planned
Lai Chau Unit 2 & 3	Lai Chau	Hydropower	2x400	2016	Planned
Trung Son Unit 1 & 2	Thanh Hoa	Hydropower	2x65	2016	Planned
Nhan Hac	Nghe An	Hydropower	59	2016	Planned
Song Bung 2	Quang Nam	Hydropower	100	2016	Planned
Song Tranh 4	Quang Nam	Hydropower	48	2016	Planned
Dak Mi 2	Quang Nam	Hydropower	98	2016	Planned
Dak Mi 3	Quang Nam	Hydropower	45	2016	Planned
Chi Khe	Nghe An	Hydropower	41	2017	Planned
Long Tao	Dien Bien	Hydropower	42	2017	Planned
Trung Son Unit 3 & 4	Thanh Hoa	Hydropower	2x65	2017	Planned
Yen Son	Tuyen Quang	Hydropower	70	2017	Planned
Tra Khuc 1	Quang Ngai	Hydropower	36	2017	Planned
Thac Mo Expansion	Binh Phuoc	Hydropower	75	2017	Planned
Song Lo 6	Ha Giang	Hydropower	44	2018	Planned
Hoi Xuan	Thanh Hoa	Hydropower	102	2018	Planned
Song Mien 4	Ha Giang	Hydropower	38	2018	Planned
La Ngau	Binh Thuan	Hydropower	36	2018	Planned
Dak Mi 1	Quang Nam	Hydropower	54	2018	Planned
Da Nhim Expansion	Lam Dong	Hydropower	100	2018	Planned
A Lin	Thua Thien Hue	Hydropower	62	2018	Planned
Bao Lam 3	Lam Dong	Hydropower	46	2019	Planned
Pac Ma	Lai Chau	Hydropower	140	2019	Planned
Upper Kon Unit 1 & 2	Kon Tum	Hydropower	2x110	2019	Planned

Name	Province	Type	Capacity (MW)	Year	Status
Nam Cum 1, 4, 5	Dien Bien	Hydropower	65	2019	Planned
Nam Pan 5	Son La	Hydropower	35	2020	Planned
Nam Mo (Viet Nam)	Lai Chau	Hydropower	95	2020	Planned
Ialy Expansion	Gia Lai	Hydropower	360	2020	Planned
Nam Cum 2, 3, 6	Dien Bien	Hydropower	54	2020	Planned
My Ly	Lai Chau	Hydropower	250	2021	Planned
Hoa Binh Expansion Unit 1	Hoa Binh	Hydropower	240	2021	Planned
Ban Mong (Song Hieu)	Quang Tri	Hydropower	60	2022	Planned
Hoa Binh Expansion Unit 2	Hoa Binh	Hydropower	240	2022	Planned
Dak Re	Quang Ngai	Hydropower	60	2022	Planned
Phu Tho low head	Phu Tho	Hydropower	105	2023	Planned
Bac Ai pumped-storage Unit 1 & 2	Ninh Thuan	Hydropower	2x300	2023	Planned
Tri An Expansion	Dong Nai	Hydropower	200	2025	Planned
Bac Ai pumped-storage Unit 3 & 4	Ninh Thuan	Hydropower	2x300	2025	Planned
Dong Phu Yen pumped-storage Unit 1	Phu Yen	Hydropower	300	2028	Planned
Dong Phu Yen pumped-storage Unit 2	Phu Yen	Hydropower	300	2029	Planned
Huoi Tao	Son La	Hydropower	180	2030	Planned
Dong Phu Yen pumped-storage Unit 3	Phu Yen	Hydropower	300	2030	Planned
Don Duong pumped-storage Unit 1	Lam Dong	Hydropower	300	2030	Planned

Table 54: Existing and planned thermal generators in Viet Nam

Name	Province	Type	Capacity (MW)	Year	Status
Pha Lai 1	Hai Duong	Coal	440	-	existing
Pha Lai 2	Hai Duong	Coal	600	-	existing
Uong Bi	Quang Ninh	Coal	630	-	existing
Ninh Binh	Ninh Binh	Coal	100	-	existing
Hai Phong	Hai Phong	Coal	1200	-	existing
Quang Ninh	Quang Ninh	Coal	1200	-	existing
Nghi Son	Thanh Hoa	Coal	600	-	existing
Vinh Tan	Binh Thuan	Coal	1245	-	existing
Duyen Hai 1	Tra Vinh	Coal	1244	-	existing
Mon Duong 1	Quang Ninh	Coal	1200	-	existing
Thu Duc	HCM	Oil	169.5	-	existing
Can Tho	Can Tho	Oil	37	-	existing
O Mon	Can Tho	Oil	660	-	existing
Ba Ria	Ba Ria- Vung Tau	Combined Cycle	388	-	existing
Phu My 2	Ba Ria- Vung Tau	Combined Cycle	949	-	existing
Phu My 1	Ba Ria- Vung Tau	Combined Cycle	1140	-	existing
Phu My 4	Ba Ria- Vung Tau	Combined Cycle	468	-	existing
Thu Duc	HCM	Combined Cycle	114	-	existing

Name	Province	Type	Capacity (MW)	Year	Status
Can Tho	Can Tho	Combined Cycle	150	-	existing
Na Duong	Lang Son	Coal	110	-	existing
Cao Ngan	Thai Nguyen	Coal	115	-	existing
Cam Pha	Quang Ninh	Coal	660	-	existing
Son Dong	Bac Giang	Coal	220	-	existing
Mao Khe	Quang Ninh	Coal	440	-	existing
Mon Duong 2	Quang Ninh	Coal	1245	-	existing
Vung Ang	Ha Tinh	Coal	1245	-	existing
Formosa Ha Tinh	Ha Tinh	Coal	150	-	existing
An Khanh	Thai Nguyen	Coal	120	-	existing
Hiep Phuoc	HCM	Oil	375	-	existing
Formosa	Long An	Coal	310	-	existing
Phu My 3	Ba Ria- Vung Tau	Combined Cycle	740	-	existing
Phu My 22	Ba Ria- Vung Tau	Combined Cycle	740	-	existing
Nhon Trach 1	HCM	Combined Cycle	465	-	existing
Nhon Trach 2	HCM	Combined Cycle	750	-	existing
Ca Mau 1	Ca Mau	Combined Cycle	771	-	existing
Ca Mau 2	Ca Mau	Combined Cycle	771	-	existing
Ve Dan	Dong Nai	Coal	72	-	existing
Dam Phu My	Ba Ria- Vung Tau	Gas	21	-	existing
Formosa Ha Tinh Unit 2	Ha Tinh	Coal	150	2016	Planned
Formosa Ha Tinh Unit 3 & 4	Ha Tinh	Gas	2x100	2016	Planned
Formosa Ha Tinh Unit 5	Ha Tinh	Coal	150	2016	Planned
Formosa Dong Nai Unit 3	Dong Nai	Coal	150	2016	Planned
Ve Dan	Dong Nai	Coal	60	2016	Planned
Duyen Hai III Unit 1	Tra Vinh	Coal	600	2016	Planned
Thai Binh I Unit 1 & 2	Thai Binh	Coal	2x300	2017	Planned
Thai Binh II Unit1	Thai Binh	Coal	600	2017	Planned
Duyen Hai III Unit 2	Tra Vinh	Coal	600	2017	Planned
Long Son Unit 1	Ba Ria- Vung Tau	Oil	75	2017	Planned
Thang Long Unit 1	Quang Ninh	Coal	300	2018	Planned
Thai Binh II Unit 2	Thai Binh	Coal	600	2018	Planned
Vinh Tan IV Unit 1 & 2	Binh Thuan	Coal	2x600	2018	Planned
Long Phu I Unit 1	Soc Trang	Coal	600	2018	Planned
Long Son Unit 2 & 3	Ba Ria- Vung Tau	Oil	2x75	2018	Planned
Thang Long Unit 2	Quang Ninh	Coal	300	2019	Planned
Hai Ha 1 cogeneration plant	Quang Ninh	Coal	3x50	2019	Planned
Na Duong II	Lang Son	Coal	110	2019	Planned
Long Phu I Unit 2	Soc Trang	Coal	600	2019	Planned
Song Hau I Unit 1 & 2	Hau Giang	Coal	2x600	2019	Planned

Name	Province	Type	Capacity (MW)	Year	Status
Duyen Hai III Expansion	Tra Vinh	Coal	660	2019	Planned
Vinh Tan I Unit 1 & 2	Binh Thuan	Coal	2x600	2019	Planned
Vinh Tan IV Expansion	Binh Thuan	Coal	600	2019	Planned
Formosa Ha Tinh Unit 6 & 7	Ha Tinh	Coal	2x150	2020	Planned
Formosa Ha Tinh Unit 8 & 9	Ha Tinh	Gas	2x100	2020	Planned
Formosa Ha Tinh Unit 10	Ha Tinh	Coal	150	2020	Planned
Hai Duong Unit 1	Hai Duong	Coal	600	2020	Planned
Cam Pha III Unit 1 & 2	Quang Ninh	Coal	2x220	2020	Planned
Cong Thanh	Thanh Hoa	Coal	600	2020	Planned
O Mon III	Can Tho	Combined Cycle	750	2020	Planned
Nghi Son II Unit 1	Thanh Hoa	Coal	600	2021	Planned
Vung Ang II Unit 1	Ha Tinh	Coal	600	2021	Planned
Hai Duong Unit 2	Hai Duong	Coal	600	2021	Planned
Nam Dinh I Unit 1	Nam Dinh	Coal	600	2021	Planned
Quang Trach I Unit 1	Thanh Hoa	Coal	600	2021	Planned
Kien Giang 1	Kien Giang	Combined Cycle	750	2021	Planned
O Mon IV	Can Tho	Combined Cycle	750	2021	Planned
Duyen Hai II Unit 1 & 2	Tra Vinh	Coal	2x600	2021	Planned
Song Hau II Unit 1	Hau Giang	Coal	1000	2021	Planned
Long Phu II Unit 1	Soc Trang	Coal	660	2021	Planned
Long Phu III Unit 1	Soc Trang	Coal	600	2021	Planned
Uong Bi (Ceasing)	Quang Ninh	Coal	-105	2021	Planned
Hai Ha 2 cogeneration	Quang Ninh	Coal	5x150	2022	Planned
Luc Nam Unit 1	Bac Giang	Coal	50	2022	Planned
Quynh Lap I Unit 1	Nghe An	Coal	600	2022	Planned
Vung Ang II Unit 2	Ha Tinh	Coal	600	2022	Planned
Nghi Son II Unit 2	Thanh Hoa	Coal	600	2022	Planned
Nam Dinh I Unit 2	Nam Dinh	Coal	600	2022	Planned
Quang Trach I Unit 2	Thanh Hoa	Coal	600	2022	Planned
Vinh Tan III Unit 1	Binh Thuan	Coal	660	2022	Planned
Song Hau II Unit 2	Hau Giang	Coal	1000	2022	Planned
Long Phu II Unit 2	Soc Trang	Coal	660	2022	Planned
Long Phu III Unit 2 & 3	Soc Trang	Coal	2x600	2022	Planned
Van Phong I Unit 1	Khanh Hoa	Coal	660	2022	Planned
Kien Giang II	Kien Giang	Combined Cycle	750	2022	Planned
Quynh Lap I Unit 2	Nghe An	Coal	600	2023	Planned
Luc Nam Unit 2	Bac Giang	Coal	50	2023	Planned
Quang Tri Unit 1	Quang Tri	Coal	600	2023	Planned
Mien Trung I	Khanh Hoa	Combined Cycle	750	2023	Planned
Dung Quat I	Quang Ngai	Combined Cycle	750	2023	Planned

Name	Province	Type	Capacity (MW)	Year	Status
Vinh Tan III Unit 2 & 3	Binh Thuan	Coal	2x660	2023	Planned
Van Phong I Unit 2	Khanh Hoa	Coal	660	2023	Planned
Son My II Unit 1	Binh Thuan	Combined Cycle	750	2023	Planned
Vung Ang III Unit 1	Ha Tinh	Coal	600	2024	Planned
Quang Tri Unit 2	Quang Tri	Coal	600	2024	Planned
Mien Trung II	Khanh Hoa	Combined Cycle	750	2024	Planned
Dung Quat II	Quang Ngai	Combined Cycle	750	2024	Planned
Long An I Unit 1	Long An	Coal	600	2024	Planned
Son My II Unit 2	Binh Thuan	Combined Cycle	750	2024	Planned
Hai Phong III Unit 1	Hai Phong	Coal	600	2025	Planned
Hai Ha 3 cogeneration plant	Quang Ninh	Coal	2x300	2025	Planned
Rang Dong cogeneration plant	Unknown	Unknown	100	2025	Planned
Vung Ang III Unit 2	Ha Tinh	Coal	600	2025	Planned
Long An I Unit 2	Long An	Coal	600	2025	Planned
Son My II Unit 3	Binh Thuan	Combined Cycle	750	2025	Planned
Hai Phong III Unit 2	Hai Phong	Coal	600	2026	Planned
Quynh Lap II Unit 1	Nghe An	Coal	600	2026	Planned
Mien Trung III	Khanh Hoa	Combined Cycle	750	2026	Planned
Long An II Unit 1	Long An	Coal	800	2026	Planned
O Mon II	Can Tho	Gas	750	2026	Planned
Son My I Unit 1	Binh Thuan	Gas	750	2026	Planned
Quynh Lap II Unit 2	Nghe An	Coal	600	2027	Planned
Son My I Unit 2	Binh Thuan	Combined Cycle	750	2027	Planned
Long An II Unit 2	Long An	Coal	800	2027	Planned
Tan Phuoc I Unit 1	Tien Giang	Coal	600	2027	Planned
Hai Ha 4 cogeneration plant	Quang Ninh	Coal	2x300	2028	Planned
Quang Trach II Unit 1	Thanh Hoa	Coal	600	2028	Planned
Tan Phuoc I Unit 2	Tien Giang	Coal	600	2028	Planned
Tan Phuoc II Unit 1	Tien Giang	Coal	600	2028	Planned
Son My I Unit 3	Binh Thuan	Combined Cycle	750	2028	Planned
Quang Ninh III Unit 1	Quang Ninh	Coal	600	2029	Planned
Vung Ang III Unit 3	Ha Tinh	Coal	600	2029	Planned
Quang Trach II Unit 2	Thanh Hoa	Coal	600	2029	Planned
Tan Phuoc II Unit 2	Tien Giang	Coal	600	2029	Planned
Bac Lieu I Unit 1	Bac Lieu	Coal	600	2029	Planned
Quang Ninh III Unit 2	Quang Ninh	Coal	600	2030	Planned
Vung Ang III Unit 4	Ha Tinh	Coal	600	2030	Planned
Bac Lieu I Unit 2	Bac Lieu	Coal	600	2030	Planned

Table 55: Existing and under-construction renewable generators in Viet Nam

Name	Capacity (MW)	Tech Type	Retirement year
An Khe Biomass	110	Biomass	-
KCP Biomass	60	Biomass	-
Lee&Man Biomass	125	Biomass	-
Adani Phước Minh_Sol	50	Solar	-
AMI_Sol	50	Solar	-
An Cư_Sol	50	Solar	-
Bách khoa Á Châu 1_Sol	30	Solar	-
Bầu Zôn_Sol	25	Solar	-
BCG Băng Dương Phase 1_Sol	40	Solar	-
BIM 1,2,3_Sol	330	Solar	-
Bình An_Sol	50	Solar	-
Bình Nguyên_Sol	49.6	Solar	-
BMT Solar farm Đăk Lăk_Sol	30	Solar	-
BP Solar 1_Sol	46	Solar	-
Cẩm Hòa_Sol	50	Solar	-
Cam Lâm_Sol	50	Solar	-
Cát Hiệp_Sol	49.5	Solar	-
CMX Renewable Energy Việt Nam_Sol	168	Solar	-
Cư Jut_Sol	62	Solar	-
Đá Bạc 1-4_Sol	222	Solar	-
Đa Mi Floating_Sol	48	Solar	-
Đa Mi_Sol	47.5	Solar	-
Đầm Trà Ổ_Sol	50	Solar	-
Dầu Tiếng 1, 2 _Sol	420	Solar	-
Điện lực miền Trung_Sol	50	Solar	-
Dohwa Lệ Thủy_Sol	49.5	Solar	-
Đức Huệ 1,2_Sol	99	Solar	-
Đức Minh_Sol	19.2	Solar	-
Eco Seido_Sol	40	Solar	-
Europlas, Phú Yên_Sol	50	Solar	-
EuroPlast, Long An_Sol	50	Solar	-
Fujiwara_Sol	50	Solar	-
Gelex Ninh Thuận_Sol	50	Solar	-
Hà Đô (Hồng Phong 4)_Sol	48	Solar	-
Hacom Solar_Sol	50	Solar	-
Hàm Kiệm_Sol	48	Solar	-
Hàm Phú II_Sol	69	Solar	-

Name	Capacity (MW)	Tech Type	Retirement year
Hậu Giang_Sol	29	Solar	-
HCG Tây Ninh_Sol	50	Solar	-
Hồ Bầu Ngứ_Sol	50	Solar	-
Hòa Hội_Sol	215	Solar	-
Hoàng Thái Gia_Sol	50	Solar	-
Hồng Phong 1A-1B,4,5.2_Sol	346	Solar	-
Jang Pông_Sol	10	Solar	-
KCN Châu Đức Future_Sol	30	Solar	-
KCN Châu Đức_Sol	70	Solar	-
KN Cam Lâm_Sol	50	Solar	-
Krong Pa 1,2_Sol	98	Solar	-
La Rsươm - Bitexco - Tô Na_Sol	14.8	Solar	-
LIG Quảng Trị_Sol	49.5	Solar	-
Loc Ninh 1 Solar	200	Solar	-
Lộc Thạch 1-1_Sol	50	Solar	-
Long Thành 1_Sol	50	Solar	-
Mai Sơn_Sol	10	Solar	-
Mộ Đức_Sol	19.2	Solar	-
MT 1, MT2_Sol	60	Solar	-
Mũi Né_Sol	40	Solar	-
Mỹ Sơn 1,2_Sol	100	Solar	-
Mỹ Sơn- Hoàn Lộc Việt_Sol	50	Solar	-
Nam Cum SHP	119	Solar	-
Ngọc Lặc_Sol	45	Solar	-
Nhị Hà_Sol	50	Solar	-
Ninh Phước 6.1, 6.2_Sol	57	Solar	-
Ninh Sim_Sol	40	Solar	-
Phan Lâm 1,2_Sol	85.72	Solar	-
Phong Điền 2_Sol	50	Solar	-
Phong Hòa_Sol	50	Solar	-
Phong Phú_Sol	42	Solar	-
Phú Yên_Sol	257	Solar	-
Phước Hữu – Điện lực 1_Sol	30	Solar	-
Phước Hữu_Sol	65	Solar	-
Phước Ninh_Sol	45	Solar	-
Phước Thái Furtue_Sol	150	Solar	-
Phước Thái_Sol	50	Solar	-
Phuoc Trung Solar	46	Solar	-

Name	Capacity (MW)	Tech Type	Retirement year
Phước Trung_Sol	50	Solar	-
Quang Minh_Sol	50	Solar	-
Sao Mai Future_Sol	106	Solar	-
Sao Mai_Sol	104	Solar	-
Se San 4 Solar	98	Solar	-
Sê San 4_Sol	49	Solar	-
Sinenergy_Sol	50	Solar	-
Sơn Mỹ 3.1_Sol	50	Solar	-
Sông Bình Future_Sol	150	Solar	-
Song Binh Solar	200	Solar	-
Sông Bình_Sol	50	Solar	-
Sông Giang_Sol	50	Solar	-
Sông Lũy 1_Sol	47	Solar	-
SP – Infra Ninh Thuận_Sol	50	Solar	-
Srêpôk 1_Sol	50	Solar	-
Tam Bố_Sol	50	Solar	-
Tân Châu 1_Sol	50	Solar	-
Thành Long_Sol	50	Solar	-
Thiên Tân_Sol	50	Solar	-
Thịnh Long AAA_Sol	50	Solar	-
Thuận Minh 2_Sol	50	Solar	-
Thuận Nam 12_Sol	49.9	Solar	-
Thuận Nam 19_Sol	61	Solar	-
Tri An Solar	126	Solar	-
Trí Việt 1_Sol	30	Solar	-
Trung Nam Ninh Thuận_Sol	257	Solar	-
Trung Sơn_Sol	30	Solar	-
TTC 1,2_Sol	119	Solar	-
TTC Đức Huệ 1_Sol	50	Solar	-
TTC Krong Pa_Sol	69	Solar	-
TTC Phong Điền_Sol	48	Solar	-
TTC- Trúc Sơn_Sol	44.4	Solar	-
TTĐL Vĩnh Tân GĐ 1_Sol	6.2	Solar	-
Tuấn Ân_Sol	10	Solar	-
Vĩnh Hảo 4,6_Sol	86	Solar	-
Vĩnh Long_Sol	49.3	Solar	-
Vĩnh Tân 1,2_Sol	40	Solar	-
VSP Bình Thuận II_Sol	37.6	Solar	-

Name	Capacity (MW)	Tech Type	Retirement year
Vùng hồ Dầu Tiếng Future_Sol	1650	Solar	-
Vùng hồ Dầu Tiếng_Sol	350	Solar	-
Xuân Thiện Thuận Bắc - 1,2_Sol	200	Solar	-
Xuân Thọ 1,2_Sol	100	Solar	-
Yên Định_Sol	30	Solar	-
Bạc Liêu (phase I-III)_Wnd	241.2	Wind	-
Bình Đại (phase I)_Wnd	30	Wind	-
Bình Thuận 1 (Tuy Phong)_Wnd	30	Wind	-
Cầu Đất_Wnd	50	Wind	-
Đầm Nại (phase I,II)_Wnd	37.8	Wind	-
Duyên Hải_Wnd	48.3	Wind	-
HBRE An Thọ_Wnd	200	Wind	-
HBRE Chư Prông_Wnd	50	Wind	-
HBRE Tây Nguyên (phase I)_Wnd	28.8	Wind	-
Hiệp Thạnh -Trà Vinh_Wnd	78	Wind	-
Hòa Đông_Wnd	30	Wind	-
Hòa Thắng 1.2_Wnd	30	Wind	-
Hướng Linh 1,2_Wnd	60	Wind	-
Khai Long_Wnd	100	Wind	-
Lạc Hòa_Wnd	30	Wind	-
Lai Hòa (phase I)_Wnd	30	Wind	-
Mũi Dinh_Wnd	37.6	Wind	-
Phú Lạc_Wnd	50	Wind	-
Phú Quý_Wnd	6	Wind	-
Phương Mai 3_Wnd	21	Wind	-
Trà Vinh 1_Wnd	48	Wind	-
Trung Nam Ninh Thuan phase 1,2_Wnd	104	Wind	-
Trung Nam_Wnd	90	Wind	-
Tuy Phong 1,2_Wnd	120	Wind	-

Table 56: Planned and candidate small hydro in Viet Nam

Name	Capacity (MW)	Commission year
SHP_2023	100	2023
SHP_2024	120	2024
SHP_2025	180	2025
SHP_can	1519	candidate

Table 57: Additional candidate thermal generators in Viet Nam

Name	Capacity (MW)	Fuel code	Commission year
VN_coal_can	19464	Coal	candidate
VN_bulk_gas	50000	Gas	candidate

Table 58: Planned and candidate renewable generators in Viet Nam

Name	Capacity (MW)	Tech Type	Commission year
Bầu Ngứ Lake_Sol	50	Solar	2023
Nhơn Hải Solar Farm_Sol	35	Solar	2023
Ninh Thuận 1_Sol	50	Solar	2023
solar_2023	200	Solar	2023
Trung Nam Trà Vinh_Sol	165	Solar	2023
solar_2024	600	Solar	2024
solar_2025	900	Solar	2025
solar_can	7595	Solar	candidate
Huong Phung 1,2_Wnd	50	Wind	2023
Phước Hữu_Wnd	50	Wind	2023
UPC-Le Thuy_Wnd	50	Wind	2023
UPC-Quang Binh_Wnd	250	Wind	2023
Binh Thuan_Wnd	120	Wind	2024
Dam Nai 2,4_Wnd	99.2	Wind	2024
Ham Cuong 1,2_Wnd	35	Wind	2024
Ham Kiem 1,2_Wnd	30	Wind	2024
Hoa Minh_Wnd	15	Wind	2024
Hoa Thang 1.1_Wnd	85.5	Wind	2024
Nhon Hoi_Wnd	61.1	Wind	2024
Phuong Mai 1_Wnd	30	Wind	2024
Hong Phong 1,2_Wnd	60	Wind	2025
Ke Ga_Wnd	600	Wind	2025
Tien Thanh 1-3_Wnd	55	Wind	2025
Cong Ly Soc Trang 1-3_Wnd	98	Wind	candidate
Gio Ben Tre 1-11_Wnd	1230	Wind	candidate
Hoa Thang 1.3_Wnd	20	Wind	candidate
Hoa Thang 2,4_Wnd	70	Wind	candidate
Khai Long 2,3_Wnd	200	Wind	candidate
Phan Ri Thanh_Wnd	30	Wind	candidate
Phong Dien 1 - Binh Thuan_Wnd	120	Wind	candidate
Phuoc The_Wnd	28	Wind	candidate
PV Power - IMPSA_Wnd	600	Wind	candidate

Name	Capacity (MW)	Tech Type	Commission year
Saigon - Binh Thuan_Wnd	200	Wind	candidate
Tan An 1_Wnd	25	Wind	candidate
Tan Thuan_Wnd	25	Wind	candidate
Thái Hòa_Wnd	90	Wind	candidate
Thien Nghiep_Wnd	40	Wind	candidate
Thuan Nhien Phong_Wnd	32	Wind	candidate
V1-1-6_Wnd	270	Wind	candidate
Vinh Chau 1-3_Wnd	1480	Wind	candidate
wind_can	1518	Wind	candidate

B. Appendix 2: Generation and Transmission Plans

1. Scenario “M_BASE_BASE”

324. The generation plan for the “M_BASE_BASE” scenario is shown in Table 59.

Table 59: Generation plan for “M_BASE_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	228	160
2023	Myanmar	MM_run_can	Hydro	561	1398
2024	Myanmar	MM_run_can	Hydro	4000	9972
2028	Lao PDR	LA_S_st_can	Hydro	488	1216
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	112	78
2028	Myanmar	MM_run_can	Hydro	937	2336
2029	Cambodia	KH_gas_can	Gas	1681	1176
2030	Cambodia	KH_gas_can	Gas	969	679
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	380	948
2031	Viet Nam	VN_SHP_can	Hydro	144	358
2031	Cambodia	KH_N2_rr_can	Hydro	509	1269
2031	Cambodia	KH_S1_rr_can	Hydro	64	160
2031	Cambodia	KH_pot_gas	Gas	1611	1127
2031	Cambodia	KH_blk_hydro	Hydro	819	2042
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	2450	6108
2032	Thailand	TH_coal_can	Coal	2229	4206
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	7553	7553
2032	Lao PDR	LA_wind_can	Wind	500	750
2032	Lao PDR	LA_N_rr_can	Hydro	133	332
2032	Cambodia	KH_S1_rr_can	Hydro	356	887
2032	Cambodia	KH_pot_gas	Gas	2415	1691
2032	Cambodia	KH_blk_hydro	Hydro	142	355
2033	Thailand	TH_coal_can	Coal	911	1719
2033	Viet Nam	VN_coal_can	Coal	3178	7196
2033	Cambodia	KH_gas_can	Gas	610	427

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Cambodia	KH_pot_gas	Gas	1374	962
2034	Thailand	TH_gas_can	Gas	3031	2122
2034	Viet Nam	VN_coal_can	Coal	6619	14986
2034	Lao PDR	LA_N_rr_can	Hydro	1777	4431
2034	Cambodia	KH_N2_rr_can	Hydro	358	893
2034	Myanmar	MM_run_can	Hydro	552	1376
2035	Thailand	TH_gas_can	Gas	1256	879
2035	Viet Nam	VN_coal_can	Coal	6952	15739
2035	Lao PDR	LA_S_st_can	Hydro	745	1858
2035	Cambodia	KH_blk_hydro	Hydro	2039	5082
2035	Myanmar	MM_run_can	Hydro	3661	9127

325. The transmission plan for the “M_BASE_BASE” scenario is shown in Table 60. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 60: Transmission plan for “M_BASE_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

2. Scenario “M_GAS_BASE”

326. The generation plan for the “M_GAS_BASE” scenario is shown in Table 61.

Table 61: Generation plan for “M_GAS_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	247	173
2022	Myanmar	MM_run_can	Hydro	507	1263
2023	Cambodia	KH_gas_can	Gas	47	33
2024	Myanmar	MM_run_can	Hydro	2426	6049
2026	Myanmar	MM_run_can	Hydro	1088	2712
2028	Lao PDR	LA_C2_st_can	Hydro	96	240
2028	Lao PDR	LA_S_st_can	Hydro	219	546
2028	Cambodia	KH_gas_can	Gas	880	616
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_S_st_can	Hydro	159	398
2029	Cambodia	KH_gas_can	Gas	1209	846
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Lao PDR	LA_S_st_can	Hydro	854	2130
2030	Cambodia	KH_bio_can	Biomass	43	175
2030	Cambodia	KH_sol_can	Solar	744	744
2030	Cambodia	KH_gas_can	Gas	1217	852
2030	Myanmar	MM_run_can	Hydro	4221	10523
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	293	730
2031	Viet Nam	VN_S_stor_c	Hydro	176	439
2031	Viet Nam	VN_SHP_can	Hydro	195	486
2031	Lao PDR	LA_S_rr_can	Hydro	355	885
2031	Cambodia	KH_N2_rr_can	Hydro	413	1030
2031	Cambodia	KH_S1_rr_can	Hydro	33	82
2031	Cambodia	KH_pot_gas	Gas	2055	1438
2031	Cambodia	KH_blk_hydro	Hydro	813	2026
2032	Thailand	TH_gas_can	Gas	2144	1501
2032	Viet Nam	VN_coal_can	Coal	1012	2290
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	2811	2811
2032	Viet Nam	VN_C2_stor_c	Hydro	83	208
2032	Viet Nam	VN_SHP_can	Hydro	584	1457
2032	Cambodia	KH_pot_gas	Gas	2476	1733

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Thailand	TH_gas_can	Gas	462	323
2033	Viet Nam	VN_coal_can	Coal	4505	10200
2033	Lao PDR	LA_wind_can	Wind	500	750
2033	Lao PDR	LA_N_rr_can	Hydro	994	2478
2033	Lao PDR	LA_C2_st_can	Hydro	458	1142
2033	Cambodia	KH_pot_gas	Gas	564	395
2034	Thailand	TH_gas_can	Gas	2456	1719
2034	Viet Nam	VN_coal_can	Coal	3708	8395
2034	Viet Nam	VN_solar_can	Solar	4784	4784
2034	Cambodia	KH_wnd_can	Wind	85	128
2034	Cambodia	KH_sol_can	Solar	346	346
2034	Cambodia	KH_N2_rr_can	Hydro	67	167
2034	Cambodia	KH_pot_gas	Gas	305	213
2034	Cambodia	KH_bulk_sol	Solar	1500	1500
2035	Thailand	TH_gas_can	Gas	2483	1738
2035	Viet Nam	VN_coal_can	Coal	7287	16497
2035	Myanmar	MM_run_can	Hydro	1077	2685

327. The transmission plan for the "M_GAS_BASE" scenario is shown in Table 62. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 62: Transmission plan for "M_GAS_BASE" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2034	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

3. Scenario "M_VRE_BASE"

328. The generation plan for the "M_VRE_BASE" scenario is shown in Table 63.

Table 63: Generation plan for "M_VRE_BASE" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	2928	2342
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_wnd_can	Wind	94	113
2022	Cambodia	KH_gas_can	Gas	91	63
2022	Myanmar	MM_run_can	Hydro	840	2095
2023	Thailand	TH_solar_can	Solar	3751	3001
2023	Cambodia	KH_gas_can	Gas	249	174
2024	Thailand	TH_solar_can	Solar	452	362
2024	Myanmar	MM_run_can	Hydro	3548	8845
2025	Thailand	TH_solar_can	Solar	4000	3200
2026	Thailand	TH_solar_can	Solar	988	790
2028	Cambodia	KH_sol_can	Solar	954	763
2028	Myanmar	MM_run_can	Hydro	3067	7645
2029	Lao PDR	LA_wind_can	Wind	550	660
2029	Lao PDR	LA_N_st_can	Hydro	522	1301
2029	Cambodia	KH_sol_can	Solar	245	196
2029	Cambodia	KH_gas_can	Gas	1476	1033
2030	Lao PDR	LA_C1_st_can	Hydro	45	112
2030	Cambodia	KH_gas_can	Gas	1298	909
2031	Viet Nam	VN_C_wnd_can	Wind	835	1002
2031	Viet Nam	VN_N1_stor_c	Hydro	115	285
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	126	313
2031	Viet Nam	VN_SHP_can	Hydro	538	1340
2031	Lao PDR	LA_S_st_can	Hydro	484	1208
2031	Cambodia	KH_N2_rr_can	Hydro	1148	2861
2031	Cambodia	KH_S1_rr_can	Hydro	61	151
2031	Cambodia	KH_pot_gas	Gas	1001	701
2031	Cambodia	KH_blk_hydro	Hydro	734	1829

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_bulk_sol	Solar	1650	1320
2031	Myanmar	MM_run_can	Hydro	1377	3433
2032	Thailand	TH_coal_can	Coal	1888	3563
2032	Viet Nam	VN_gas_can	Gas	860	602
2032	Viet Nam	VN_S_wnd_can	Wind	5848	7018
2032	Viet Nam	VN_solar_can	Solar	8160	6528
2032	Lao PDR	LA_S_st_can	Hydro	381	951
2032	Cambodia	KH_pot_gas	Gas	2841	1989
2033	Viet Nam	VN_coal_can	Coal	2872	6502
2033	Viet Nam	VN_gas_can	Gas	640	448
2033	Viet Nam	VN_solar_can	Solar	195	156
2033	Cambodia	KH_gas_can	Gas	486	341
2033	Cambodia	KH_pot_gas	Gas	1558	1090
2034	Thailand	TH_coal_can	Coal	1252	2362
2034	Thailand	TH_gas_can	Gas	635	445
2034	Thailand	TH_wind_can	Wind	770	924
2034	Viet Nam	VN_coal_can	Coal	5936	13438
2034	Viet Nam	VN_SHP_can	Hydro	134	333
2034	Cambodia	KH_S1_rr_can	Hydro	359	896
2034	Cambodia	KH_blk_hydro	Hydro	1050	2619
2035	Thailand	TH_gas_can	Gas	2232	1562
2035	Viet Nam	VN_coal_can	Coal	7056	15974
2035	Viet Nam	VN_C2_stor_c	Hydro	774	1930

329. The transmission plan for the "M_VRE_BASE" scenario is shown in Table 64. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 64: Transmission plan for "M_VRE_BASE" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2033	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

4. Scenario “M_HIF_BASE”

330. The generation plan for the “M_HIF_BASE” scenario is shown in Table 65.

Table 65: Generation plan for “M_HIF_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Thailand	TH_solar_can	Solar	700	700
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	117	82
2023	Thailand	TH_solar_can	Solar	1561	1561
2023	Cambodia	KH_gas_can	Gas	691	484
2023	Myanmar	MM_run_can	Hydro	1748	4359
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	4757	4757
2026	Myanmar	MM_run_can	Hydro	1583	3946
2027	Lao PDR	LA_C1_st_can	Hydro	45	112
2027	Lao PDR	LA_S_st_can	Hydro	701	1747
2028	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_sol_can	Solar	1090	1090
2029	Cambodia	KH_gas_can	Gas	1941	1359
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Cambodia	KH_gas_can	Gas	341	239
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	257	642
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	485	1210
2031	Lao PDR	LA_N_st_can	Hydro	522	1301
2031	Cambodia	KH_N2_rr_can	Hydro	394	981
2031	Cambodia	KH_S1_rr_can	Hydro	293	732

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_pot_gas	Gas	1366	956
2031	Cambodia	KH_blk_hydro	Hydro	1384	3452
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	1868	4656
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	3987	5981
2032	Viet Nam	VN_solar_can	Solar	7595	7595
2032	Cambodia	KH_N2_rr_can	Hydro	613	1529
2032	Cambodia	KH_pot_gas	Gas	2706	1894
2033	Viet Nam	VN_coal_can	Coal	4485	10153
2033	Viet Nam	VN_N1_stor_c	Hydro	180	449
2033	Viet Nam	VN_S_wnd_can	Wind	1329	1994
2033	Viet Nam	VN_SHP_can	Hydro	11	29
2033	Cambodia	KH_N2_rr_can	Hydro	38	95
2034	Thailand	TH_gas_can	Gas	513	359
2034	Thailand	TH_wind_can	Wind	700	1050
2034	Viet Nam	VN_coal_can	Coal	4808	10884
2034	Cambodia	KH_gas_can	Gas	509	357
2034	Cambodia	KH_pot_gas	Gas	1329	930
2035	Thailand	TH_gas_can	Gas	3443	2410
2035	Viet Nam	VN_coal_can	Coal	7651	17323

331. The transmission plan for the "M_HIF_BASE" scenario is shown in Table 66. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 66: Transmission plan for "M_HIF_BASE" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

5. Scenario “M_BASE_BSS”

332. The generation plan for the “M_BASE_BSS” scenario is shown in Table 67.

Table 67: Generation plan for “M_BASE_BSS” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	231	162
2022	Myanmar	MM_run_can	Hydro	1477	3683
2023	Cambodia	KH_gas_can	Gas	209	146
2024	Cambodia	KH_gas_can	Gas	35	25
2024	Myanmar	MM_run_can	Hydro	3573	8908
2027	Lao PDR	LA_S_st_can	Hydro	618	1542
2028	Lao PDR	LA_N_st_can	Hydro	522	1301
2028	Lao PDR	LA_C2_st_can	Hydro	554	1381
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	273	273
2028	Cambodia	KH_gas_can	Gas	81	57
2028	Cambodia	KH_sol_bat_c	Solar_BSS	1295	1619
2029	Cambodia	KH_gas_can	Gas	1372	960
2030	Cambodia	KH_gas_can	Gas	1143	800
2030	Myanmar	MM_run_can	Hydro	2396	5973
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_SHP_can	Hydro	356	888
2031	Lao PDR	LA_N_rr_can	Hydro	467	1165
2031	Cambodia	KH_N2_rr_can	Hydro	377	940
2031	Cambodia	KH_S1_rr_can	Hydro	220	549
2031	Cambodia	KH_pot_gas	Gas	1902	1332
2031	Cambodia	KH_blk_hydro	Hydro	1359	3387

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_bulk_sol	Solar	750	750
2032	Thailand	TH_coal_can	Coal	1415	2671
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	3013	4519
2032	Viet Nam	VN_solar_can	Solar	1260	1260
2032	Viet Nam	VN_C2_stor_c	Hydro	386	963
2032	Viet Nam	VN_sol_bat_c	Solar_BSS	3798	4748
2032	Lao PDR	LA_N_rr_can	Hydro	502	1252
2032	Lao PDR	LA_C1_st_can	Hydro	45	112
2032	Cambodia	KH_N2_rr_can	Hydro	328	817
2032	Cambodia	KH_pot_gas	Gas	2950	2065
2033	Thailand	TH_coal_can	Coal	1474	2782
2033	Viet Nam	VN_coal_can	Coal	3081	6975
2033	Viet Nam	VN_S_wnd_can	Wind	2304	3456
2033	Viet Nam	VN_S_stor_c	Hydro	208	519
2033	Cambodia	KH_gas_can	Gas	529	370
2033	Cambodia	KH_S1_rr_can	Hydro	200	498
2033	Cambodia	KH_pot_gas	Gas	547	383
2034	Thailand	TH_coal_can	Coal	250	472
2034	Thailand	TH_gas_can	Gas	1648	1153
2034	Thailand	TH_sol_bat_c	Solar_BSS	96	120
2034	Viet Nam	VN_coal_can	Coal	5935	13436
2034	Lao PDR	LA_wind_can	Wind	500	750
2034	Lao PDR	LA_N_rr_can	Hydro	902	2248
2034	Myanmar	MM_run_can	Hydro	1586	3954
2035	Thailand	TH_gas_can	Gas	2121	1485
2035	Viet Nam	VN_coal_can	Coal	7357	16655
2035	Viet Nam	VN_C2_stor_c	Hydro	479	1194
2035	Cambodia	KH_bulk_gas	Gas	231	162
2035	Myanmar	MM_run_can	Hydro	1689	4210

333. The transmission plan for the “M_BASE_BSS” scenario is shown in Table 68. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 68: Transmission plan for "M_BASE_BSS" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2034	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524

6. Scenario "M_VRE_BSS"

334. The generation plan for the "M_VRE_BSS" scenario is shown in Table 69.

Table 69: Generation plan for "M_VRE_BSS" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	3763	3010
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_gas_can	Gas	190	133
2023	Thailand	TH_solar_can	Solar	2297	1838
2023	Myanmar	MM_run_can	Hydro	814	2028
2024	Myanmar	MM_run_can	Hydro	4000	9972
2028	Cambodia	KH_wnd_can	Wind	85	102
2028	Cambodia	KH_sol_can	Solar	300	240
2028	Cambodia	KH_gas_can	Gas	403	282
2028	Cambodia	KH_sol_bat_c	Solar_BSS	1425	1425
2028	Myanmar	MM_run_can	Hydro	2499	6230
2029	Lao PDR	LA_N_st_can	Hydro	98	245
2029	Lao PDR	LA_S_st_can	Hydro	57	143
2029	Cambodia	KH_gas_can	Gas	1269	888
2030	Lao PDR	LA_wind_can	Wind	550	660

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Lao PDR	LA_N_rr_can	Hydro	633	1577
2030	Lao PDR	LA_C2_st_can	Hydro	554	1381
2030	Cambodia	KH_gas_can	Gas	1738	1217
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	450	1121
2031	Viet Nam	VN_sol_bat_c	Solar_BSS	3587	3587
2031	Lao PDR	LA_C2_rr_can	Hydro	275	686
2031	Cambodia	KH_N2_rr_can	Hydro	1036	2582
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	208	145
2031	Cambodia	KH_blk_hydro	Hydro	1227	3059
2031	Cambodia	KH_bulk_sol	Solar	825	660
2031	Myanmar	MM_run_can	Hydro	942	2348
2032	Thailand	TH_sol_bat_c	Solar_BSS	6060	6060
2032	Viet Nam	VN_C_wnd_can	Wind	919	1103
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	6433	7720
2032	Viet Nam	VN_C2_stor_c	Hydro	416	1037
2032	Viet Nam	VN_sol_bat_c	Solar_BSS	1009	1009
2032	Lao PDR	LA_S_st_can	Hydro	1176	2931
2032	Cambodia	KH_pot_gas	Gas	2953	2067
2033	Thailand	TH_coal_can	Coal	1638	3092
2033	Viet Nam	VN_coal_can	Coal	1808	4092
2033	Viet Nam	VN_solar_can	Solar	4596	3677
2033	Cambodia	KH_pot_gas	Gas	2240	1568
2034	Thailand	TH_coal_can	Coal	1502	2834
2034	Viet Nam	VN_coal_can	Coal	6302	14268
2035	Thailand	TH_gas_can	Gas	2538	1777
2035	Thailand	TH_wind_can	Wind	770	924
2035	Viet Nam	VN_coal_can	Coal	7159	16207
2035	Lao PDR	LA_N_rr_can	Hydro	304	759
2035	Cambodia	KH_N2_rr_can	Hydro	1163	2900

335. The transmission plan for the "M_VRE_BSS" scenario is shown in Table 70. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 70: Transmission plan for "M_VRE_BSS" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2033	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2034	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2035	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

7. Scenario "M_BASE_NUC"

336. The generation plan for the "M_BASE_NUC" scenario is shown in Table 71.

Table 71: Generation plan for "M_BASE_NUC" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	227	159
2023	Myanmar	MM_run_can	Hydro	950	2367
2024	Myanmar	MM_run_can	Hydro	3005	7491
2028	Lao PDR	LA_S_st_can	Hydro	881	2196
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	823	576
2029	Lao PDR	LA_N_rr_can	Hydro	701	1747
2029	Lao PDR	LA_S_st_can	Hydro	352	878
2029	Cambodia	KH_gas_can	Gas	481	336
2029	Myanmar	MM_run_can	Hydro	3305	8239
2030	Cambodia	KH_gas_can	Gas	1947	1363
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	485	1210
2031	Viet Nam	VN_SHP_can	Hydro	191	475
2031	Cambodia	KH_N2_rr_can	Hydro	185	461
2031	Cambodia	KH_S1_rr_can	Hydro	128	318
2031	Cambodia	KH_pot_gas	Gas	1586	1110
2031	Cambodia	KH_blk_hydro	Hydro	578	1440
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	3098	5845
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	5383	5383
2032	Viet Nam	VN_S_stor_c	Hydro	300	748
2032	Viet Nam	VN_SHP_can	Hydro	247	616
2032	Lao PDR	LA_C2_st_can	Hydro	554	1381
2032	Cambodia	KH_N2_rr_can	Hydro	503	1255
2032	Cambodia	KH_pot_gas	Gas	2270	1589
2033	Viet Nam	VN_coal_can	Coal	3593	8135
2033	Lao PDR	LA_wind_can	Wind	500	750
2033	Cambodia	KH_gas_can	Gas	123	86
2033	Cambodia	KH_pot_gas	Gas	1544	1081
2034	Thailand	TH_coal_can	Coal	42	80
2034	Thailand	TH_gas_can	Gas	2301	1611
2034	Viet Nam	VN_coal_can	Coal	6200	14037
2034	Lao PDR	LA_N_st_can	Hydro	522	1301
2034	Myanmar	MM_run_can	Hydro	4064	10132
2035	Thailand	TH_gas_can	Gas	1842	1289
2035	Viet Nam	VN_coal_can	Coal	6853	15515
2035	Cambodia	KH_bulk_gas	Gas	209	146

337. The transmission plan for the “M_BASE_NUC” scenario is shown in Table 72. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 72: Transmission plan for “M_BASE_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

8. Scenario “M_HIF_NUC”

338. The generation plan for the “M_HIF_NUC” scenario is shown in Table 73.

Table 73: Generation plan for “M_HIF_NUC” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	131	92
2022	Myanmar	MM_run_can	Hydro	686	1710
2023	Thailand	TH_solar_can	Solar	2960	2960
2023	Cambodia	KH_gas_can	Gas	459	322
2023	Myanmar	MM_run_can	Hydro	581	1448
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	4057	4057
2027	Lao PDR	LA_N_rr_can	Hydro	730	1821
2027	Myanmar	MM_run_can	Hydro	998	2488
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2029	Lao PDR	LA_C2_st_can	Hydro	235	586
2029	Cambodia	KH_gas_can	Gas	1147	803
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Lao PDR	LA_N_st_can	Hydro	522	1301

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Lao PDR	LA_S_rr_can	Hydro	801	1997
2030	Cambodia	KH_gas_can	Gas	1480	1036
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	313	781
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	418	1042
2031	Cambodia	KH_N2_rr_can	Hydro	992	2474
2031	Cambodia	KH_gas_can	Gas	383	268
2031	Cambodia	KH_pot_gas	Gas	1033	723
2031	Cambodia	KH_blk_hydro	Hydro	3000	7479
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	7595	7595
2032	Lao PDR	LA_C1_st_can	Hydro	45	112
2032	Cambodia	KH_S1_rr_can	Hydro	420	1047
2032	Cambodia	KH_pot_gas	Gas	1903	1332
2033	Viet Nam	VN_coal_can	Coal	3187	7214
2033	Lao PDR	LA_S_st_can	Hydro	696	1735
2033	Cambodia	KH_pot_gas	Gas	2465	1725
2033	Myanmar	MM_run_can	Hydro	4127	10288
2034	Thailand	TH_nuc_can	Nuclear	918	4615
2034	Viet Nam	VN_coal_can	Coal	6037	13668
2035	Thailand	TH_nuc_can	Nuclear	3562	17901
2035	Viet Nam	VN_coal_can	Coal	7947	17991
2035	Cambodia	KH_N2_rr_can	Hydro	1207	3008

339. The transmission plan for the “M_HIF_NUC” scenario is shown in Table 74. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 74: Transmission plan for “M_HIF_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2031	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

9. Scenario "M_BASE_INT"

340. The generation plan for the "M_BASE_INT" scenario is shown in Table 75.

Table 75: Generation plan for "M_BASE_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	271	190
2022	Myanmar	MM_run_can	Hydro	549	1369
2024	Myanmar	MM_run_can	Hydro	4000	9972
2027	Lao PDR	LA_N_rr_can	Hydro	761	1898
2027	Lao PDR	LA_C2_st_can	Hydro	554	1381
2028	Lao PDR	LA_N_st_can	Hydro	522	1301
2028	Myanmar	MM_run_can	Hydro	2346	5849
2029	Lao PDR	LA_wind_can	Wind	500	750
2029	Lao PDR	LA_C2_rr_can	Hydro	132	329
2029	Lao PDR	LA_S_rr_can	Hydro	462	1153
2030	Lao PDR	LA_S_st_can	Hydro	528	1316
2030	Myanmar	MM_run_can	Hydro	2522	6287
2031	Viet Nam	VN_N1_stor_c	Hydro	103	257
2031	Viet Nam	VN_C2_stor_c	Hydro	394	983
2031	Viet Nam	VN_SHP_can	Hydro	823	2053
2031	Lao PDR	LA_C1_st_can	Hydro	45	112
2031	Lao PDR	LA_S_st_can	Hydro	46	115

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_N2_rr_can	Hydro	1242	3097
2031	Cambodia	KH_blk_hydro	Hydro	808	2015
2032	Thailand	TH_coal_can	Coal	3140	5925
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_S_stor_c	Hydro	300	748
2032	Lao PDR	LA_S_st_can	Hydro	292	728
2032	Cambodia	KH_bio_can	Biomass	43	175
2032	Cambodia	KH_wnd_can	Wind	85	128
2032	Cambodia	KH_sol_can	Solar	1090	1090
2032	Cambodia	KH_S1_rr_can	Hydro	420	1047
2032	Cambodia	KH_pot_gas	Gas	503	352
2032	Cambodia	KH_bulk_sol	Solar	1500	1500
2033	Thailand	TH_solar_can	Solar	11017	11017
2033	Viet Nam	VN_S_wnd_can	Wind	1491	2236
2033	Viet Nam	VN_solar_can	Solar	7595	7595
2033	Cambodia	KH_pot_gas	Gas	3529	2470
2033	Myanmar	MM_wind_can	Wind	2900	4350
2034	Viet Nam	VN_coal_can	Coal	3001	6794
2034	Viet Nam	VN_N1_stor_c	Hydro	77	192
2034	Viet Nam	VN_S_wnd_can	Wind	3826	5739
2034	Viet Nam	VN_C2_stor_c	Hydro	268	667
2034	Lao PDR	LA_N_rr_can	Hydro	0	1
2034	Lao PDR	LA_S_rr_can	Hydro	569	1418
2034	Cambodia	KH_gas_can	Gas	1512	1059
2034	Cambodia	KH_pot_gas	Gas	1368	957
2035	Thailand	TH_gas_can	Gas	3049	2134
2035	Viet Nam	VN_coal_can	Coal	4978	11271
2035	Cambodia	KH_gas_can	Gas	1816	1271
2035	Myanmar	MM_run_can	Hydro	1416	3530

341. The transmission plan for the “M_BASE_INT” scenario is shown in Table 76. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 76: Transmission plan for "M_BASE_INT" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2028	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2031	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2032	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2034	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247

10. Scenario "M_HIF_INT"

342. The generation plan for the "M_HIF_INT" scenario is shown in Table 77.

Table 77: Generation plan for "M_HIF_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	2867	5410
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	247	173
2022	Myanmar	MM_run_can	Hydro	843	2102
2023	Thailand	TH_coal_can	Coal	273	515
2023	Thailand	TH_solar_can	Solar	3727	3727

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	3734	3734
2025	Lao PDR	LA_C1_st_can	Hydro	45	112
2025	Lao PDR	LA_C2_st_can	Hydro	221	550
2026	Lao PDR	LA_N_rr_can	Hydro	325	811
2026	Lao PDR	LA_N_st_can	Hydro	353	880
2026	Lao PDR	LA_S_rr_can	Hydro	692	1726
2027	Lao PDR	LA_wind_can	Wind	500	750
2027	Lao PDR	LA_S_st_can	Hydro	763	1901
2028	Thailand	TH_solar_can	Solar	3555	3555
2028	Lao PDR	LA_C2_rr_can	Hydro	265	660
2028	Myanmar	MM_run_can	Hydro	1446	3605
2029	Myanmar	MM_run_can	Hydro	3569	8898
2030	Lao PDR	LA_N_rr_can	Hydro	1320	3292
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_C2_stor_c	Hydro	452	1126
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Lao PDR	LA_C1_rr_can	Hydro	96	239
2031	Cambodia	KH_N2_rr_can	Hydro	2199	5482
2031	Cambodia	KH_blk_hydro	Hydro	440	1098
2031	Myanmar	MM_wind_can	Wind	1384	2076
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_solar_can	Solar	2874	2874
2032	Viet Nam	VN_SHP_can	Hydro	1039	2591
2032	Cambodia	KH_wnd_can	Wind	85	128
2032	Cambodia	KH_sol_can	Solar	1090	1090
2032	Cambodia	KH_S1_rr_can	Hydro	189	470
2032	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Myanmar	MM_wind_can	Wind	1516	2274
2033	Viet Nam	VN_solar_can	Solar	4721	4721
2033	Lao PDR	LA_S_rr_can	Hydro	460	1147
2033	Cambodia	KH_gas_can	Gas	3353	2347
2033	Cambodia	KH_pot_gas	Gas	395	277
2034	Viet Nam	VN_coal_can	Coal	3408	7715
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Lao PDR	LA_solar_can	Solar	865	865
2034	Lao PDR	LA_S_rr_can	Hydro	110	275
2034	Cambodia	KH_pot_gas	Gas	2674	1872
2035	Thailand	TH_gas_can	Gas	1966	1376

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_coal_can	Coal	4707	10658
2035	Cambodia	KH_pot_gas	Gas	2331	1631
2035	Cambodia	KH_blk_hydro	Hydro	364	908
2035	Myanmar	MM_run_can	Hydro	1492	3719

343. The transmission plan for the "M_HIF_INT" scenario is shown in Table 78. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 78: Transmission plan for "M_HIF_INT" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2026	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2029	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2029	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2031	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2033	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247

11. Scenario "M_VRE_INT"

344. The generation plan for the "M_VRE_INT" scenario is shown in Table 79.

Table 79: Generation plan for "M_VRE_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	2398	1918
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_wnd_can	Wind	94	113
2022	Cambodia	KH_gas_can	Gas	199	139
2022	Myanmar	MM_run_can	Hydro	1262	3146
2023	Thailand	TH_solar_can	Solar	4000	3200
2024	Thailand	TH_solar_can	Solar	915	732
2024	Myanmar	MM_run_can	Hydro	3085	7690
2025	Thailand	TH_solar_can	Solar	4000	3200
2026	Thailand	TH_solar_can	Solar	806	645
2026	Lao PDR	LA_wind_can	Wind	550	660
2027	Lao PDR	LA_N_st_can	Hydro	522	1301
2027	Lao PDR	LA_S_rr_can	Hydro	502	1252
2027	Lao PDR	LA_S_st_can	Hydro	889	2215
2028	Lao PDR	LA_N_rr_can	Hydro	1170	2918
2028	Lao PDR	LA_C2_st_can	Hydro	513	1279
2028	Myanmar	MM_run_can	Hydro	1920	4786
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Myanmar	MM_run_can	Hydro	1707	4255
2030	Lao PDR	LA_C2_rr_can	Hydro	238	594
2030	Lao PDR	LA_C2_st_can	Hydro	41	102
2031	Viet Nam	VN_S_stor_c	Hydro	39	97
2031	Viet Nam	VN_SHP_can	Hydro	734	1831
2031	Cambodia	KH_N2_rr_can	Hydro	708	1765
2032	Viet Nam	VN_C_wnd_can	Wind	835	1002
2032	Viet Nam	VN_S_wnd_can	Wind	3754	4505
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_solar_can	Solar	6744	5395
2032	Cambodia	KH_sol_can	Solar	1199	959
2032	Cambodia	KH_blk_hydro	Hydro	1000	2492
2032	Cambodia	KH_bulk_sol	Solar	1650	1320

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Myanmar	MM_wind_can	Wind	2382	2858
2033	Thailand	TH_coal_can	Coal	2056	3879
2033	Viet Nam	VN_S_wnd_can	Wind	2094	2512
2033	Viet Nam	VN_solar_can	Solar	1611	1289
2033	Cambodia	KH_pot_gas	Gas	3811	2668
2033	Myanmar	MM_run_can	Hydro	825	2056
2033	Myanmar	MM_wind_can	Wind	808	970
2034	Thailand	TH_coal_can	Coal	1084	2046
2034	Thailand	TH_gas_can	Gas	882	617
2034	Viet Nam	VN_coal_can	Coal	2558	5792
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_C2_stor_c	Hydro	667	1663
2034	Lao PDR	LA_solar_can	Solar	952	762
2034	Cambodia	KH_gas_can	Gas	1718	1203
2034	Cambodia	KH_S1_rr_can	Hydro	375	936
2034	Myanmar	MM_run_can	Hydro	2827	7047
2035	Thailand	TH_gas_can	Gas	625	437
2035	Viet Nam	VN_coal_can	Coal	5567	12604
2035	Cambodia	KH_gas_can	Gas	1682	1178
2035	Cambodia	KH_pot_gas	Gas	1589	1112

345. The transmission plan for the “M_VRE_INT” scenario is shown in Table 80. Lines with benefit greater than $1 billion are highlighted **green**, lines with benefit between $100 million and $1 billion are highlighted light **orange**, and lines with benefit less than $100 million are highlighted **dark orange**.

Table 80: Transmission plan for “M_VRE_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2031	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2032	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2032	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2034	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247

12. Scenario "M_REFERENCE"

346. The generation plan for the "M_REFERENCE" scenario is shown in Table 81.

Table 81: generation plan for "M_REFERENCE" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	123	86
2022	Myanmar	MM_run_can	Hydro	274	684
2023	Cambodia	KH_gas_can	Gas	449	314
2025	Cambodia	KH_wnd_can	Wind	85	128
2025	Cambodia	KH_gas_can	Gas	320	224
2026	Cambodia	KH_sol_can	Solar	1090	1090
2026	Cambodia	KH_gas_can	Gas	519	364
2026	Myanmar	MM_run_can	Hydro	877	2186
2027	Cambodia	KH_gas_can	Gas	826	578
2027	Myanmar	MM_run_can	Hydro	364	909
2028	Cambodia	KH_gas_can	Gas	1362	953
2028	Myanmar	MM_run_can	Hydro	961	2395
2029	Cambodia	KH_bulk_gas	Gas	949	664
2029	Myanmar	MM_run_can	Hydro	415	1034
2030	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2030	Cambodia	KH_bulk_gas	Gas	1586	1110

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Myanmar	MM_run_can	Hydro	1263	3149
2031	Thailand	TH_coal_can	Coal	441	831
2031	Viet Nam	VN_coal_can	Coal	420	951
2031	Viet Nam	VN_C_wnd_can	Wind	760	1139
2031	Viet Nam	VN_gas_can	Gas	1500	1050
2031	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2031	Viet Nam	VN_C2_stor_c	Hydro	481	1198
2031	Viet Nam	VN_S_stor_c	Hydro	15	37
2031	Viet Nam	VN_SHP_can	Hydro	551	1373
2031	Cambodia	KH_N2_rr_can	Hydro	674	1680
2031	Cambodia	KH_pot_gas	Gas	2603	1822
2031	Cambodia	KH_blk_hydro	Hydro	2002	4992
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	2699	5094
2032	Thailand	TH_gas_can	Gas	2892	2025
2032	Viet Nam	VN_coal_can	Coal	6606	14957
2032	Cambodia	KH_S1_rr_can	Hydro	342	851
2032	Cambodia	KH_pot_gas	Gas	2797	1958
2032	Myanmar	MM_run_can	Hydro	251	626
2033	Viet Nam	VN_coal_can	Coal	3332	7544
2033	Cambodia	KH_N2_rr_can	Hydro	1525	3802
2033	Myanmar	MM_run_can	Hydro	1158	2888
2034	Thailand	TH_gas_can	Gas	2536	1776
2034	Viet Nam	VN_coal_can	Coal	5727	12965
2034	Myanmar	MM_run_can	Hydro	727	1812
2035	Thailand	TH_gas_can	Gas	1136	796
2035	Thailand	TH_solar_can	Solar	4953	4953
2035	Viet Nam	VN_coal_can	Coal	4697	10634
2035	Viet Nam	VN_N1_stor_c	Hydro	180	449
2035	Viet Nam	VN_S_stor_c	Hydro	285	711
2035	Cambodia	KH_bulk_gas	Gas	257	180
2035	Cambodia	KH_blk_hydro	Hydro	998	2487
2035	Myanmar	MM_run_can	Hydro	376	938

13. Scenario “H_BASE_BASE”

347. The generation plan for the “H_BASE_BASE” scenario is shown in Table 82.

Table 82: Generation plan for “H_BASE_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	524	367
2022	Myanmar	MM_run_can	Hydro	510	1271
2023	Cambodia	KH_gas_can	Gas	107	75
2024	Myanmar	MM_run_can	Hydro	4000	9972
2027	Cambodia	KH_bio_can	Biomass	43	175
2027	Myanmar	MM_run_can	Hydro	2160	5385
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	1293	905
2029	Viet Nam	VN_gas_can	Gas	89	62
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_C1_rr_can	Hydro	96	239
2029	Lao PDR	LA_S_st_can	Hydro	757	1886
2029	Cambodia	KH_gas_can	Gas	1676	1173
2030	Thailand	TH_coal_can	Coal	2155	4067
2030	Viet Nam	VN_coal_can	Coal	505	1143
2030	Viet Nam	VN_C_wnd_can	Wind	760	1139
2030	Viet Nam	VN_gas_can	Gas	1411	988
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Lao PDR	LA_N_rr_can	Hydro	1299	3239
2030	Lao PDR	LA_C2_rr_can	Hydro	275	686
2030	Lao PDR	LA_S_rr_can	Hydro	1101	2745
2030	Cambodia	KH_bulk_gas	Gas	1798	1259
2030	Myanmar	MM_run_can	Hydro	3085	7692
2031	Viet Nam	VN_N1_stor_c	Hydro	149	372
2031	Viet Nam	VN_solar_can	Solar	5406	5406
2031	Viet Nam	VN_C2_stor_c	Hydro	404	1006
2031	Viet Nam	VN_S_stor_c	Hydro	102	255
2031	Viet Nam	VN_SHP_can	Hydro	542	1351
2031	Cambodia	KH_N2_rr_can	Hydro	1143	2848
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	3394	2376
2031	Cambodia	KH_blk_hydro	Hydro	886	2208
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	985	1858
2032	Thailand	TH_gas_can	Gas	3226	2258

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Viet Nam	VN_coal_can	Coal	6804	15404
2032	Viet Nam	VN_solar_can	Solar	2189	2189
2032	Lao PDR	LA_wind_can	Wind	500	750
2032	Cambodia	KH_pot_gas	Gas	2006	1404
2032	Cambodia	KH_blk_hydro	Hydro	1709	4262
2033	Thailand	TH_gas_can	Gas	903	632
2033	Thailand	TH_solar_can	Solar	7542	7542
2033	Viet Nam	VN_coal_can	Coal	5788	13105
2033	Lao PDR	LA_N_st_can	Hydro	522	1301
2033	Lao PDR	LA_C1_st_can	Hydro	45	112
2033	Myanmar	MM_wind_can	Wind	2900	4350
2034	Thailand	TH_gas_can	Gas	2603	1822
2034	Viet Nam	VN_coal_can	Coal	7936	17966
2034	Cambodia	KH_bulk_gas	Gas	1164	815
2035	Thailand	TH_gas_can	Gas	1668	1167
2035	Thailand	TH_wind_can	Wind	700	1050
2035	Thailand	TH_solar_can	Solar	3475	3475
2035	Viet Nam	VN_coal_can	Coal	6155	13935
2035	Lao PDR	LA_S_st_can	Hydro	476	1188
2035	Cambodia	KH_N2_rr_can	Hydro	1056	2634
2035	Cambodia	KH_bulk_gas	Gas	2241	1569
2035	Cambodia	KH_blk_hydro	Hydro	405	1010
2035	Myanmar	MM_run_can	Hydro	2759	6879
2035	Myanmar	MM_gas_can	Gas	583	408

348. The transmission plan for the “H_BASE_BASE” scenario is shown in Table 83.

Table 83: Transmission plan for “H_BASE_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2035	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

14. Scenario “H_GAS_BASE”

349. The generation plan for the “H_GAS_BASE” scenario is shown in Table 84.

Table 84: Generation plan for “H_GAS_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	440	308
2023	Cambodia	KH_gas_can	Gas	82	58
2024	Myanmar	MM_run_can	Hydro	2651	6609
2027	Lao PDR	LA_C2_st_can	Hydro	349	871
2027	Cambodia	KH_gas_can	Gas	568	398
2028	Lao PDR	LA_C1_rr_can	Hydro	96	239
2028	Lao PDR	LA_S_rr_can	Hydro	450	1122
2028	Cambodia	KH_gas_can	Gas	1854	1297
2028	Myanmar	MM_run_can	Hydro	2103	5243
2029	Viet Nam	VN_gas_can	Gas	465	326
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_N_rr_can	Hydro	858	2139
2029	Cambodia	KH_bio_can	Biomass	43	175
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_sol_can	Solar	1090	1090
2029	Cambodia	KH_gas_can	Gas	656	459
2030	Thailand	TH_gas_can	Gas	3247	2273
2030	Viet Nam	VN_coal_can	Coal	629	1424
2030	Viet Nam	VN_C_wnd_can	Wind	760	1139
2030	Viet Nam	VN_gas_can	Gas	1035	724
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Cambodia	KH_bulk_gas	Gas	1569	1098
2031	Viet Nam	VN_coal_can	Coal	74	167
2031	Viet Nam	VN_N1_stor_c	Hydro	126	313

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Viet Nam	VN_solar_can	Solar	7595	7595
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	766	1909
2031	Cambodia	KH_N2_rr_can	Hydro	535	1334
2031	Cambodia	KH_pot_gas	Gas	5400	3780
2031	Cambodia	KH_blk_hydro	Hydro	884	2203
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	1509	3762
2032	Thailand	TH_gas_can	Gas	3508	2455
2032	Viet Nam	VN_coal_can	Coal	7909	17907
2032	Viet Nam	VN_C2_stor_c	Hydro	631	1573
2032	Cambodia	KH_S1_rr_can	Hydro	290	722
2032	Myanmar	MM_run_can	Hydro	3614	9009
2033	Thailand	TH_coal_can	Coal	2458	4638
2033	Thailand	TH_gas_can	Gas	1646	1152
2033	Viet Nam	VN_coal_can	Coal	4920	11138
2033	Lao PDR	LA_N_st_can	Hydro	522	1301
2033	Lao PDR	LA_S_st_can	Hydro	1034	2579
2033	Cambodia	KH_N2_rr_can	Hydro	654	1631
2034	Viet Nam	VN_coal_can	Coal	6026	13642
2034	Lao PDR	LA_S_st_can	Hydro	199	495
2034	Cambodia	KH_S1_rr_can	Hydro	69	171
2034	Cambodia	KH_bulk_gas	Gas	2084	1459
2034	Myanmar	MM_run_can	Hydro	2639	6580
2034	Myanmar	MM_wind_can	Wind	2900	4350
2035	Thailand	TH_coal_can	Coal	682	1287
2035	Thailand	TH_wind_can	Wind	700	1050
2035	Thailand	TH_solar_can	Solar	7266	7266
2035	Viet Nam	VN_coal_can	Coal	6043	13681
2035	Lao PDR	LA_C2_rr_can	Hydro	275	686
2035	Lao PDR	LA_C2_st_can	Hydro	205	510
2035	Lao PDR	LA_S_rr_can	Hydro	78	194
2035	Cambodia	KH_S1_rr_can	Hydro	62	154
2035	Cambodia	KH_bulk_gas	Gas	2110	1477
2035	Cambodia	KH_blk_hydro	Hydro	2116	5276
2035	Myanmar	MM_gas_can	Gas	1795	1257

350. The transmission plan for the "H_GAS_BASE" scenario is shown in Table 85.

Table 85: Transmission plan for "H_GAS_BASE" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2035	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

15. Scenario "H_VRE_BASE"

351. The generation plan for the "H_VRE_BASE" scenario is shown in Table 86.

Table 86: Generation plan for "H_VRE_BASE" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	2396	1917
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_wnd_can	Wind	94	113
2022	Cambodia	KH_gas_can	Gas	486	340
2022	Myanmar	MM_run_can	Hydro	977	2436
2023	Thailand	TH_solar_can	Solar	4000	3200
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	4000	3200
2026	Thailand	TH_solar_can	Solar	1723	1379
2026	Myanmar	MM_run_can	Hydro	455	1134
2027	Lao PDR	LA_N_st_can	Hydro	192	479
2027	Cambodia	KH_sol_can	Solar	1199	959

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2027	Cambodia	KH_gas_can	Gas	1068	748
2028	Cambodia	KH_gas_can	Gas	1132	793
2028	Myanmar	MM_run_can	Hydro	931	2322
2029	Viet Nam	VN_C_wnd_can	Wind	835	1002
2029	Viet Nam	VN_gas_can	Gas	334	234
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Cambodia	KH_gas_can	Gas	913	639
2030	Thailand	TH_coal_can	Coal	3140	5925
2030	Viet Nam	VN_gas_can	Gas	1166	816
2030	Viet Nam	VN_S_wnd_can	Wind	5848	7018
2030	Viet Nam	VN_solar_can	Solar	2002	1601
2030	Lao PDR	LA_wind_can	Wind	550	660
2030	Lao PDR	LA_N_rr_can	Hydro	1247	3108
2030	Lao PDR	LA_N_st_can	Hydro	310	773
2030	Cambodia	KH_bulk_gas	Gas	1850	1295
2030	Myanmar	MM_run_can	Hydro	4057	10114
2031	Viet Nam	VN_solar_can	Solar	6353	5083
2031	Viet Nam	VN_C2_stor_c	Hydro	629	1567
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	573	1427
2031	Cambodia	KH_N2_rr_can	Hydro	774	1929
2031	Cambodia	KH_S1_rr_can	Hydro	157	391
2031	Cambodia	KH_pot_gas	Gas	3065	2146
2031	Cambodia	KH_blk_hydro	Hydro	1274	3176
2031	Cambodia	KH_bulk_sol	Solar	1650	1320
2032	Thailand	TH_gas_can	Gas	4235	2965
2032	Thailand	TH_wind_can	Wind	770	924
2032	Viet Nam	VN_coal_can	Coal	8569	19401
2032	Cambodia	KH_pot_gas	Gas	724	507
2032	Myanmar	MM_wind_can	Wind	3190	3828
2033	Viet Nam	VN_coal_can	Coal	4880	11048
2033	Cambodia	KH_pot_gas	Gas	1611	1128
2034	Thailand	TH_gas_can	Gas	2134	1493
2034	Viet Nam	VN_coal_can	Coal	6945	15724
2034	Cambodia	KH_bulk_gas	Gas	999	699
2034	Cambodia	KH_blk_hydro	Hydro	1726	4303
2035	Thailand	TH_gas_can	Gas	2031	1422
2035	Viet Nam	VN_coal_can	Coal	6434	14566
2035	Lao PDR	LA_N_rr_can	Hydro	1502	3745
2035	Lao PDR	LA_S_rr_can	Hydro	578	1441
2035	Cambodia	KH_N2_rr_can	Hydro	1425	3553

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Cambodia	KH_S1_rr_can	Hydro	263	656
2035	Cambodia	KH_bulk_gas	Gas	2271	1590
2035	Myanmar	MM_run_can	Hydro	2453	6114

352. The transmission plan for the "H_VRE_BASE" scenario is shown in Table 87.

Table 87: Transmission plan for "H_VRE_BASE" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2031	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

16. Scenario "H_HIF_BASE"

353. The generation plan for the "H_HIF_BASE" scenario is shown in Table 88.

Table 88: Generation plan for "H_HIF_BASE" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	599	420
2022	Myanmar	MM_run_can	Hydro	218	543
2023	Thailand	TH_solar_can	Solar	3028	3028
2023	Myanmar	MM_run_can	Hydro	972	2424
2024	Thailand	TH_solar_can	Solar	335	335

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	MM_run_can	Hydro	3665	9138
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	3655	3655
2026	Lao PDR	LA_C2_st_can	Hydro	229	571
2027	Cambodia	KH_wnd_can	Wind	85	128
2027	Cambodia	KH_sol_can	Solar	1090	1090
2027	Myanmar	MM_run_can	Hydro	804	2004
2028	Lao PDR	LA_N_st_can	Hydro	379	944
2028	Cambodia	KH_gas_can	Gas	1612	1128
2028	Myanmar	MM_run_can	Hydro	2129	5307
2029	Viet Nam	VN_C_wnd_can	Wind	760	1139
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_N_rr_can	Hydro	192	478
2029	Lao PDR	LA_S_st_can	Hydro	587	1462
2029	Cambodia	KH_gas_can	Gas	1389	972
2030	Viet Nam	VN_gas_can	Gas	1500	1050
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Viet Nam	VN_solar_can	Solar	2399	2399
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Cambodia	KH_bulk_gas	Gas	1601	1121
2031	Viet Nam	VN_coal_can	Coal	1001	2266
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_solar_can	Solar	5196	5196
2031	Viet Nam	VN_C2_stor_c	Hydro	176	439
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	366	913
2031	Lao PDR	LA_S_rr_can	Hydro	776	1935
2031	Cambodia	KH_N2_rr_can	Hydro	1294	3226
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	2566	1796
2031	Cambodia	KH_blk_hydro	Hydro	3000	7479
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	3187	7944
2032	Thailand	TH_gas_can	Gas	3765	2636
2032	Viet Nam	VN_coal_can	Coal	7082	16033
2032	Cambodia	KH_pot_gas	Gas	2834	1984
2033	Thailand	TH_gas_can	Gas	750	525
2033	Thailand	TH_wind_can	Wind	700	1050
2033	Viet Nam	VN_coal_can	Coal	5987	13554
2034	Thailand	TH_gas_can	Gas	1954	1368
2034	Viet Nam	VN_coal_can	Coal	6718	15210

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Cambodia	KH_bulk_gas	Gas	1531	1072
2034	Myanmar	MM_wind_can	Wind	2900	4350
2035	Thailand	TH_gas_can	Gas	1931	1352
2035	Viet Nam	VN_coal_can	Coal	4479	10140
2035	Cambodia	KH_N2_rr_can	Hydro	905	2256
2035	Cambodia	KH_bulk_gas	Gas	2588	1812
2035	Myanmar	MM_run_can	Hydro	3706	9238
2035	Myanmar	MM_gas_can	Gas	2653	1857

354. The transmission plan for the “H_HIF_BASE” scenario is shown in Table 89.

Table 89: Transmission plan for “H_HIF_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2032	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

17. Scenario “H_BASE_BSS”

355. The generation plan for the “H_BASE_BSS” scenario is shown in Table 90.

Table 90: Generation plan for “H_BASE_BSS” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	613	429
2022	Myanmar	MM_run_can	Hydro	1603	3996
2024	Myanmar	MM_run_can	Hydro	1475	3678
2027	Lao PDR	LA_N_st_can	Hydro	253	632
2027	Cambodia	KH_bio_can	Biomass	43	175
2027	Cambodia	KH_sol_can	Solar	273	273
2027	Cambodia	KH_gas_can	Gas	190	133
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_gas_can	Gas	1280	896
2028	Cambodia	KH_sol_bat_c	Solar_BSS	1295	1619
2028	Myanmar	MM_run_can	Hydro	4728	11786
2029	Viet Nam	VN_gas_can	Gas	176	124
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_N_rr_can	Hydro	1020	2542
2029	Lao PDR	LA_C1_rr_can	Hydro	96	239
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_C2_st_can	Hydro	554	1381
2029	Lao PDR	LA_S_st_can	Hydro	802	1999
2029	Cambodia	KH_gas_can	Gas	1517	1062
2030	Thailand	TH_coal_can	Coal	1500	2831
2030	Viet Nam	VN_C_wnd_can	Wind	760	1139
2030	Viet Nam	VN_gas_can	Gas	1324	926
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Viet Nam	VN_sol_bat_c	Solar_BSS	2635	3294
2030	Lao PDR	LA_N_st_can	Hydro	269	669
2030	Cambodia	KH_bulk_gas	Gas	1426	998
2031	Viet Nam	VN_coal_can	Coal	890	2014
2031	Viet Nam	VN_C2_stor_c	Hydro	221	551
2031	Viet Nam	VN_SHP_can	Hydro	516	1287
2031	Viet Nam	VN_sol_bat_c	Solar_BSS	1163	1454
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Cambodia	KH_N2_rr_can	Hydro	399	996
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	5400	3780
2031	Cambodia	KH_bulk_sol	Solar	750	750
2032	Thailand	TH_coal_can	Coal	1640	3094

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Thailand	TH_gas_can	Gas	2540	1778
2032	Thailand	TH_sol_bat_c	Solar_BSS	5509	6886
2032	Viet Nam	VN_coal_can	Coal	7773	17597
2032	Viet Nam	VN_S_stor_c	Hydro	178	443
2032	Cambodia	KH_blk_hydro	Hydro	1337	3333
2033	Thailand	TH_gas_can	Gas	3269	2288
2033	Viet Nam	VN_coal_can	Coal	5887	13327
2033	Cambodia	KH_N2_rr_can	Hydro	1800	4486
2033	Myanmar	MM_run_can	Hydro	3702	9229
2034	Thailand	TH_gas_can	Gas	109	76
2034	Viet Nam	VN_coal_can	Coal	7726	17492
2034	Cambodia	KH_bulk_gas	Gas	1715	1201
2034	Myanmar	MM_wind_can	Wind	2900	4350
2035	Thailand	TH_gas_can	Gas	2482	1737
2035	Thailand	TH_solar_can	Solar	5509	5509
2035	Viet Nam	VN_coal_can	Coal	4127	9342
2035	Lao PDR	LA_C2_rr_can	Hydro	275	686
2035	Lao PDR	LA_S_rr_can	Hydro	65	162
2035	Lao PDR	LA_S_st_can	Hydro	431	1075
2035	Cambodia	KH_bulk_gas	Gas	2042	1430
2035	Cambodia	KH_blk_hydro	Hydro	1663	4146
2035	Myanmar	MM_run_can	Hydro	1409	3514
2035	Myanmar	MM_solar_can	Solar	215	215
2035	Myanmar	MM_gas_can	Gas	372	261

356. The transmission plan for the “H_BASE_BSS” scenario is shown in Table 91.

Table 91: Transmission plan for “H_BASE_BSS” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137

18. Scenario “H_VRE_BSS”

357. The generation plan for the “H_VRE_BSS” scenario is shown in Table 92.

Table 92: Generation plan for “H_VRE_BSS” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	3363	2691
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_wnd_can	Wind	85	102
2022	Cambodia	KH_gas_can	Gas	329	231
2022	Myanmar	MM_run_can	Hydro	175	437
2023	Thailand	TH_solar_can	Solar	2697	2157
2023	Cambodia	KH_gas_can	Gas	114	80
2023	Myanmar	MM_run_can	Hydro	1189	2964
2024	Myanmar	MM_run_can	Hydro	3420	8526
2027	Lao PDR	LA_N_rr_can	Hydro	702	1751
2027	Lao PDR	LA_C1_rr_can	Hydro	96	239
2027	Lao PDR	LA_S_st_can	Hydro	397	990
2027	Cambodia	KH_sol_can	Solar	300	240
2027	Cambodia	KH_sol_bat_c	Solar_BSS	41	41
2028	Lao PDR	LA_wind_can	Wind	550	660
2028	Cambodia	KH_gas_can	Gas	1048	734
2028	Cambodia	KH_sol_bat_c	Solar_BSS	1384	1384
2029	Viet Nam	VN_C_wnd_can	Wind	919	1103
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Cambodia	KH_gas_can	Gas	1847	1293
2030	Thailand	TH_sol_bat_c	Solar_BSS	6060	6060
2030	Viet Nam	VN_gas_can	Gas	1500	1050
2030	Viet Nam	VN_S_wnd_can	Wind	6433	7720
2030	Cambodia	KH_gas_can	Gas	261	183
2030	Cambodia	KH_bulk_gas	Gas	1684	1179

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Myanmar	MM_run_can	Hydro	3838	9569
2031	Thailand	TH_coal_can	Coal	696	1313
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_solar_can	Solar	4596	3677
2031	Viet Nam	VN_C2_stor_c	Hydro	164	409
2031	Viet Nam	VN_S_stor_c	Hydro	262	652
2031	Viet Nam	VN_SHP_can	Hydro	892	2224
2031	Viet Nam	VN_sol_bat_c	Solar_BSS	4596	4596
2031	Cambodia	KH_N2_rr_can	Hydro	892	2224
2031	Cambodia	KH_pot_gas	Gas	2708	1895
2031	Cambodia	KH_blk_hydro	Hydro	3000	7479
2031	Cambodia	KH_bulk_sol	Solar	825	660
2032	Thailand	TH_coal_can	Coal	2444	4612
2032	Thailand	TH_gas_can	Gas	3630	2541
2032	Thailand	TH_wind_can	Wind	770	924
2032	Viet Nam	VN_coal_can	Coal	6295	14251
2032	Lao PDR	LA_N_st_can	Hydro	522	1301
2032	Cambodia	KH_S1_rr_can	Hydro	420	1047
2032	Cambodia	KH_pot_gas	Gas	2692	1885
2032	Myanmar	MM_wind_can	Wind	3190	3828
2033	Thailand	TH_gas_can	Gas	242	169
2033	Viet Nam	VN_coal_can	Coal	5494	12438
2034	Thailand	TH_gas_can	Gas	1776	1243
2034	Viet Nam	VN_coal_can	Coal	7617	17246
2034	Cambodia	KH_N2_rr_can	Hydro	1307	3258
2034	Cambodia	KH_bulk_gas	Gas	1305	913
2034	Myanmar	MM_run_can	Hydro	3411	8504
2035	Thailand	TH_gas_can	Gas	2752	1927
2035	Viet Nam	VN_coal_can	Coal	6523	14768
2035	Viet Nam	VN_S_stor_c	Hydro	38	96
2035	Cambodia	KH_bulk_gas	Gas	2133	1493
2035	Myanmar	MM_gas_can	Gas	2653	1857

358. The transmission plan for the “H_VRE_BSS” scenario is shown in Table 93.

Table 93: Transmission plan for “H_VRE_BSS” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

19. Scenario “H_BASE_NUC”

359. The generation plan for the “H_BASE_NUC” scenario is shown in Table 94.

Table 94: Generation plan for “H_BASE_NUC” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	441	309
2023	Cambodia	KH_gas_can	Gas	71	49
2023	Myanmar	MM_run_can	Hydro	649	1619
2024	Myanmar	MM_run_can	Hydro	3506	8740
2027	Lao PDR	LA_C1_st_can	Hydro	45	112
2027	Cambodia	KH_bio_can	Biomass	43	175
2027	Cambodia	KH_wnd_can	Wind	85	128
2027	Cambodia	KH_sol_can	Solar	1090	1090
2027	Cambodia	KH_gas_can	Gas	34	24
2027	Myanmar	MM_run_can	Hydro	2475	6170
2028	Lao PDR	LA_S_rr_can	Hydro	452	1128
2028	Cambodia	KH_gas_can	Gas	1803	1262
2029	Viet Nam	VN_gas_can	Gas	563	394
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_S_st_can	Hydro	436	1087
2029	Cambodia	KH_gas_can	Gas	1252	876
2030	Thailand	TH_coal_can	Coal	2714	5122
2030	Viet Nam	VN_coal_can	Coal	980	2220

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Viet Nam	VN_C_wnd_can	Wind	760	1139
2030	Viet Nam	VN_gas_can	Gas	937	656
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Lao PDR	LA_S_st_can	Hydro	189	471
2030	Cambodia	KH_bulk_gas	Gas	1586	1110
2031	Thailand	TH_coal_can	Coal	426	803
2031	Viet Nam	VN_N1_stor_c	Hydro	107	267
2031	Viet Nam	VN_solar_can	Solar	6302	6302
2031	Viet Nam	VN_C2_stor_c	Hydro	102	253
2031	Viet Nam	VN_SHP_can	Hydro	490	1221
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_N_rr_can	Hydro	290	722
2031	Lao PDR	LA_S_st_can	Hydro	608	1516
2031	Cambodia	KH_N2_rr_can	Hydro	779	1942
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	4245	2972
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	581	1447
2032	Thailand	TH_gas_can	Gas	3283	2298
2032	Viet Nam	VN_coal_can	Coal	8075	18281
2032	Viet Nam	VN_C2_stor_c	Hydro	187	466
2032	Cambodia	KH_pot_gas	Gas	1155	808
2032	Cambodia	KH_blk_hydro	Hydro	1115	2780
2032	Myanmar	MM_run_can	Hydro	1091	2719
2033	Thailand	TH_gas_can	Gas	2548	1784
2033	Viet Nam	VN_coal_can	Coal	5091	11525
2033	Lao PDR	LA_N_st_can	Hydro	251	626
2033	Lao PDR	LA_C1_rr_can	Hydro	96	239
2033	Myanmar	MM_run_can	Hydro	4281	10671
2034	Thailand	TH_gas_can	Gas	2569	1798
2034	Thailand	TH_solar_can	Solar	514	514
2034	Viet Nam	VN_coal_can	Coal	6286	14232
2034	Viet Nam	VN_solar_can	Solar	1293	1293
2034	Lao PDR	LA_C2_rr_can	Hydro	275	686
2034	Lao PDR	LA_C2_st_can	Hydro	554	1381
2034	Cambodia	KH_bulk_gas	Gas	1774	1242
2034	Myanmar	MM_run_can	Hydro	472	1177
2034	Myanmar	MM_wind_can	Wind	2900	4350
2035	Thailand	TH_solar_can	Solar	8164	8164
2035	Thailand	TH_nuc_can	Nuclear	1419	7131
2035	Viet Nam	VN_coal_can	Coal	5689	12880

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Cambodia	KH_N2_rr_can	Hydro	1420	3540
2035	Cambodia	KH_bulk_gas	Gas	1578	1105
2035	Cambodia	KH_blk_hydro	Hydro	1885	4699

360. The transmission plan for the “H_BASE_NUC” scenario is shown in Table 95.

Table 95: Transmission plan for “H_BASE_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137

20. Scenario “H_HIF_NUC”

361. The generation plan for the “H_HIF_NUC” scenario is shown in Table 96.

Table 96: Generation plan for “H_HIF_NUC” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	505	354
2022	Myanmar	MM_run_can	Hydro	312	777
2023	Thailand	TH_solar_can	Solar	2980	2980
2023	Cambodia	KH_gas_can	Gas	6	4
2023	Myanmar	MM_run_can	Hydro	1015	2530

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Thailand	TH_solar_can	Solar	1071	1071
2024	Myanmar	MM_run_can	Hydro	2929	7303
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	2967	2967
2026	Lao PDR	LA_C1_st_can	Hydro	45	112
2027	Lao PDR	LA_N_rr_can	Hydro	639	1593
2027	Lao PDR	LA_S_st_can	Hydro	514	1282
2027	Cambodia	KH_wnd_can	Wind	85	128
2027	Cambodia	KH_sol_can	Solar	1090	1090
2027	Cambodia	KH_gas_can	Gas	595	417
2028	Lao PDR	LA_N_st_can	Hydro	522	1301
2028	Lao PDR	LA_C2_rr_can	Hydro	275	686
2028	Cambodia	KH_gas_can	Gas	752	526
2028	Myanmar	MM_run_can	Hydro	3971	9900
2029	Viet Nam	VN_C_wnd_can	Wind	760	1139
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Lao PDR	LA_S_st_can	Hydro	397	989
2029	Cambodia	KH_gas_can	Gas	1557	1090
2029	Myanmar	MM_run_can	Hydro	1222	3046
2030	Viet Nam	VN_gas_can	Gas	1500	1050
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Viet Nam	VN_solar_can	Solar	2514	2514
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Cambodia	KH_gas_can	Gas	184	129
2030	Cambodia	KH_bulk_gas	Gas	1869	1308
2031	Viet Nam	VN_coal_can	Coal	648	1468
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_solar_can	Solar	5081	5081
2031	Viet Nam	VN_C2_stor_c	Hydro	900	2244
2031	Viet Nam	VN_SHP_can	Hydro	686	1710
2031	Lao PDR	LA_S_rr_can	Hydro	521	1299
2031	Cambodia	KH_N2_rr_can	Hydro	609	1519
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	3038	2126
2031	Cambodia	KH_blk_hydro	Hydro	1062	2646
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_nuc_can	Nuclear	4471	22473
2032	Viet Nam	VN_coal_can	Coal	6836	15476
2032	Cambodia	KH_pot_gas	Gas	2362	1654
2033	Viet Nam	VN_coal_can	Coal	5759	13039
2033	Myanmar	MM_wind_can	Wind	2900	4350

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Thailand	TH_nuc_can	Nuclear	3529	17735
2034	Viet Nam	VN_coal_can	Coal	7158	16206
2034	Cambodia	KH_N2_rr_can	Hydro	1590	3963
2034	Cambodia	KH_bulk_gas	Gas	1088	762
2034	Cambodia	KH_blk_hydro	Hydro	1938	4833
2035	Thailand	TH_gas_can	Gas	931	652
2035	Thailand	TH_wind_can	Wind	700	1050
2035	Viet Nam	VN_coal_can	Coal	5536	12535
2035	Lao PDR	LA_C2_st_can	Hydro	554	1381
2035	Cambodia	KH_bulk_gas	Gas	2203	1542
2035	Myanmar	MM_run_can	Hydro	3655	9112
2035	Myanmar	MM_solar_can	Solar	430	430

362. The transmission plan for the “H_HIF_NUC” scenario is shown in Table 97.

Table 97: Transmission plan for “H_HIF_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2032	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

21. Scenario "H_BASE_INT"

363. The generation plan for the "H_BASE_INT" scenario is shown in Table 98.

Table 98: Generation plan for "H_BASE_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	481	337
2022	Myanmar	MM_run_can	Hydro	1309	3264
2023	Cambodia	KH_gas_can	Gas	56	39
2024	Myanmar	MM_run_can	Hydro	4000	9972
2026	Lao PDR	LA_N_rr_can	Hydro	476	1186
2027	Lao PDR	LA_S_st_can	Hydro	446	1113
2028	Lao PDR	LA_wind_can	Wind	500	750
2028	Lao PDR	LA_N_rr_can	Hydro	965	2407
2028	Lao PDR	LA_N_st_can	Hydro	197	490
2028	Myanmar	MM_run_can	Hydro	4748	11838
2029	Lao PDR	LA_N_st_can	Hydro	325	811
2029	Lao PDR	LA_C1_rr_can	Hydro	96	239
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_C2_rr_can	Hydro	1	2
2029	Lao PDR	LA_C2_st_can	Hydro	81	202
2029	Lao PDR	LA_S_rr_can	Hydro	395	985
2029	Lao PDR	LA_S_st_can	Hydro	394	981
2030	Thailand	TH_coal_can	Coal	3140	5925
2030	Thailand	TH_solar_can	Solar	2526	2526
2030	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2030	Cambodia	KH_bio_can	Biomass	43	175
2030	Cambodia	KH_wnd_can	Wind	85	128
2030	Cambodia	KH_sol_can	Solar	1090	1090
2030	Myanmar	MM_run_can	Hydro	223	556
2031	Viet Nam	VN_gas_can	Gas	1500	1050
2031	Viet Nam	VN_N1_stor_c	Hydro	83	207
2031	Viet Nam	VN_solar_can	Solar	7595	7595
2031	Viet Nam	VN_C2_stor_c	Hydro	70	174
2031	Viet Nam	VN_SHP_can	Hydro	291	725
2031	Lao PDR	LA_C2_st_can	Hydro	473	1180
2031	Cambodia	KH_N2_rr_can	Hydro	852	2124
2031	Cambodia	KH_gas_can	Gas	2877	2014
2031	Cambodia	KH_blk_hydro	Hydro	52	130
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	1341	3342
2032	Thailand	TH_solar_can	Solar	8491	8491

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Viet Nam	VN_coal_can	Coal	3156	7145
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Cambodia	KH_pot_gas	Gas	4287	3001
2032	Myanmar	MM_wind_can	Wind	2900	4350
2033	Thailand	TH_gas_can	Gas	5491	3843
2033	Viet Nam	VN_coal_can	Coal	4299	9733
2033	Viet Nam	VN_S_stor_c	Hydro	257	641
2033	Cambodia	KH_gas_can	Gas	186	130
2033	Cambodia	KH_pot_gas	Gas	1113	779
2033	Myanmar	MM_run_can	Hydro	2263	5642
2034	Thailand	TH_gas_can	Gas	2909	2037
2034	Viet Nam	VN_coal_can	Coal	7542	17075
2034	Lao PDR	LA_coal_can	Coal	85	192
2034	Cambodia	KH_S1_rr_can	Hydro	236	589
2034	Cambodia	KH_blk_hydro	Hydro	430	1073
2035	Viet Nam	VN_coal_can	Coal	7376	16700
2035	Lao PDR	LA_coal_can	Coal	3113	7048
2035	Myanmar	MM_coal_can	Coal	1757	3977
2035	Myanmar	MM_solar_can	Solar	430	430
2035	Myanmar	MM_gas_can	Gas	2653	1857

364. The transmission plan for the “H_BASE_INT” scenario is shown in Table 99.

Table 99: Transmission plan for “H_BASE_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2029	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2032	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2034	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144

22. Scenario “H_HIF_INT”

365. The generation plan for the “H_HIF_INT” scenario is shown in Table 100.

Table 100: Generation plan for “H_HIF_INT” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_wnd_can	Wind	85	128
2022	Cambodia	KH_gas_can	Gas	443	310
2022	Myanmar	MM_run_can	Hydro	289	721
2023	Thailand	TH_solar_can	Solar	2862	2862
2023	Myanmar	MM_run_can	Hydro	1138	2838
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	3955	3955
2025	Lao PDR	LA_C1_st_can	Hydro	45	112
2026	Thailand	TH_solar_can	Solar	4200	4200
2026	Lao PDR	LA_wind_can	Wind	500	750
2026	Lao PDR	LA_N_st_can	Hydro	375	935
2027	Lao PDR	LA_N_rr_can	Hydro	795	1982
2027	Lao PDR	LA_C2_st_can	Hydro	554	1381
2027	Lao PDR	LA_S_rr_can	Hydro	353	879
2027	Lao PDR	LA_S_st_can	Hydro	953	2376
2028	Lao PDR	LA_C2_rr_can	Hydro	275	686
2028	Myanmar	MM_run_can	Hydro	3471	8652
2029	Lao PDR	LA_N_rr_can	Hydro	278	693

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Viet Nam	VN_C_wnd_can	Wind	105	157
2030	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2030	Lao PDR	LA_S_st_can	Hydro	117	291
2030	Cambodia	KH_sol_can	Solar	1090	1090
2030	Myanmar	MM_run_can	Hydro	678	1691
2031	Viet Nam	VN_C_wnd_can	Wind	655	982
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2031	Viet Nam	VN_solar_can	Solar	7595	7595
2031	Viet Nam	VN_SHP_can	Hydro	728	1815
2031	Cambodia	KH_N2_rr_can	Hydro	857	2135
2031	Cambodia	KH_pot_gas	Gas	1120	784
2031	Cambodia	KH_blk_hydro	Hydro	1231	3070
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_wind_can	Wind	2900	4350
2032	Viet Nam	VN_coal_can	Coal	2639	5976
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Lao PDR	LA_N_st_can	Hydro	147	366
2032	Lao PDR	LA_S_rr_can	Hydro	133	332
2032	Cambodia	KH_gas_can	Gas	2653	1857
2032	Cambodia	KH_pot_gas	Gas	4280	2996
2033	Thailand	TH_gas_can	Gas	2938	2057
2033	Viet Nam	VN_coal_can	Coal	3840	8694
2033	Viet Nam	VN_S_stor_c	Hydro	9	22
2033	Lao PDR	LA_coal_can	Coal	2594	5873
2033	Lao PDR	LA_solar_can	Solar	865	865
2033	Cambodia	KH_gas_can	Gas	504	353
2033	Myanmar	MM_run_can	Hydro	3372	8405
2033	Myanmar	MM_solar_can	Solar	430	430
2034	Thailand	TH_gas_can	Gas	1531	1072
2034	Viet Nam	VN_coal_can	Coal	8762	19836
2034	Viet Nam	VN_S_stor_c	Hydro	291	726
2034	Lao PDR	LA_coal_can	Coal	2506	5673
2034	Cambodia	KH_S1_rr_can	Hydro	420	1047
2035	Thailand	TH_gas_can	Gas	3931	2752
2035	Thailand	TH_wind_can	Wind	700	1050
2035	Viet Nam	VN_coal_can	Coal	6146	13914
2035	Myanmar	MM_run_can	Hydro	2054	5120

366. The transmission plan for the “H_HIF_INT” scenario is shown in Table 101.

Table 101: Transmission plan for “H_HIF_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2026	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2029	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2032	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2032	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182
2034	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217

23. Scenario “H_VRE_INT”

367. The generation plan for the “H_VRE_INT” scenario is shown in Table 102.

Table 102: Generation plan for “H_VRE_INT” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	1418	1134

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_bio_can	Biomass	47	153
2022	Cambodia	KH_wnd_can	Wind	94	113
2022	Cambodia	KH_sol_can	Solar	1199	959
2022	Cambodia	KH_gas_can	Gas	210	147
2022	Myanmar	MM_run_can	Hydro	1032	2574
2023	Thailand	TH_solar_can	Solar	4000	3200
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	3478	2782
2025	Lao PDR	LA_N_st_can	Hydro	522	1301
2026	Thailand	TH_solar_can	Solar	3223	2579
2026	Lao PDR	LA_wind_can	Wind	550	660
2026	Myanmar	MM_run_can	Hydro	1126	2807
2028	Lao PDR	LA_N_rr_can	Hydro	1599	3985
2028	Lao PDR	LA_C1_rr_can	Hydro	96	239
2028	Lao PDR	LA_C1_st_can	Hydro	45	112
2028	Lao PDR	LA_C2_rr_can	Hydro	275	686
2028	Lao PDR	LA_C2_st_can	Hydro	554	1381
2029	Lao PDR	LA_S_st_can	Hydro	901	2245
2029	Myanmar	MM_run_can	Hydro	3947	9840
2030	Viet Nam	VN_C_wnd_can	Wind	835	1002
2030	Viet Nam	VN_CC_can	Combined Cycle	2003	1402
2030	Lao PDR	LA_S_rr_can	Hydro	811	2022
2031	Thailand	TH_coal_can	Coal	1516	2861
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_S_wnd_can	Wind	5848	7018
2031	Viet Nam	VN_CC_can	Combined Cycle	247	173
2031	Viet Nam	VN_solar_can	Solar	8355	6684
2031	Viet Nam	VN_C2_stor_c	Hydro	380	947
2031	Viet Nam	VN_S_stor_c	Hydro	149	370
2031	Viet Nam	VN_SHP_can	Hydro	492	1225
2031	Cambodia	KH_N2_rr_can	Hydro	611	1524
2031	Cambodia	KH_gas_can	Gas	1219	853
2031	Cambodia	KH_S1_rr_can	Hydro	388	968
2031	Cambodia	KH_blk_hydro	Hydro	683	1703
2031	Cambodia	KH_bulk_sol	Solar	1650	1320
2031	Myanmar	MM_wind_can	Wind	3190	3828
2032	Thailand	TH_coal_can	Coal	1624	3065
2032	Thailand	TH_gas_can	Gas	48	34
2032	Viet Nam	VN_coal_can	Coal	525	1189
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Lao PDR	LA_solar_can	Solar	952	762

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Cambodia	KH_gas_can	Gas	2171	1520
2032	Cambodia	KH_pot_gas	Gas	5400	3780
2033	Thailand	TH_gas_can	Gas	3504	2453
2033	Viet Nam	VN_coal_can	Coal	6489	14691
2033	Lao PDR	LA_coal_can	Coal	722	1635
2033	Myanmar	MM_run_can	Hydro	2267	5652
2033	Myanmar	MM_solar_can	Solar	473	378
2034	Thailand	TH_gas_can	Gas	984	689
2034	Viet Nam	VN_coal_can	Coal	7853	17778
2034	Cambodia	KH_S1_rr_can	Hydro	32	79
2034	Myanmar	MM_run_can	Hydro	2456	6122
2035	Thailand	TH_gas_can	Gas	3864	2705
2035	Thailand	TH_wind_can	Wind	770	924
2035	Viet Nam	VN_coal_can	Coal	6056	13710
2035	Viet Nam	VN_C2_stor_c	Hydro	354	883
2035	Lao PDR	LA_coal_can	Coal	2549	5771
2035	Cambodia	KH_blk_hydro	Hydro	307	766
2035	Myanmar	MM_gas_can	Gas	2653	1857

368. The transmission plan for the “H_VRE_INT” scenario is shown in Table 103.

Table 103: Transmission plan for “H_VRE_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2027	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2028	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2035	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2035	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2035	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144

24. Scenario “H_REFERENCE”

369. The generation plan for the “H_REFERENCE” scenario is shown in Table 104.

Table 104: generation plan for “H_REFERENCE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	522	365
2024	Cambodia	KH_wnd_can	Wind	85	128
2024	Cambodia	KH_sol_can	Solar	1090	1090
2024	Cambodia	KH_gas_can	Gas	433	303
2024	Myanmar	MM_run_can	Hydro	579	1444
2026	Cambodia	KH_gas_can	Gas	1178	825
2026	Myanmar	MM_run_can	Hydro	433	1079
2027	Cambodia	KH_gas_can	Gas	1467	1027
2027	Myanmar	MM_run_can	Hydro	1040	2593
2028	Thailand	TH_coal_can	Coal	3140	5925
2028	Cambodia	KH_bulk_gas	Gas	2459	1722
2028	Myanmar	MM_run_can	Hydro	1342	3345
2029	Viet Nam	VN_gas_can	Gas	1500	1050
2029	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2029	Cambodia	KH_bulk_gas	Gas	674	472
2029	Myanmar	MM_run_can	Hydro	160	398
2030	Thailand	TH_gas_can	Gas	1810	1267
2030	Viet Nam	VN_coal_can	Coal	3874	8770
2030	Viet Nam	VN_C_wnd_can	Wind	760	1139
2030	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2030	Cambodia	KH_bulk_gas	Gas	1362	953

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Myanmar	MM_run_can	Hydro	1917	4778
2031	Thailand	TH_gas_can	Gas	1754	1228
2031	Viet Nam	VN_coal_can	Coal	4186	9476
2031	Viet Nam	VN_N1_stor_c	Hydro	123	307
2031	Viet Nam	VN_C2_stor_c	Hydro	584	1456
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	443	1104
2031	Cambodia	KH_N2_rr_can	Hydro	1404	3500
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	5400	3780
2031	Cambodia	KH_blk_hydro	Hydro	2304	5743
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	612	1525
2032	Thailand	TH_gas_can	Gas	4449	3114
2032	Viet Nam	VN_coal_can	Coal	6659	15076
2032	Myanmar	MM_run_can	Hydro	1837	4580
2033	Thailand	TH_gas_can	Gas	386	271
2033	Viet Nam	VN_coal_can	Coal	4570	10347
2033	Myanmar	MM_run_can	Hydro	1054	2627
2034	Thailand	TH_wind_can	Wind	700	1050
2034	Thailand	TH_solar_can	Solar	11017	11017
2034	Viet Nam	VN_coal_can	Coal	6683	15131
2034	Viet Nam	VN_C2_stor_c	Hydro	316	787
2034	Cambodia	KH_N2_rr_can	Hydro	795	1982
2034	Cambodia	KH_bulk_gas	Gas	1366	956
2034	Cambodia	KH_blk_hydro	Hydro	696	1736
2034	Myanmar	MM_run_can	Hydro	973	2425
2034	Myanmar	MM_gas_can	Gas	2050	1435
2035	Viet Nam	VN_coal_can	Coal	4377	9911
2035	Viet Nam	VN_N1_stor_c	Hydro	57	142
2035	Viet Nam	VN_solar_can	Solar	1015	1015
2035	Viet Nam	VN_SHP_can	Hydro	1076	2683
2035	Cambodia	KH_bulk_gas	Gas	3089	2163
2035	Myanmar	MM_run_can	Hydro	1306	3256
2035	Myanmar	MM_wind_can	Wind	2900	4350

25. Scenario “L_BASE_BASE”

370. The generation plan for the “L_BASE_BASE” scenario is shown in Table 105.

Table 105: Generation plan for “L_BASE_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Cambodia	KH_gas_can	Gas	242	169
2024	Myanmar	MM_run_can	Hydro	3201	7979
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_C2_st_can	Hydro	554	1381
2029	Cambodia	KH_bio_can	Biomass	43	175
2029	Cambodia	KH_gas_can	Gas	321	225
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Lao PDR	LA_S_st_can	Hydro	1058	2637
2030	Cambodia	KH_wnd_can	Wind	85	128
2030	Cambodia	KH_sol_can	Solar	1090	1090
2030	Cambodia	KH_gas_can	Gas	639	447
2031	Cambodia	KH_N2_rr_can	Hydro	575	1435
2031	Cambodia	KH_gas_can	Gas	277	194
2031	Cambodia	KH_S1_rr_can	Hydro	64	159
2031	Cambodia	KH_blk_hydro	Hydro	486	1213
2031	Myanmar	MM_run_can	Hydro	681	1699
2032	Viet Nam	VN_SHP_can	Hydro	177	440
2032	Cambodia	KH_gas_can	Gas	732	512
2032	Cambodia	KH_blk_hydro	Hydro	162	405
2032	Cambodia	KH_bulk_sol	Solar	1500	1500
2033	Viet Nam	VN_N1_stor_c	Hydro	163	406
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Viet Nam	VN_S_stor_c	Hydro	52	129
2033	Lao PDR	LA_wind_can	Wind	500	750
2033	Cambodia	KH_pot_gas	Gas	1984	1389
2033	Cambodia	KH_blk_hydro	Hydro	416	1037
2033	Myanmar	MM_run_can	Hydro	2214	5520
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_solar_can	Solar	2085	2085
2034	Viet Nam	VN_C2_stor_c	Hydro	289	719
2034	Viet Nam	VN_SHP_can	Hydro	282	703
2034	Lao PDR	LA_N_rr_can	Hydro	434	1081
2034	Cambodia	KH_pot_gas	Gas	2912	2038
2034	Cambodia	KH_blk_hydro	Hydro	254	632
2035	Thailand	TH_coal_can	Coal	1802	3400

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_coal_can	Coal	2850	6451
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2035	Lao PDR	LA_N_rr_can	Hydro	1251	3120
2035	Cambodia	KH_N2_rr_can	Hydro	501	1248
2035	Cambodia	KH_gas_can	Gas	964	674

371. The transmission plan for the “L_BASE_BASE” scenario is shown in Table 106.

Table 106: Transmission plan for “L_BASE_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2029	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2034	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

26. Scenario “L_GAS_BASE”

372. The generation plan for the “L_GAS_BASE” scenario is shown in Table 107.

Table 107: Generation plan for “L_GAS_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	MM_run_can	Hydro	1308	3260
2027	Myanmar	MM_run_can	Hydro	3078	7673
2029	Cambodia	KH_gas_can	Gas	801	561
2030	Lao PDR	LA_N_st_can	Hydro	522	1301

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Lao PDR	LA_C2_st_can	Hydro	278	693
2030	Cambodia	KH_gas_can	Gas	1180	826
2031	Viet Nam	VN_SHP_can	Hydro	419	1044
2031	Cambodia	KH_N2_rr_can	Hydro	880	2193
2031	Cambodia	KH_S1_rr_can	Hydro	156	389
2031	Cambodia	KH_pot_gas	Gas	348	243
2031	Cambodia	KH_blk_hydro	Hydro	532	1327
2032	Viet Nam	VN_N1_stor_c	Hydro	54	134
2032	Viet Nam	VN_C2_stor_c	Hydro	235	585
2032	Viet Nam	VN_S_stor_c	Hydro	300	748
2032	Lao PDR	LA_S_st_can	Hydro	1233	3074
2032	Cambodia	KH_gas_can	Gas	989	692
2032	Cambodia	KH_pot_gas	Gas	402	281
2033	Viet Nam	VN_gas_can	Gas	839	587
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Lao PDR	LA_N_rr_can	Hydro	721	1797
2033	Lao PDR	LA_C1_st_can	Hydro	45	112
2033	Lao PDR	LA_C2_st_can	Hydro	276	688
2033	Cambodia	KH_gas_can	Gas	629	441
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	661	463
2034	Viet Nam	VN_solar_can	Solar	4728	4728
2034	Lao PDR	LA_N_rr_can	Hydro	594	1481
2034	Lao PDR	LA_S_rr_can	Hydro	268	668
2034	Cambodia	KH_pot_gas	Gas	3211	2248
2035	Thailand	TH_gas_can	Gas	3720	2604
2035	Viet Nam	VN_coal_can	Coal	1972	4464
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2035	Viet Nam	VN_solar_can	Solar	2867	2867
2035	Lao PDR	LA_wind_can	Wind	500	750
2035	Cambodia	KH_bio_can	Biomass	43	175
2035	Cambodia	KH_pot_gas	Gas	1439	1007

373. The transmission plan for the “L_GAS_BASE” scenario is shown in Table 108.

Table 108: Transmission plan for “L_GAS_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2028	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2034	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

27. Scenario “L_VRE_BASE”

374. The generation plan for the “L_VRE_BASE” scenario is shown in Table 109.

Table 109: Generation plan for “L_VRE_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	4000	3200
2023	Thailand	TH_solar_can	Solar	4000	3200
2024	Thailand	TH_solar_can	Solar	850	680
2024	Myanmar	MM_run_can	Hydro	3150	7853
2025	Thailand	TH_solar_can	Solar	3269	2615
2029	Cambodia	KH_bio_can	Biomass	47	153
2029	Cambodia	KH_wnd_can	Wind	94	113
2029	Cambodia	KH_sol_can	Solar	1199	959
2029	Cambodia	KH_gas_can	Gas	51	35
2030	Lao PDR	LA_wind_can	Wind	550	660
2030	Cambodia	KH_gas_can	Gas	1052	737
2030	Myanmar	MM_run_can	Hydro	2299	5732
2031	Viet Nam	VN_S_stor_c	Hydro	137	341
2031	Viet Nam	VN_SHP_can	Hydro	448	1117

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Lao PDR	LA_C2_st_can	Hydro	554	1381
2031	Cambodia	KH_N2_rr_can	Hydro	581	1450
2031	Cambodia	KH_S1_rr_can	Hydro	338	844
2031	Cambodia	KH_blk_hydro	Hydro	580	1447
2031	Cambodia	KH_bulk_sol	Solar	1650	1320
2032	Viet Nam	VN_N1_stor_c	Hydro	180	449
2032	Lao PDR	LA_S_rr_can	Hydro	335	834
2032	Cambodia	KH_gas_can	Gas	1013	709
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Viet Nam	VN_solar_can	Solar	886	709
2033	Cambodia	KH_S1_rr_can	Hydro	82	203
2033	Cambodia	KH_pot_gas	Gas	1780	1246
2034	Viet Nam	VN_C_wnd_can	Wind	835	1002
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_S_wnd_can	Wind	5848	7018
2034	Lao PDR	LA_S_st_can	Hydro	1233	3074
2034	Cambodia	KH_pot_gas	Gas	1350	945
2034	Cambodia	KH_blk_hydro	Hydro	345	861
2035	Thailand	TH_coal_can	Coal	2477	4675
2035	Viet Nam	VN_coal_can	Coal	1497	3390
2035	Viet Nam	VN_solar_can	Solar	7469	5975
2035	Viet Nam	VN_C2_stor_c	Hydro	589	1468
2035	Lao PDR	LA_N_rr_can	Hydro	2749	6853
2035	Lao PDR	LA_C1_st_can	Hydro	45	112
2035	Cambodia	KH_pot_gas	Gas	2053	1437
2035	Myanmar	MM_run_can	Hydro	4811	11994

375. The transmission plan for the “L_VRE_BASE” scenario is shown in Table 110.

Table 110: Transmission plan for “L_VRE_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2029	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2035	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

28. Scenario “L_HIF_BASE”

376. The generation plan for the “L_HIF_BASE” scenario is shown in Table 111.

Table 111: Generation plan for “L_HIF_BASE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Thailand	TH_solar_can	Solar	860	860
2023	Thailand	TH_solar_can	Solar	4000	4000
2024	Thailand	TH_solar_can	Solar	501	501
2024	Myanmar	MM_run_can	Hydro	3499	8724
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	1656	1656
2027	Myanmar	MM_run_can	Hydro	935	2332
2028	Lao PDR	LA_C2_st_can	Hydro	554	1381
2028	Lao PDR	LA_S_st_can	Hydro	493	1228
2029	Cambodia	KH_bio_can	Biomass	43	175
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_sol_can	Solar	1090	1090
2029	Cambodia	KH_gas_can	Gas	172	120
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Cambodia	KH_gas_can	Gas	1098	768
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_S_st_can	Hydro	262	654
2031	Cambodia	KH_N2_rr_can	Hydro	541	1349
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_blk_hydro	Hydro	1756	4378
2031	Cambodia	KH_bulk_sol	Solar	1431	1431
2031	Myanmar	MM_run_can	Hydro	2359	5880
2032	Viet Nam	VN_N1_stor_c	Hydro	180	449
2032	Viet Nam	VN_C2_stor_c	Hydro	634	1582

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Cambodia	KH_gas_can	Gas	1565	1096
2032	Cambodia	KH_bulk_sol	Solar	69	69
2033	Viet Nam	VN_CC_can	Combined Cycle	1991	1394
2033	Viet Nam	VN_S_stor_c	Hydro	300	748
2033	Viet Nam	VN_SHP_can	Hydro	553	1378
2033	Cambodia	KH_pot_gas	Gas	1148	804
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_CC_can	Combined Cycle	259	181
2034	Viet Nam	VN_solar_can	Solar	4785	4785
2034	Viet Nam	VN_SHP_can	Hydro	966	2409
2034	Cambodia	KH_N2_rr_can	Hydro	203	506
2034	Cambodia	KH_pot_gas	Gas	2061	1443
2035	Viet Nam	VN_coal_can	Coal	2154	4877
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2035	Viet Nam	VN_solar_can	Solar	2810	2810
2035	Lao PDR	LA_C1_st_can	Hydro	45	112
2035	Cambodia	KH_pot_gas	Gas	1970	1379

377. The transmission plan for the “L_HIF_BASE” scenario is shown in Table 112.

Table 112: Transmission plan for “L_HIF_BASE” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2033	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

29. Scenario “L_BASE_BSS”

378. The generation plan for the “L_BASE_BSS” scenario is shown in Table 113.

Table 113: Generation plan for “L_BASE_BSS” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Cambodia	KH_gas_can	Gas	61	43
2024	Myanmar	MM_run_can	Hydro	3269	8149
2029	Lao PDR	LA_N_st_can	Hydro	522	1301
2029	Lao PDR	LA_C2_st_can	Hydro	405	1011
2029	Cambodia	KH_bio_can	Biomass	43	175
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_sol_can	Solar	273	273
2029	Cambodia	KH_gas_can	Gas	338	237
2030	Cambodia	KH_gas_can	Gas	553	387
2030	Cambodia	KH_sol_bat_c	Solar_BSS	1295	1619
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Cambodia	KH_N2_rr_can	Hydro	926	2308
2031	Cambodia	KH_gas_can	Gas	136	95
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_blk_hydro	Hydro	556	1386
2031	Cambodia	KH_bulk_sol	Solar	750	750
2031	Myanmar	MM_run_can	Hydro	2707	6749
2032	Viet Nam	VN_C2_stor_c	Hydro	106	264
2032	Cambodia	KH_gas_can	Gas	1429	1000
2033	Thailand	TH_coal_can	Coal	194	365
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Viet Nam	VN_SHP_can	Hydro	998	2488
2033	Cambodia	KH_pot_gas	Gas	1395	977
2034	Thailand	TH_coal_can	Coal	1938	3657
2034	Viet Nam	VN_C_wnd_can	Wind	307	460
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_N1_stor_c	Hydro	180	449
2034	Viet Nam	VN_C2_stor_c	Hydro	194	485
2034	Viet Nam	VN_sol_bat_c	Solar_BSS	2290	2862
2034	Lao PDR	LA_wind_can	Wind	500	750
2034	Cambodia	KH_pot_gas	Gas	3278	2295
2035	Thailand	TH_coal_can	Coal	1009	1903
2035	Viet Nam	VN_coal_can	Coal	1591	3602
2035	Viet Nam	VN_C_wnd_can	Wind	453	679
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_solar_can	Solar	3798	3798
2035	Viet Nam	VN_sol_bat_c	Solar_BSS	1508	1885
2035	Lao PDR	LA_C1_rr_can	Hydro	2	6
2035	Cambodia	KH_gas_can	Gas	594	416

379. The transmission plan for the “L_BASE_BSS” scenario is shown in Table 114.

Table 114: Transmission plan for “L_BASE_BSS” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2029	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2034	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

30. Scenario “L_VRE_BSS”

380. The generation plan for the “L_VRE_BSS” scenario is shown in Table 115.

Table 115: Generation plan for “L_VRE_BSS” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	4000	3200
2023	Thailand	TH_solar_can	Solar	2060	1648
2024	Myanmar	MM_run_can	Hydro	3729	9296
2029	Cambodia	KH_bio_can	Biomass	47	153
2029	Cambodia	KH_wnd_can	Wind	85	102
2029	Cambodia	KH_sol_can	Solar	300	240
2029	Cambodia	KH_sol_bat_c	Solar_BSS	837	837
2030	Lao PDR	LA_wind_can	Wind	550	660
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Cambodia	KH_gas_can	Gas	825	578
2030	Cambodia	KH_sol_bat_c	Solar_BSS	588	588
2030	Myanmar	MM_run_can	Hydro	1497	3731
2031	Viet Nam	VN_S_stor_c	Hydro	124	310
2031	Cambodia	KH_N2_rr_can	Hydro	349	870
2031	Cambodia	KH_gas_can	Gas	294	206
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_blk_hydro	Hydro	806	2009
2031	Cambodia	KH_bulk_sol	Solar	825	660
2032	Cambodia	KH_N2_rr_can	Hydro	517	1288
2032	Cambodia	KH_gas_can	Gas	1490	1043
2032	Cambodia	KH_blk_hydro	Hydro	104	260
2033	Viet Nam	VN_C_wnd_can	Wind	919	1103
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Viet Nam	VN_sol_bat_c	Solar_BSS	1672	1672
2033	Cambodia	KH_gas_can	Gas	866	606
2033	Myanmar	MM_run_can	Hydro	2602	6486
2034	Viet Nam	VN_S_wnd_can	Wind	6433	7720
2034	Viet Nam	VN_SHP_can	Hydro	167	417
2034	Viet Nam	VN_sol_bat_c	Solar_BSS	2352	2352
2034	Lao PDR	LA_C1_st_can	Hydro	45	112
2034	Cambodia	KH_pot_gas	Gas	2003	1402
2035	Thailand	TH_coal_can	Coal	1043	1967
2035	Thailand	TH_sol_bat_c	Solar_BSS	6060	6060
2035	Viet Nam	VN_coal_can	Coal	401	908
2035	Viet Nam	VN_gas_can	Gas	1500	1050
2035	Viet Nam	VN_N1_stor_c	Hydro	180	449

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_solar_can	Solar	4596	3677
2035	Viet Nam	VN_C2_stor_c	Hydro	900	2244
2035	Viet Nam	VN_SHP_can	Hydro	408	1016
2035	Viet Nam	VN_sol_bat_c	Solar_BSS	572	572
2035	Cambodia	KH_gas_can	Gas	125	87
2035	Cambodia	KH_pot_gas	Gas	2038	1426

381. The transmission plan for the “L_VRE_BSS” scenario is shown in Table 116.

Table 116: Transmission plan for “L_VRE_BSS” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2029	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2034	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

31. Scenario “L_BASE_NUC”

382. The generation plan for the “L_BASE_NUC” scenario is shown in Table 117.

Table 117: Generation plan for “L_BASE_NUC” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Myanmar	MM_run_can	Hydro	729	1818
2024	Myanmar	MM_run_can	Hydro	2604	6491
2027	Myanmar	MM_run_can	Hydro	1581	3940
2029	Cambodia	KH_bio_can	Biomass	43	175

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_gas_can	Gas	951	666
2030	Lao PDR	LA_S_st_can	Hydro	1233	3074
2030	Cambodia	KH_sol_can	Solar	1090	1090
2030	Cambodia	KH_gas_can	Gas	269	188
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_C2_stor_c	Hydro	446	1112
2031	Viet Nam	VN_SHP_can	Hydro	674	1679
2031	Cambodia	KH_N2_rr_can	Hydro	354	882
2031	Cambodia	KH_gas_can	Gas	495	346
2031	Cambodia	KH_blk_hydro	Hydro	1748	4357
2032	Cambodia	KH_gas_can	Gas	1022	715
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Cambodia	KH_pot_gas	Gas	1533	1073
2033	Cambodia	KH_bulk_sol	Solar	1500	1500
2033	Myanmar	MM_run_can	Hydro	1126	2807
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_solar_can	Solar	2609	2609
2034	Lao PDR	LA_N_st_can	Hydro	522	1301
2034	Lao PDR	LA_S_rr_can	Hydro	913	2277
2034	Cambodia	KH_N2_rr_can	Hydro	505	1259
2034	Cambodia	KH_pot_gas	Gas	2575	1803
2035	Thailand	TH_coal_can	Coal	3140	5925
2035	Viet Nam	VN_coal_can	Coal	3834	8679
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2035	Lao PDR	LA_wind_can	Wind	500	750
2035	Lao PDR	LA_C1_rr_can	Hydro	96	239
2035	Lao PDR	LA_S_rr_can	Hydro	449	1119

383. The transmission plan for the “L_BASE_NUC” scenario is shown in Table 118.

Table 118: Transmission plan for “L_BASE_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2029	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2034	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

32. Scenario “L_HIF_NUC”

384. The generation plan for the “L_HIF_NUC” scenario is shown in Table 119.

Table 119: Generation plan for “L_HIF_NUC” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Thailand	TH_solar_can	Solar	860	860
2023	Thailand	TH_solar_can	Solar	4000	4000
2024	Myanmar	MM_run_can	Hydro	4000	9972
2025	Thailand	TH_solar_can	Solar	4000	4000
2026	Thailand	TH_solar_can	Solar	2157	2157
2028	Myanmar	MM_run_can	Hydro	2464	6143
2029	Cambodia	KH_bio_can	Biomass	43	175
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_sol_can	Solar	1090	1090
2029	Cambodia	KH_gas_can	Gas	298	209
2029	Myanmar	MM_run_can	Hydro	45	113
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Lao PDR	LA_C2_st_can	Hydro	91	228
2030	Cambodia	KH_gas_can	Gas	979	685
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	190	473
2031	Cambodia	KH_N2_rr_can	Hydro	879	2190
2031	Cambodia	KH_gas_can	Gas	187	131
2031	Cambodia	KH_blk_hydro	Hydro	1591	3967

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Viet Nam	VN_C2_stor_c	Hydro	499	1243
2032	Lao PDR	LA_wind_can	Wind	500	750
2032	Cambodia	KH_gas_can	Gas	628	439
2032	Cambodia	KH_S1_rr_can	Hydro	249	621
2033	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2033	Cambodia	KH_pot_gas	Gas	1734	1214
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	1500	1050
2034	Viet Nam	VN_S_wnd_can	Wind	1075	1612
2034	Viet Nam	VN_solar_can	Solar	7595	7595
2034	Viet Nam	VN_C2_stor_c	Hydro	401	1001
2034	Lao PDR	LA_N_rr_can	Hydro	959	2391
2034	Lao PDR	LA_C2_rr_can	Hydro	275	686
2034	Cambodia	KH_gas_can	Gas	1508	1056
2034	Cambodia	KH_pot_gas	Gas	211	148
2035	Viet Nam	VN_coal_can	Coal	1982	4487
2035	Viet Nam	VN_S_wnd_can	Wind	4242	6362
2035	Cambodia	KH_S1_rr_can	Hydro	171	426
2035	Cambodia	KH_pot_gas	Gas	1981	1387

385. The transmission plan for the “L_HIF_NUC” scenario is shown in Table 120.

Table 120: Transmission plan for “L_HIF_NUC” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182
2033	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

33. Scenario "L_BASE_INT"

386. The generation plan for the "L_BASE_INT" scenario is shown in Table 121.

Table 121: Generation plan for "L_BASE_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	MM_run_can	Hydro	2751	6859
2026	Lao PDR	LA_C2_st_can	Hydro	404	1008
2027	Lao PDR	LA_N_rr_can	Hydro	572	1425
2027	Lao PDR	LA_N_st_can	Hydro	5	12
2028	Lao PDR	LA_S_rr_can	Hydro	403	1004
2028	Lao PDR	LA_S_st_can	Hydro	865	2157
2029	Lao PDR	LA_wind_can	Wind	500	750
2029	Lao PDR	LA_C2_st_can	Hydro	150	373
2030	Lao PDR	LA_S_rr_can	Hydro	457	1139
2030	Myanmar	MM_run_can	Hydro	3037	7572
2031	Cambodia	KH_N2_rr_can	Hydro	529	1318
2031	Cambodia	KH_S1_rr_can	Hydro	115	287
2031	Myanmar	MM_run_can	Hydro	1796	4478
2032	Lao PDR	LA_C2_rr_can	Hydro	275	686
2033	Thailand	TH_coal_can	Coal	2100	3962
2033	Viet Nam	VN_S_stor_c	Hydro	300	748
2033	Viet Nam	VN_SHP_can	Hydro	635	1582
2033	Lao PDR	LA_N_st_can	Hydro	517	1289
2033	Lao PDR	LA_C1_rr_can	Hydro	96	239
2033	Cambodia	KH_blk_hydro	Hydro	907	2261
2034	Thailand	TH_coal_can	Coal	1040	1963
2034	Thailand	TH_solar_can	Solar	901	901
2034	Viet Nam	VN_N1_stor_c	Hydro	180	449
2034	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2034	Viet Nam	VN_C2_stor_c	Hydro	62	154
2034	Lao PDR	LA_N_rr_can	Hydro	582	1450
2034	Lao PDR	LA_C1_st_can	Hydro	45	112
2034	Cambodia	KH_bio_can	Biomass	43	175
2034	Cambodia	KH_wnd_can	Wind	85	128

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Cambodia	KH_sol_can	Solar	1090	1090
2034	Cambodia	KH_bulk_sol	Solar	1500	1500
2034	Myanmar	MM_run_can	Hydro	2607	6500
2035	Thailand	TH_solar_can	Solar	4365	4365
2035	Viet Nam	VN_C_wnd_can	Wind	760	1139
2035	Viet Nam	VN_gas_can	Gas	1500	1050
2035	Viet Nam	VN_solar_can	Solar	7595	7595
2035	Viet Nam	VN_C2_stor_c	Hydro	198	493
2035	Cambodia	KH_N2_rr_can	Hydro	173	431
2035	Cambodia	KH_pot_gas	Gas	2797	1958

387. The transmission plan for the “L_BASE_INT” scenario is shown in Table 122.

Table 122: Transmission plan for “L_BASE_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2033	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2033	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2034	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84

34. Scenario “L_HIF_INT”

388. The generation plan for the “L_HIF_INT” scenario is shown in Table 123.

Table 123: Generation plan for “L_HIF_INT” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_coal_can	Coal	3140	5925
2022	Thailand	TH_solar_can	Solar	860	860
2023	Thailand	TH_solar_can	Solar	2922	2922
2023	Myanmar	MM_run_can	Hydro	1078	2686
2024	Myanmar	MM_run_can	Hydro	2424	6043
2025	Lao PDR	LA_C2_st_can	Hydro	429	1070
2025	Lao PDR	LA_S_st_can	Hydro	477	1189
2026	Lao PDR	LA_S_st_can	Hydro	26	64
2027	Lao PDR	LA_wind_can	Wind	500	750
2027	Lao PDR	LA_N_rr_can	Hydro	252	627
2028	Lao PDR	LA_N_st_can	Hydro	135	335
2028	Lao PDR	LA_C2_st_can	Hydro	125	312
2028	Lao PDR	LA_S_rr_can	Hydro	473	1178
2028	Lao PDR	LA_S_st_can	Hydro	467	1163
2028	Myanmar	MM_run_can	Hydro	92	230
2029	Lao PDR	LA_C2_rr_can	Hydro	275	686
2029	Myanmar	MM_run_can	Hydro	2868	7151
2030	Thailand	TH_solar_can	Solar	7235	7235
2030	Lao PDR	LA_N_rr_can	Hydro	792	1975
2031	Viet Nam	VN_C2_stor_c	Hydro	471	1175
2031	Viet Nam	VN_S_stor_c	Hydro	300	748
2031	Viet Nam	VN_SHP_can	Hydro	376	938
2031	Lao PDR	LA_N_st_can	Hydro	387	966
2031	Cambodia	KH_N2_rr_can	Hydro	804	2006
2031	Cambodia	KH_S1_rr_can	Hydro	304	757
2031	Cambodia	KH_blk_hydro	Hydro	714	1780
2032	Myanmar	MM_run_can	Hydro	4029	10045
2033	Cambodia	KH_bio_can	Biomass	43	175
2034	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2034	Cambodia	KH_wnd_can	Wind	85	128

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Cambodia	KH_sol_can	Solar	594	594
2034	Cambodia	KH_bulk_sol	Solar	1500	1500
2035	Viet Nam	VN_C_wnd_can	Wind	760	1139
2035	Viet Nam	VN_gas_can	Gas	1500	1050
2035	Viet Nam	VN_N1_stor_c	Hydro	180	449
2035	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2035	Viet Nam	VN_solar_can	Solar	7595	7595
2035	Cambodia	KH_sol_can	Solar	496	496
2035	Cambodia	KH_pot_gas	Gas	164	115

389. The transmission plan for the “L_HIF_INT” scenario is shown in Table 124.

Table 124: Transmission plan for “L_HIF_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2026	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2029	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2029	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2031	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2034	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217

35. Scenario "L_VRE_INT"

390. The generation plan for the "L_VRE_INT" scenario is shown in Table 125.

Table 125: Generation plan for "L_VRE_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	4000	3200
2023	Thailand	TH_solar_can	Solar	4000	3200
2024	Thailand	TH_solar_can	Solar	1117	894
2024	Myanmar	MM_run_can	Hydro	2883	7187
2026	Lao PDR	LA_C2_st_can	Hydro	108	269
2026	Myanmar	MM_run_can	Hydro	360	898
2027	Lao PDR	LA_wind_can	Wind	550	660
2027	Lao PDR	LA_N_rr_can	Hydro	707	1763
2027	Lao PDR	LA_S_rr_can	Hydro	202	505
2028	Thailand	TH_solar_can	Solar	3002	2402
2028	Lao PDR	LA_S_st_can	Hydro	815	2031
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Myanmar	MM_run_can	Hydro	2675	6670
2030	Myanmar	MM_run_can	Hydro	1627	4057
2031	Viet Nam	VN_C2_stor_c	Hydro	286	713
2031	Viet Nam	VN_S_stor_c	Hydro	106	265
2031	Cambodia	KH_S1_rr_can	Hydro	74	183
2031	Cambodia	KH_blk_hydro	Hydro	983	2450
2033	Cambodia	KH_bio_can	Biomass	47	153
2033	Cambodia	KH_N2_rr_can	Hydro	602	1502
2033	Myanmar	MM_wind_can	Wind	3190	3828
2034	Viet Nam	VN_C_wnd_can	Wind	835	1002
2034	Viet Nam	VN_S_wnd_can	Wind	1250	1500
2034	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2034	Lao PDR	LA_S_rr_can	Hydro	898	2239
2034	Lao PDR	LA_S_st_can	Hydro	418	1043
2034	Cambodia	KH_wnd_can	Wind	94	113
2034	Cambodia	KH_sol_can	Solar	1199	959
2034	Cambodia	KH_bulk_sol	Solar	1650	1320
2035	Thailand	TH_coal_can	Coal	1996	3766
2035	Viet Nam	VN_N1_stor_c	Hydro	122	304

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_S_wnd_can	Wind	4598	5517
2035	Viet Nam	VN_solar_can	Solar	8355	6684
2035	Lao PDR	LA_C1_rr_can	Hydro	96	239
2035	Cambodia	KH_S1_rr_can	Hydro	127	318
2035	Cambodia	KH_pot_gas	Gas	1753	1227

391. The transmission plan for the “L_VRE_INT” scenario is shown in Table 126.

Table 126: Transmission plan for “L_VRE_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2025	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2026	Thailand	Cambodia	Wangnoi - Banteay Mean Chey - Siem Reap - Kampong Cham	HVAC	300	524
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2027	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2032	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2032	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2032	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2033	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2034	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2034	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242

36. Scenario “L_REFERENCE”

392. The generation plan for the “L_REFERENCE” scenario is shown in Table 127.

Table 127: generation plan for “L_REFERENCE” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Myanmar	MM_run_can	Hydro	479	1194
2024	Cambodia	KH_gas_can	Gas	175	123
2025	Cambodia	KH_bio_can	Biomass	43	175
2025	Cambodia	KH_gas_can	Gas	147	103
2026	Cambodia	KH_wnd_can	Wind	85	128
2026	Cambodia	KH_sol_can	Solar	1090	1090
2026	Cambodia	KH_gas_can	Gas	208	146
2027	Cambodia	KH_gas_can	Gas	740	518
2028	Cambodia	KH_gas_can	Gas	991	694
2029	Cambodia	KH_gas_can	Gas	756	529
2030	Cambodia	KH_gas_can	Gas	581	407
2030	Cambodia	KH_bulk_gas	Gas	628	440
2030	Myanmar	MM_run_can	Hydro	1498	3735
2031	Viet Nam	VN_N1_stor_c	Hydro	79	196
2031	Viet Nam	VN_SHP_can	Hydro	315	786
2031	Cambodia	KH_S1_rr_can	Hydro	420	1047
2031	Cambodia	KH_pot_gas	Gas	1331	932
2031	Cambodia	KH_blk_hydro	Hydro	369	920
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	1157	2184
2032	Viet Nam	VN_gas_can	Gas	476	333
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_S_stor_c	Hydro	145	362
2032	Cambodia	KH_N2_rr_can	Hydro	800	1994
2033	Thailand	TH_coal_can	Coal	1983	3741
2033	Viet Nam	VN_C_wnd_can	Wind	760	1139
2033	Viet Nam	VN_gas_can	Gas	1024	717
2033	Viet Nam	VN_S_wnd_can	Wind	4170	6255
2033	Viet Nam	VN_C2_stor_c	Hydro	457	1140
2033	Cambodia	KH_N2_rr_can	Hydro	1399	3488
2033	Cambodia	KH_pot_gas	Gas	4069	2848
2033	Myanmar	MM_run_can	Hydro	434	1083
2034	Thailand	TH_gas_can	Gas	256	179
2034	Viet Nam	VN_coal_can	Coal	4311	9761
2034	Viet Nam	VN_S_wnd_can	Wind	1147	1720
2034	Cambodia	KH_blk_hydro	Hydro	1083	2700
2034	Myanmar	MM_run_can	Hydro	976	2432
2035	Thailand	TH_gas_can	Gas	2010	1407

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2035	Viet Nam	VN_coal_can	Coal	5138	11632
2035	Cambodia	KH_blk_hydro	Hydro	1548	3859

37. Scenario "COVID-19 demand"

393. The generation plan for the "COVID-19 demand" scenario is shown inTable 128.

Table 128: Generation plan for "COVID-19 demand" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2023	Myanmar	MM_run_can	Hydro	474	1181
2024	Myanmar	MM_run_can	Hydro	1087	2710
2028	Myanmar	MM_run_can	Hydro	3899	9720
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_S_st_can	Hydro	663	1652
2030	Lao PDR	LA_N_rr_can	Hydro	995	2481
2030	Lao PDR	LA_S_rr_can	Hydro	703	1753
2030	Cambodia	KH_bio_can	Biomass	43	175
2030	Cambodia	KH_wnd_can	Wind	85	128
2030	Cambodia	KH_sol_can	Solar	1090	1090
2030	Cambodia	KH_gas_can	Gas	498	349
2031	Viet Nam	VN_N1_stor_c	Hydro	159	397
2031	Viet Nam	VN_C2_stor_c	Hydro	97	241
2031	Viet Nam	VN_SHP_can	Hydro	509	1268
2031	Cambodia	KH_N2_rr_can	Hydro	496	1236
2031	Cambodia	KH_pot_gas	Gas	311	218
2031	Cambodia	KH_blk_hydro	Hydro	641	1597
2032	Cambodia	KH_pot_gas	Gas	1031	722
2033	Viet Nam	VN_S_stor_c	Hydro	33	83
2033	Lao PDR	LA_N_st_can	Hydro	522	1301
2033	Cambodia	KH_pot_gas	Gas	872	611
2034	Viet Nam	VN_CC_can	Combined Cycle	1601	1121
2034	Cambodia	KH_gas_can	Gas	563	394
2034	Cambodia	KH_S1_rr_can	Hydro	255	635
2034	Cambodia	KH_pot_gas	Gas	205	144
2034	Cambodia	KH_bulk_sol	Solar	1500	1500
2034	Myanmar	MM_run_can	Hydro	758	1889
2035	Viet Nam	VN_gas_can	Gas	1500	1050
2035	Viet Nam	VN_CC_can	Combined Cycle	649	454
2035	Cambodia	KH_pot_gas	Gas	2980	2086

394. The transmission plan for the “COVID-19 demand” scenario is shown Table 129.

Table 129: Transmission plan for “COVID-19 demand” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2028	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2029	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2035	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

38. Scenario “Dry future”

395. The generation plan for the “Dry future” scenario is shown in Table 130.

Table 130: Generation plan for “Dry future” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	206	144
2022	Myanmar	MM_run_can	Hydro	1855	4626
2023	Cambodia	KH_gas_can	Gas	106	74
2024	Myanmar	MM_run_can	Hydro	3201	7981
2027	Lao PDR	LA_N_rr_can	Hydro	745	1857
2027	Lao PDR	LA_C2_st_can	Hydro	20	50
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	815	571
2028	Myanmar	MM_run_can	Hydro	744	1854
2029	Cambodia	KH_gas_can	Gas	884	619
2030	Viet Nam	VN_CC_can	Combined Cycle	1276	893
2030	Lao PDR	LA_wind_can	Wind	500	750
2030	Cambodia	KH_gas_can	Gas	1589	1112
2031	Viet Nam	VN_gas_can	Gas	1500	1050
2031	Viet Nam	VN_CC_can	Combined Cycle	974	682
2031	Viet Nam	VN_C2_stor_c	Hydro	243	606
2031	Viet Nam	VN_SHP_can	Hydro	205	512
2031	Cambodia	KH_N2_rr_can	Hydro	1064	2652
2031	Cambodia	KH_S1_rr_can	Hydro	212	528
2031	Cambodia	KH_pot_gas	Gas	2433	1703
2031	Cambodia	KH_blk_hydro	Hydro	604	1506
2031	Myanmar	MM_run_can	Hydro	933	2326
2032	Thailand	TH_coal_can	Coal	3140	5925
2032	Viet Nam	VN_coal_can	Coal	5464	12371
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_S_stor_c	Hydro	300	748
2032	Cambodia	KH_pot_gas	Gas	307	215
2032	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Myanmar	MM_run_can	Hydro	3345	8340
2033	Thailand	TH_solar_can	Solar	4549	4549
2033	Viet Nam	VN_coal_can	Coal	349	791
2033	Viet Nam	VN_N1_stor_c	Hydro	180	449
2033	Viet Nam	VN_solar_can	Solar	7595	7595

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Lao PDR	LA_N_rr_can	Hydro	525	1308
2033	Cambodia	KH_pot_gas	Gas	2660	1862
2034	Thailand	TH_gas_can	Gas	2839	1987
2034	Viet Nam	VN_coal_can	Coal	6221	14085
2035	Thailand	TH_gas_can	Gas	1202	841
2035	Viet Nam	VN_coal_can	Coal	6857	15523
2035	Viet Nam	VN_C2_stor_c	Hydro	657	1638
2035	Lao PDR	LA_N_st_can	Hydro	522	1301
2035	Lao PDR	LA_C1_rr_can	Hydro	96	239
2035	Lao PDR	LA_C2_st_can	Hydro	534	1331
2035	Lao PDR	LA_S_rr_can	Hydro	572	1426
2035	Cambodia	KH_bulk_gas	Gas	365	256

396. The transmission plan for the “Dry future” scenario is shown in Table 131.

Table 131: Transmission plan for “Dry future” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

39. Scenario “Reduced carbon emmission”

397. The generation plan for the “Reduced carbon emmission” scenario is shown in Table 132.

Table 132: Generation plan for “Reduced carbon emmission” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Thailand	TH_solar_can	Solar	1592	1592
2022	Cambodia	KH_gas_can	Gas	208	145
2022	Myanmar	MM_run_can	Hydro	2200	5485
2023	Thailand	TH_solar_can	Solar	3918	3918
2023	Cambodia	KH_gas_can	Gas	82	57
2024	Thailand	TH_solar_can	Solar	1568	1568
2024	Myanmar	MM_run_can	Hydro	2432	6064
2025	Thailand	TH_solar_can	Solar	3939	3939
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2029	Cambodia	KH_gas_can	Gas	1332	932
2029	Myanmar	MM_run_can	Hydro	2833	7062
2030	Lao PDR	LA_N_st_can	Hydro	522	1301
2030	Cambodia	KH_gas_can	Gas	1542	1079
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	451	1125
2031	Viet Nam	VN_SHP_can	Hydro	1244	3102
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_N_rr_can	Hydro	241	601
2031	Cambodia	KH_N2_rr_can	Hydro	625	1558
2031	Cambodia	KH_gas_can	Gas	437	306
2031	Cambodia	KH_pot_gas	Gas	1449	1014
2031	Cambodia	KH_blk_hydro	Hydro	531	1323
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	1372	2589
2032	Thailand	TH_wind_can	Wind	700	1050
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	2641	2641
2032	Viet Nam	VN_S_stor_c	Hydro	300	748
2032	Viet Nam	VN_SHP_can	Hydro	275	685
2032	Cambodia	KH_S1_rr_can	Hydro	420	1047
2032	Cambodia	KH_pot_gas	Gas	3951	2766
2033	Viet Nam	VN_coal_can	Coal	3906	8843

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Myanmar	MM_run_can	Hydro	1101	2745
2034	Thailand	TH_coal_can	Coal	1768	3336
2034	Thailand	TH_gas_can	Gas	2535	1774
2034	Viet Nam	VN_coal_can	Coal	6530	14785
2035	Thailand	TH_gas_can	Gas	939	658
2035	Viet Nam	VN_coal_can	Coal	7588	17179

398. The transmission plan for the “Reduced carbon emmission” scenario is shown in Table 133.

Table 133: Transmission plan for “Reduced carbon emmission” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2027	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

40. Scenario “No import restrictions”

399. The generation plan for the “No import restrictions” scenario is shown in Table 134.

Table 134: Generation plan for “No import restrictions” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	100	70
2023	Cambodia	KH_gas_can	Gas	172	121

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	LA_N_st_can	Hydro	456	1138
2024	Lao PDR	LA_C2_st_can	Hydro	102	253
2024	Cambodia	KH_gas_can	Gas	213	149
2024	Myanmar	MM_run_can	Hydro	3228	8048
2025	Lao PDR	LA_C1_st_can	Hydro	45	112
2025	Lao PDR	LA_S_st_can	Hydro	829	2065
2025	Myanmar	MM_run_can	Hydro	3126	7794
2026	Lao PDR	LA_wind_can	Wind	500	750
2026	Lao PDR	LA_N_rr_can	Hydro	1193	2973
2026	Lao PDR	LA_C1_rr_can	Hydro	69	171
2026	Lao PDR	LA_C2_rr_can	Hydro	275	686
2026	Lao PDR	LA_C2_st_can	Hydro	288	718
2026	Lao PDR	LA_S_rr_can	Hydro	785	1957
2026	Myanmar	MM_run_can	Hydro	3204	7987
2029	Lao PDR	LA_S_rr_can	Hydro	128	320
2029	Myanmar	MM_wind_can	Wind	2900	4350
2031	Viet Nam	VN_N1_stor_c	Hydro	45	113
2031	Viet Nam	VN_S_stor_c	Hydro	136	340
2031	Viet Nam	VN_SHP_can	Hydro	404	1008
2031	Cambodia	KH_N2_rr_can	Hydro	810	2020
2031	Cambodia	KH_blk_hydro	Hydro	1046	2608
2031	Myanmar	MM_run_can	Hydro	592	1477
2032	Thailand	TH_coal_can	Coal	3140	5925
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_C2_stor_c	Hydro	332	828
2032	Lao PDR	LA_coal_can	Coal	4169	9438
2032	Cambodia	KH_wnd_can	Wind	85	128
2032	Cambodia	KH_S1_rr_can	Hydro	231	575
2033	Thailand	TH_solar_can	Solar	5808	5808
2033	Viet Nam	VN_gas_can	Gas	1421	994
2033	Viet Nam	VN_solar_can	Solar	7595	7595
2033	Lao PDR	LA_coal_can	Coal	931	2108
2033	Cambodia	KH_sol_can	Solar	1090	1090
2033	Cambodia	KH_bulk_sol	Solar	1500	1500
2033	Myanmar	MM_run_can	Hydro	218	543
2034	Thailand	TH_solar_can	Solar	3840	3840
2034	Viet Nam	VN_C_wnd_can	Wind	760	1139
2034	Viet Nam	VN_gas_can	Gas	79	56
2034	Viet Nam	VN_S_wnd_can	Wind	1980	2970
2034	Cambodia	KH_gas_can	Gas	922	645
2034	Cambodia	KH_pot_gas	Gas	5400	3780

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Myanmar	MM_run_can	Hydro	1052	2622
2035	Thailand	TH_gas_can	Gas	642	449
2035	Thailand	TH_solar_can	Solar	1369	1369
2035	Viet Nam	VN_coal_can	Coal	4169	9438
2035	Viet Nam	VN_S_wnd_can	Wind	3336	5005
2035	Lao PDR	LA_solar_can	Solar	865	865
2035	Lao PDR	LA_S_rr_can	Hydro	1857	4629
2035	Cambodia	KH_gas_can	Gas	2192	1535
2035	Cambodia	KH_S1_rr_can	Hydro	189	472
2035	Myanmar	MM_run_can	Hydro	1383	3448

400. The transmission plan for the "No import restrictions" scenario is shown in Table 135.

Table 135: Transmission plan for "No import restrictions" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Thailand	Lao PDR - Thailand	HVAC	1500	236
2025	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2025	Lao PDR	Thailand	Lao PDR - Thailand	HVAC	1500	236
2026	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2026	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Lao PDR	Thailand	Thabok - Pakxan - Bungkan	HVAC	500	89
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Thailand	Lao PDR - Thailand	HVAC	1500	236
2027	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2028	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2030	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2030	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2031	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2031	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2032	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2032	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2032	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2032	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2035	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247

41. Scenario “Increased power wheeling to Malaysia”

401. The generation plan for the “Increased power wheeling to Malaysia” scenario is shown in Table 136.

Table 136: Generation plan for “Increased power wheeling to Malaysia” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	264	185
2022	Myanmar	MM_run_can	Hydro	809	2017
2023	Myanmar	MM_run_can	Hydro	883	2200
2024	Myanmar	MM_run_can	Hydro	4000	9972
2028	Lao PDR	LA_N_st_can	Hydro	522	1301
2028	Lao PDR	LA_S_rr_can	Hydro	206	514
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	114	80
2029	Lao PDR	LA_C1_st_can	Hydro	45	112
2029	Lao PDR	LA_S_st_can	Hydro	591	1473
2029	Cambodia	KH_gas_can	Gas	1127	789
2030	Lao PDR	LA_S_st_can	Hydro	195	486
2030	Cambodia	KH_gas_can	Gas	2095	1467
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	231	577
2031	Viet Nam	VN_S_stor_c	Hydro	28	71
2031	Viet Nam	VN_SHP_can	Hydro	575	1433
2031	Lao PDR	LA_C2_st_can	Hydro	554	1381
2031	Cambodia	KH_N2_rr_can	Hydro	1051	2619
2031	Cambodia	KH_S1_rr_can	Hydro	311	776

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_pot_gas	Gas	723	506
2031	Cambodia	KH_blk_hydro	Hydro	1077	2684
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2031	Myanmar	MM_run_can	Hydro	1057	2634
2032	Thailand	TH_coal_can	Coal	2963	5592
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	4141	6211
2032	Viet Nam	VN_solar_can	Solar	7595	7595
2032	Cambodia	KH_pot_gas	Gas	2469	1728
2033	Thailand	TH_coal_can	Coal	177	333
2033	Thailand	TH_gas_can	Gas	955	669
2033	Viet Nam	VN_coal_can	Coal	2885	6531
2033	Viet Nam	VN_S_wnd_can	Wind	1176	1764
2033	Lao PDR	LA_wind_can	Wind	500	750
2033	Lao PDR	LA_N_rr_can	Hydro	505	1259
2033	Cambodia	KH_pot_gas	Gas	2208	1546
2033	Myanmar	MM_run_can	Hydro	1495	3726
2034	Thailand	TH_gas_can	Gas	1865	1305
2034	Viet Nam	VN_coal_can	Coal	6263	14179
2035	Thailand	TH_gas_can	Gas	2796	1957
2035	Viet Nam	VN_coal_can	Coal	7459	16888
2035	Viet Nam	VN_C2_stor_c	Hydro	669	1667
2035	Viet Nam	VN_S_stor_c	Hydro	272	677
2035	Lao PDR	LA_N_rr_can	Hydro	2244	5594

402. The transmission plan for the “Increased power wheeling to Malaysia” scenario is shown in Table 137.

Table 137: Transmission plan for “Increased power wheeling to Malaysia” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432

2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2033	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182

42. Scenario “Increase of electric vehicles in Thailand”

403. The generation plan for the “Increase of electric vehicles in Thailand” scenario is shown in Table 138.

Table 138: Generation plan for “Increase of electric vehicles in Thailand” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	370	259
2022	Myanmar	MM_run_can	Hydro	731	1823
2024	Myanmar	MM_run_can	Hydro	3024	7538
2027	Lao PDR	LA_S_st_can	Hydro	94	234
2028	Lao PDR	LA_C2_st_can	Hydro	554	1381
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2029	Lao PDR	LA_N_st_can	Hydro	522	1301
2029	Lao PDR	LA_S_st_can	Hydro	357	889
2029	Cambodia	KH_gas_can	Gas	1322	926
2029	Myanmar	MM_run_can	Hydro	4147	10339
2030	Cambodia	KH_gas_can	Gas	1359	951
2030	Myanmar	MM_run_can	Hydro	376	937
2031	Viet Nam	VN_N1_stor_c	Hydro	108	270
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	360	898
2031	Viet Nam	VN_S_stor_c	Hydro	226	563
2031	Viet Nam	VN_SHP_can	Hydro	1396	3480
2031	Cambodia	KH_N2_rr_can	Hydro	889	2217
2031	Cambodia	KH_gas_can	Gas	549	384
2031	Cambodia	KH_S1_rr_can	Hydro	412	1028
2031	Cambodia	KH_pot_gas	Gas	989	692
2031	Cambodia	KH_blk_hydro	Hydro	415	1034

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	3140	5925
2032	Thailand	TH_gas_can	Gas	31	22
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2032	Viet Nam	VN_solar_can	Solar	3169	3169
2032	Lao PDR	LA_wind_can	Wind	500	750
2032	Lao PDR	LA_N_rr_can	Hydro	1457	3631
2032	Lao PDR	LA_C1_st_can	Hydro	45	112
2032	Cambodia	KH_N2_rr_can	Hydro	323	806
2032	Cambodia	KH_pot_gas	Gas	4161	2913
2033	Thailand	TH_gas_can	Gas	1363	954
2033	Viet Nam	VN_coal_can	Coal	3689	8352
2033	Cambodia	KH_pot_gas	Gas	250	175
2034	Thailand	TH_gas_can	Gas	2364	1655
2034	Viet Nam	VN_coal_can	Coal	6595	14930
2034	Lao PDR	LA_S_rr_can	Hydro	1355	3379
2034	Myanmar	MM_run_can	Hydro	974	2429
2035	Thailand	TH_gas_can	Gas	2370	1659
2035	Viet Nam	VN_coal_can	Coal	7422	16803
2035	Cambodia	KH_bulk_gas	Gas	41	28
2035	Myanmar	MM_run_can	Hydro	3157	7871

404. The transmission plan for the “Increase of electric vehicles in Thailand” scenario is shown in Table 139.

Table 139: Transmission plan for “Increase of electric vehicles in Thailand” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2031	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219

43. Scenario “PRC power wheeling”

405. The generation plan for the “PRC power wheeling” scenario is shown in Table 140.

Table 140: Generation plan for “PRC power wheeling” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	206	144
2024	Myanmar	MM_run_can	Hydro	4000	9972
2027	Lao PDR	LA_C2_st_can	Hydro	330	824
2027	Myanmar	MM_run_can	Hydro	1694	4223
2028	Lao PDR	LA_C1_st_can	Hydro	45	112
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	438	307
2029	Lao PDR	LA_S_st_can	Hydro	610	1521
2029	Cambodia	KH_gas_can	Gas	1412	989
2030	Cambodia	KH_gas_can	Gas	1402	982
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	622	435
2031	Viet Nam	VN_C2_stor_c	Hydro	406	1013
2031	Viet Nam	VN_S_stor_c	Hydro	85	212
2031	Viet Nam	VN_SHP_can	Hydro	309	769
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_N_rr_can	Hydro	875	2183
2031	Cambodia	KH_N2_rr_can	Hydro	432	1078
2031	Cambodia	KH_S1_rr_can	Hydro	66	164
2031	Cambodia	KH_pot_gas	Gas	303	212
2031	Cambodia	KH_blk_hydro	Hydro	403	1003
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	1296	2445
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	1628	1140
2032	Cambodia	KH_N2_rr_can	Hydro	573	1430
2032	Cambodia	KH_pot_gas	Gas	4450	3115
2032	Cambodia	KH_blk_hydro	Hydro	564	1406
2032	Myanmar	MM_run_can	Hydro	4517	11262
2033	Viet Nam	VN_coal_can	Coal	203	459
2033	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2033	Viet Nam	VN_solar_can	Solar	7595	7595
2033	Lao PDR	LA_C2_st_can	Hydro	224	558
2033	Lao PDR	LA_S_rr_can	Hydro	751	1872
2033	Cambodia	KH_gas_can	Gas	142	99
2033	Cambodia	KH_pot_gas	Gas	647	453
2034	Thailand	TH_coal_can	Coal	1844	3480
2034	Thailand	TH_gas_can	Gas	745	521
2034	Viet Nam	VN_coal_can	Coal	6638	15030
2035	Thailand	TH_gas_can	Gas	1004	703
2035	Thailand	TH_solar_can	Solar	10073	10073
2035	Viet Nam	VN_coal_can	Coal	7003	15855

406. The transmission plan for the “PRC power wheeling” scenario is shown in Table 141.

Table 141: Transmission plan for “PRC power wheeling” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	PRC	Thailand	Gan Lan Ba - Tha Wung via Lao PDR-N	HVDC	3000	1631
2026	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2026	PRC	Viet Nam	Yunnan - Hiep Hoa	HVDC	3000	1591

2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

44. Scenario "Further delayed interconnections"

407. The generation plan for the "Further delayed interconnections" scenario is shown in Table ***142***.

Table 142: Generation plan for "Further delayed interconnections" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_bio_can	Biomass	43	175
2022	Cambodia	KH_gas_can	Gas	182	127
2022	Myanmar	MM_run_can	Hydro	764	1904
2023	Cambodia	KH_gas_can	Gas	89	62
2024	Cambodia	KH_gas_can	Gas	166	116
2024	Myanmar	MM_run_can	Hydro	1086	2708
2025	Cambodia	KH_wnd_can	Wind	85	128
2025	Cambodia	KH_gas_can	Gas	318	222
2026	Cambodia	KH_sol_can	Solar	1090	1090
2026	Cambodia	KH_gas_can	Gas	543	380
2027	Cambodia	KH_gas_can	Gas	1035	724
2028	Cambodia	KH_gas_can	Gas	1023	716
2029	Lao PDR	LA_C2_st_can	Hydro	554	1381
2029	Cambodia	KH_gas_can	Gas	244	171
2029	Cambodia	KH_bulk_gas	Gas	798	558
2029	Myanmar	MM_run_can	Hydro	669	1667
2030	Lao PDR	LA_N_rr_can	Hydro	386	963
2030	Lao PDR	LA_S_rr_can	Hydro	311	776
2030	Lao PDR	LA_S_st_can	Hydro	1233	3074
2030	Myanmar	MM_run_can	Hydro	5381	13414
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2031	Viet Nam	VN_C2_stor_c	Hydro	535	1335
2031	Viet Nam	VN_S_stor_c	Hydro	192	479
2031	Viet Nam	VN_SHP_can	Hydro	752	1876
2031	Cambodia	KH_N2_rr_can	Hydro	1525	3801
2031	Cambodia	KH_pot_gas	Gas	512	359
2031	Cambodia	KH_blk_hydro	Hydro	577	1438
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	1929	3640

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_S_wnd_can	Wind	1591	2387
2032	Viet Nam	VN_solar_can	Solar	6239	6239
2032	Viet Nam	VN_C2_stor_c	Hydro	93	231
2032	Lao PDR	LA_C1_rr_can	Hydro	96	239
2032	Cambodia	KH_pot_gas	Gas	4888	3421
2032	Cambodia	KH_blk_hydro	Hydro	967	2412
2033	Thailand	TH_coal_can	Coal	1211	2285
2033	Viet Nam	VN_coal_can	Coal	3235	7324
2033	Viet Nam	VN_S_wnd_can	Wind	3725	5588
2034	Thailand	TH_gas_can	Gas	1324	927
2034	Viet Nam	VN_coal_can	Coal	5388	12199
2034	Viet Nam	VN_solar_can	Solar	1356	1356
2034	Lao PDR	LA_wind_can	Wind	500	750
2034	Lao PDR	LA_C1_st_can	Hydro	45	112
2034	Myanmar	MM_run_can	Hydro	748	1864
2035	Thailand	TH_gas_can	Gas	2081	1457
2035	Thailand	TH_solar_can	Solar	6593	6593
2035	Viet Nam	VN_coal_can	Coal	6074	13751
2035	Lao PDR	LA_N_st_can	Hydro	522	1301

408. The transmission plan for the "Further delayed interconnections" scenario is shown in Table ***143***.

Table 143: Transmission plan for "Further delayed interconnections" scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2030	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2030	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2030	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2030	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2030	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2030	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

45. Scenario “PRC export”

409. The generation plan for the “PRC export” scenario is shown in Table 144.

Table 144: Generation plan for “PRC export” scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	586	410
2022	Myanmar	MM_run_can	Hydro	1360	3390
2024	Myanmar	MM_run_can	Hydro	2574	6416
2027	Myanmar	MM_run_can	Hydro	1379	3437
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_wnd_can	Wind	85	128
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	179	125
2028	Myanmar	MM_run_can	Hydro	2347	5851
2029	Cambodia	KH_gas_can	Gas	1618	1132
2030	Lao PDR	LA_N_rr_can	Hydro	768	1915
2030	Lao PDR	LA_S_rr_can	Hydro	614	1530
2030	Cambodia	KH_gas_can	Gas	996	697
2030	Myanmar	MM_run_can	Hydro	515	1284
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_C2_stor_c	Hydro	385	960
2031	Viet Nam	VN_SHP_can	Hydro	419	1044
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_N_st_can	Hydro	522	1301
2031	Lao PDR	LA_C1_rr_can	Hydro	96	239
2031	Lao PDR	LA_C2_st_can	Hydro	49	123
2031	Cambodia	KH_N2_rr_can	Hydro	599	1493
2031	Cambodia	KH_gas_can	Gas	221	155
2031	Cambodia	KH_pot_gas	Gas	918	643
2031	Cambodia	KH_blk_hydro	Hydro	931	2321
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Lao PDR	LA_S_st_can	Hydro	37	91
2032	Cambodia	KH_S1_rr_can	Hydro	42	105
2032	Cambodia	KH_pot_gas	Gas	3670	2569
2032	Myanmar	MM_run_can	Hydro	802	1999
2033	Thailand	TH_coal_can	Coal	1359	2565
2033	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2033	Viet Nam	VN_solar_can	Solar	6951	6951

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Lao PDR	LA_S_st_can	Hydro	1196	2982
2033	Cambodia	KH_S1_rr_can	Hydro	378	942
2033	Cambodia	KH_pot_gas	Gas	812	568
2034	Thailand	TH_coal_can	Coal	1781	3361
2034	Viet Nam	VN_coal_can	Coal	6541	14808
2034	Viet Nam	VN_solar_can	Solar	644	644
2034	Myanmar	MM_run_can	Hydro	676	1686
2035	Thailand	TH_gas_can	Gas	1920	1344
2035	Viet Nam	VN_coal_can	Coal	6895	15609
2035	Myanmar	MM_run_can	Hydro	516	1287

410. The transmission plan for the “PRC export” scenario is shown in Table 145.

Table 145: Transmission plan for “PRC export” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	PRC	Thailand	Gan Lan Ba - Tha Wung via Lao PDR-N	HVDC	3000	1631
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2031	PRC	Viet Nam	Yunnan - Hiep Hoa	HVDC	3000	1591
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2034	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

46. Scenario "PRC import"

411. The generation plan for the "PRC import" scenario is shown in Table 146.

Table 146: Generation plan for "PRC import" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	268	187
2022	Myanmar	MM_run_can	Hydro	1635	4076
2024	Myanmar	MM_run_can	Hydro	2510	6257
2026	Lao PDR	LA_S_st_can	Hydro	912	2273
2027	Myanmar	MM_run_can	Hydro	1056	2633
2028	Lao PDR	LA_C1_st_can	Hydro	45	112
2028	Lao PDR	LA_S_rr_can	Hydro	368	919
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	555	389
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_gas_can	Gas	1080	756
2030	Lao PDR	LA_N_rr_can	Hydro	772	1925
2030	Lao PDR	LA_C2_rr_can	Hydro	275	686
2030	Lao PDR	LA_C2_st_can	Hydro	554	1381
2030	Cambodia	KH_gas_can	Gas	1532	1072
2030	Myanmar	MM_run_can	Hydro	1631	4066
2031	Viet Nam	VN_CC_can	Combined Cycle	434	304
2031	Viet Nam	VN_C2_stor_c	Hydro	262	654
2031	Viet Nam	VN_SHP_can	Hydro	488	1217
2031	Cambodia	KH_N2_rr_can	Hydro	715	1784
2031	Cambodia	KH_S1_rr_can	Hydro	63	157
2031	Cambodia	KH_pot_gas	Gas	370	259
2031	Cambodia	KH_blk_hydro	Hydro	473	1180
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Thailand	TH_coal_can	Coal	3140	5925
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	1816	1271
2032	Lao PDR	LA_wind_can	Wind	500	750
2032	Cambodia	KH_S1_rr_can	Hydro	357	890
2032	Cambodia	KH_pot_gas	Gas	4418	3093
2032	Cambodia	KH_blk_hydro	Hydro	229	572
2032	Myanmar	MM_run_can	Hydro	181	451
2033	Thailand	TH_solar_can	Solar	2322	2322
2033	Viet Nam	VN_N1_stor_c	Hydro	180	449

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2033	Viet Nam	VN_solar_can	Solar	7595	7595
2033	Cambodia	KH_gas_can	Gas	165	115
2033	Cambodia	KH_pot_gas	Gas	612	428
2033	Cambodia	KH_blk_hydro	Hydro	393	979
2033	Myanmar	MM_run_can	Hydro	2364	5894
2034	Thailand	TH_gas_can	Gas	1154	808
2034	Thailand	TH_solar_can	Solar	4936	4936
2034	Viet Nam	VN_coal_can	Coal	6775	15339
2034	Viet Nam	VN_S_stor_c	Hydro	300	748
2035	Thailand	TH_gas_can	Gas	2506	1754
2035	Thailand	TH_solar_can	Solar	3759	3759
2035	Viet Nam	VN_coal_can	Coal	6720	15213
2035	Lao PDR	LA_N_st_can	Hydro	522	1301

412. The transmission plan for the “PRC import” scenario is shown in Table 147.

Table 147: Transmission plan for “PRC import”” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	PRC	Thailand	Gan Lan Ba - Tha Wung via Lao PDR-N	HVDC	3000	1631
2026	PRC	Viet Nam	Yunnan - Hiep Hoa	HVDC	3000	1591
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2030	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2030	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2033	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2034	Lao PDR	Thailand	M. Houn - Nan	HVAC	3000	182
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

47. Scenario "PRC hydro export"

413. The generation plan for the "PRC hydro export" scenario is shown in Table 148.

Table 148: Generation plan for "PRC hydro export" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	232	162
2022	Myanmar	MM_run_can	Hydro	1193	2975
2024	Myanmar	MM_run_can	Hydro	3384	8437
2028	Lao PDR	LA_N_st_can	Hydro	522	1301
2028	Cambodia	KH_bio_can	Biomass	43	175
2028	Cambodia	KH_sol_can	Solar	1090	1090
2028	Cambodia	KH_gas_can	Gas	441	309
2028	Myanmar	MM_run_can	Hydro	2536	6322
2029	Cambodia	KH_wnd_can	Wind	85	128
2029	Cambodia	KH_gas_can	Gas	1357	950
2030	Cambodia	KH_gas_can	Gas	1377	964
2030	Myanmar	MM_run_can	Hydro	1858	4631
2031	Viet Nam	VN_N1_stor_c	Hydro	63	157
2031	Viet Nam	VN_CC_can	Combined Cycle	18	13
2031	Viet Nam	VN_C2_stor_c	Hydro	230	574
2031	Viet Nam	VN_S_stor_c	Hydro	163	406
2031	Viet Nam	VN_SHP_can	Hydro	248	618
2031	Lao PDR	LA_wind_can	Wind	500	750
2031	Lao PDR	LA_S_st_can	Hydro	977	2435
2031	Cambodia	KH_N2_rr_can	Hydro	433	1081
2031	Cambodia	KH_S1_rr_can	Hydro	86	213
2031	Cambodia	KH_pot_gas	Gas	699	490
2031	Cambodia	KH_blk_hydro	Hydro	816	2035
2031	Cambodia	KH_bulk_sol	Solar	1500	1500
2032	Viet Nam	VN_C_wnd_can	Wind	760	1139
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	2232	1562
2032	Viet Nam	VN_solar_can	Solar	2292	2292
2032	Viet Nam	VN_SHP_can	Hydro	368	917
2032	Lao PDR	LA_C2_st_can	Hydro	554	1381
2032	Cambodia	KH_N2_rr_can	Hydro	410	1022
2032	Cambodia	KH_pot_gas	Gas	3179	2225
2032	Myanmar	MM_run_can	Hydro	216	539
2033	Thailand	TH_coal_can	Coal	933	1761
2033	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2033	Viet Nam	VN_solar_can	Solar	5085	5085

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2033	Cambodia	KH_gas_can	Gas	193	135
2033	Cambodia	KH_pot_gas	Gas	1468	1028
2034	Thailand	TH_coal_can	Coal	2207	4164
2034	Viet Nam	VN_coal_can	Coal	6280	14219
2034	Viet Nam	VN_solar_can	Solar	218	218
2034	Lao PDR	LA_N_rr_can	Hydro	867	2163
2034	Cambodia	KH_pot_gas	Gas	54	38
2034	Myanmar	MM_run_can	Hydro	591	1474
2035	Thailand	TH_gas_can	Gas	1102	771
2035	Thailand	TH_solar_can	Solar	5899	5899
2035	Viet Nam	VN_coal_can	Coal	7181	16257
2035	Viet Nam	VN_N1_stor_c	Hydro	117	292

414. The transmission plan for the “PRC hydro export” scenario is shown in Table 149.

Table 149: Transmission plan for “PRC hydro export” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84
2024	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2024	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2025	Lao PDR	Viet Nam	Xekaman 4 HPP - Ban Soc/Ban Hatxan - Pleiku	HVAC	1000	215
2025	Lao PDR	Viet Nam	Luang Prabang HPP - Xam Nau (Lao PDR-N) - Nho Quan	HVAC	2500	432
2025	Lao PDR	PRC	Luang Prabang - Yunnan	HVAC	650	207
2025	Lao PDR	Viet Nam	Savannakhet - Ha Tihn	HVAC	600	137
2025	Lao PDR	Myanmar	Namo - Kenglatt - Tachileik - Kengtung	HVAC	800	250
2026	PRC	Thailand	Gan Lan Ba - Tha Wung via Lao PDR-N	HVDC	3000	1631
2027	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2028	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2031	PRC	Viet Nam	Yunnan - Hiep Hoa	HVDC	3000	1591
2032	Lao PDR	Viet Nam	Nam Mo HPP - Ban Ve	HVAC	120	219
2035	Thailand	Cambodia	Wangnoi - Banteay Mean Chey – Siem Reap - Kampong Cham	HVAC	300	524

48. Scenario “M_GAS_INT”

415. The generation plan for the “M_GAS_INT” scenario is shown in Table 150.

Table 150: Generation plan for "M_GAS_INT" scenario

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2022	Cambodia	KH_gas_can	Gas	215	151
2023	Cambodia	KH_gas_can	Gas	53	37
2023	Myanmar	MM_run_can	Hydro	1624	4049
2025	Lao PDR	LA_N_st_can	Hydro	522	1301
2026	Lao PDR	LA_S_st_can	Hydro	836	2085
2026	Myanmar	MM_run_can	Hydro	4352	10849
2028	Lao PDR	LA_S_rr_can	Hydro	398	992
2028	Myanmar	MM_run_can	Hydro	951	2370
2029	Lao PDR	LA_wind_can	Wind	500	750
2029	Lao PDR	LA_C2_rr_can	Hydro	141	351
2029	Lao PDR	LA_C2_st_can	Hydro	554	1381
2030	Myanmar	MM_run_can	Hydro	2134	5320
2031	Viet Nam	VN_N1_stor_c	Hydro	180	449
2031	Viet Nam	VN_C2_stor_c	Hydro	33	83
2031	Viet Nam	VN_S_stor_c	Hydro	27	68
2031	Viet Nam	VN_SHP_can	Hydro	363	904
2031	Lao PDR	LA_N_rr_can	Hydro	695	1734
2031	Lao PDR	LA_C1_st_can	Hydro	45	112
2031	Cambodia	KH_N2_rr_can	Hydro	452	1128
2031	Cambodia	KH_blk_hydro	Hydro	596	1485
2032	Viet Nam	VN_gas_can	Gas	1500	1050
2032	Viet Nam	VN_CC_can	Combined Cycle	2250	1575
2032	Viet Nam	VN_C2_stor_c	Hydro	545	1358
2032	Viet Nam	VN_SHP_can	Hydro	10	25
2032	Lao PDR	LA_N_rr_can	Hydro	448	1117
2032	Lao PDR	LA_C1_rr_can	Hydro	83	207
2032	Cambodia	KH_gas_can	Gas	1234	864
2032	Cambodia	KH_pot_gas	Gas	3954	2768
2032	Myanmar	MM_run_can	Hydro	1175	2930
2033	Thailand	TH_gas_can	Gas	4415	3090
2033	Viet Nam	VN_C_wnd_can	Wind	760	1139
2033	Viet Nam	VN_solar_can	Solar	7595	7595
2033	Lao PDR	LA_S_rr_can	Hydro	281	702
2033	Cambodia	KH_N2_rr_can	Hydro	535	1333
2033	Cambodia	KH_S1_rr_can	Hydro	37	92
2033	Cambodia	KH_pot_gas	Gas	1446	1012
2033	Myanmar	MM_run_can	Hydro	79	196
2034	Thailand	TH_gas_can	Gas	3735	2614
2034	Viet Nam	VN_coal_can	Coal	2788	6312

Year	Country	Project	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2034	Viet Nam	VN_S_wnd_can	Wind	5317	7975
2034	Cambodia	KH_blk_hydro	Hydro	189	472
2034	Myanmar	MM_wind_can	Wind	2461	3692
2035	Thailand	TH_gas_can	Gas	251	175
2035	Thailand	TH_solar_can	Solar	634	634
2035	Viet Nam	VN_coal_can	Coal	5497	12445
2035	Viet Nam	VN_S_stor_c	Hydro	273	679
2035	Lao PDR	LA_N_rr_can	Hydro	1605	4002
2035	Lao PDR	LA_C1_rr_can	Hydro	13	32
2035	Cambodia	KH_bio_can	Biomass	43	175
2035	Cambodia	KH_sol_can	Solar	1090	1090
2035	Cambodia	KH_gas_can	Gas	2098	1468
2035	Cambodia	KH_blk_hydro	Hydro	455	1134
2035	Cambodia	KH_bulk_sol	Solar	1500	1500
2035	Myanmar	MM_run_can	Hydro	578	1441
2035	Myanmar	MM_wind_can	Wind	439	658

416. The transmission plan for the “M_GAS_INT” scenario is shown in Table 151.

Table 151: Transmission plan for “M_GAS_INT” scenario

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2024	Myanmar	Thailand	Mawlamyine - Tha Tako	HVAC	1500	184
2024	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2024	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2024	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2025	Myanmar	Thailand	Yangon area - Mae Moh	HVAC	1500	207
2025	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2025	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2025	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Ban Soc/Ban Hatxan - Tay Ninh via Stung Treng	HVAC	1000	238
2026	Myanmar	PRC	Mandalay - Yunnan	HVAC	600	207
2026	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2026	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2026	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2026	Lao PDR	Cambodia	Lao PDR - Cambodia	HVAC	1500	125
2026	Lao PDR	Myanmar	Lao PDR - Myanmar	HVAC	1500	144
2027	Thailand	Cambodia	Thailand - Cambodia	HVAC	1500	290
2027	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125

Year	From	To	Connection Points	Type	Capacity (MW)	Investment Cost ($ million of commission year)
2028	Viet Nam	Cambodia	Viet Nam - Cambodia	HVAC	1500	125
2031	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2032	Cambodia	Viet Nam	Kampong Cham - Tay Ninh	HVAC	300	154
2032	Thailand	Myanmar	Thailand - Myanmar	HVAC	1500	217
2033	Cambodia	Viet Nam	Lower Se San 2 HPP - Pleiku	HVAC	200	247
2033	Lao PDR	Viet Nam	Lao PDR - Viet Nam	HVAC	1500	242
2035	Myanmar	Thailand	Mae Khot TPP - Mae Chan	HVAC	370	84

C. Appendix 3: Generation Availability

417. Daily and Monthly solar and wind energy availability is determined from daily and monthly solar and wind energy variation curves, shown in Figure 43, Figure 44, and Figure 45. An example of the availability curve for solar PV with battery storage system is shown in Figure 46. The availability of hydro generation is modeled based on the flow of the Mekong River, shown in Figure ***47***.

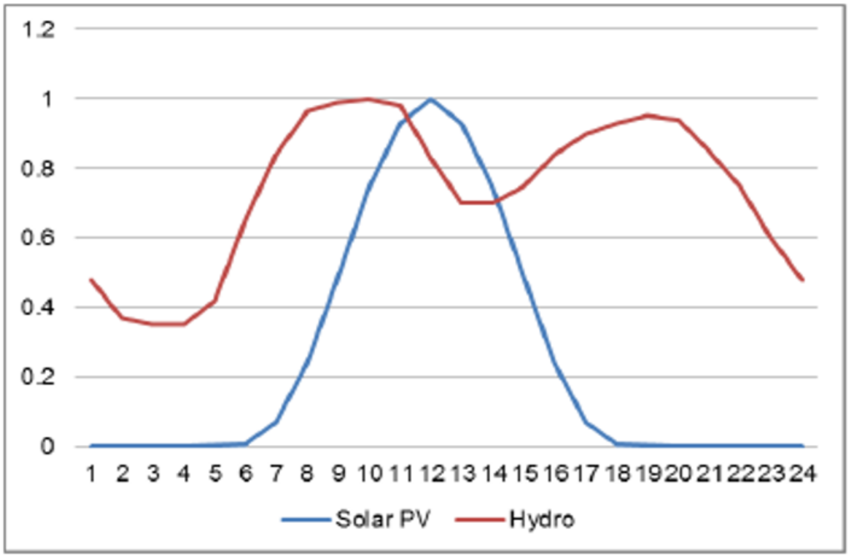

Figure 43: Myanmar Daily Solar energy

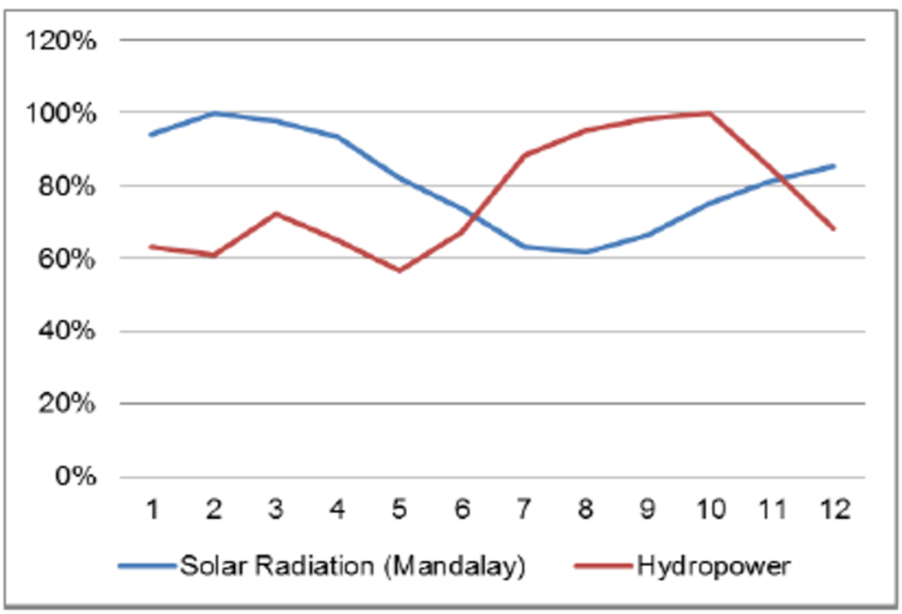

Figure 44: Myanmar Monthly Solar energy

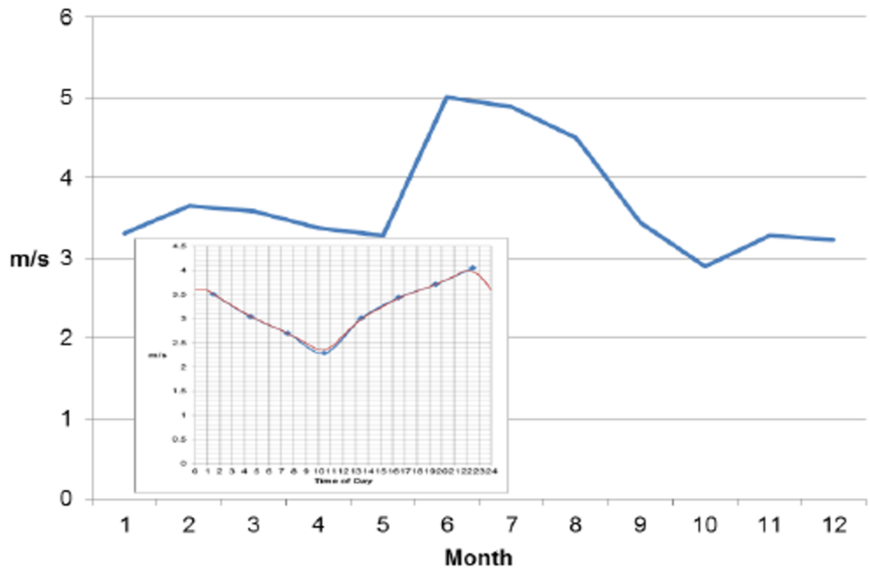

Figure 45: Myanmar Daily and Monthly Wind energy

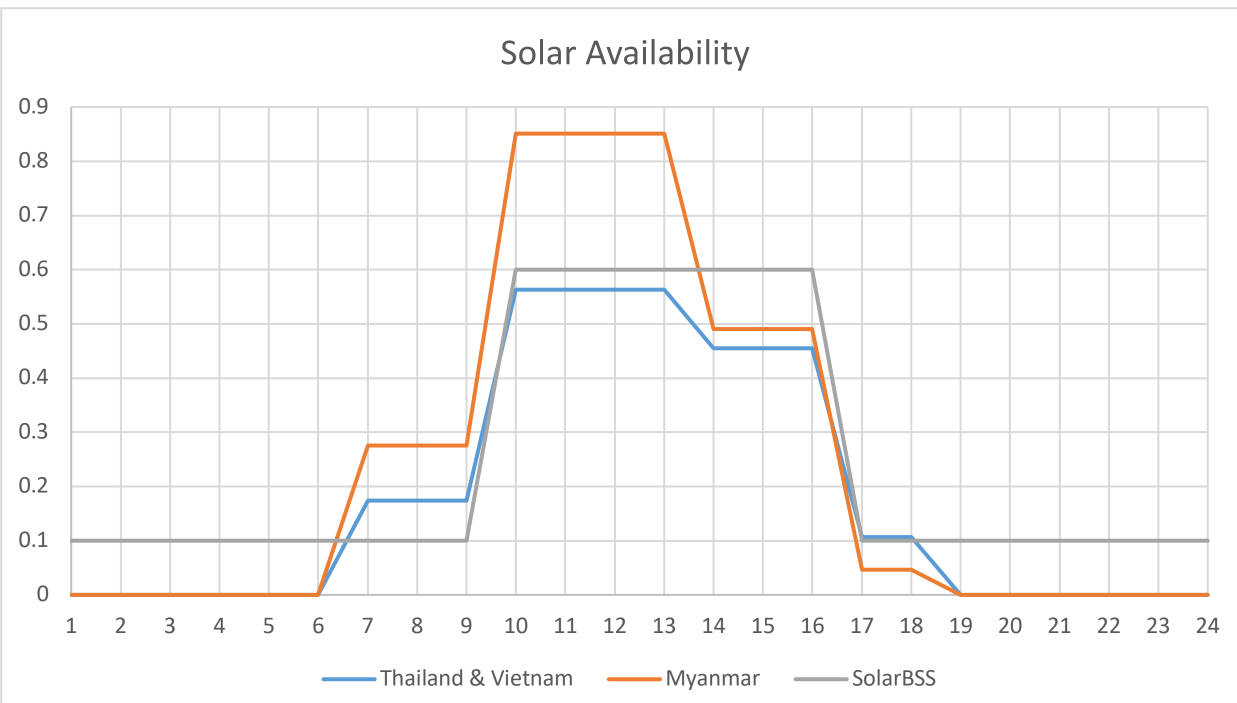

Figure 46: Solar with BSS availability curve for January

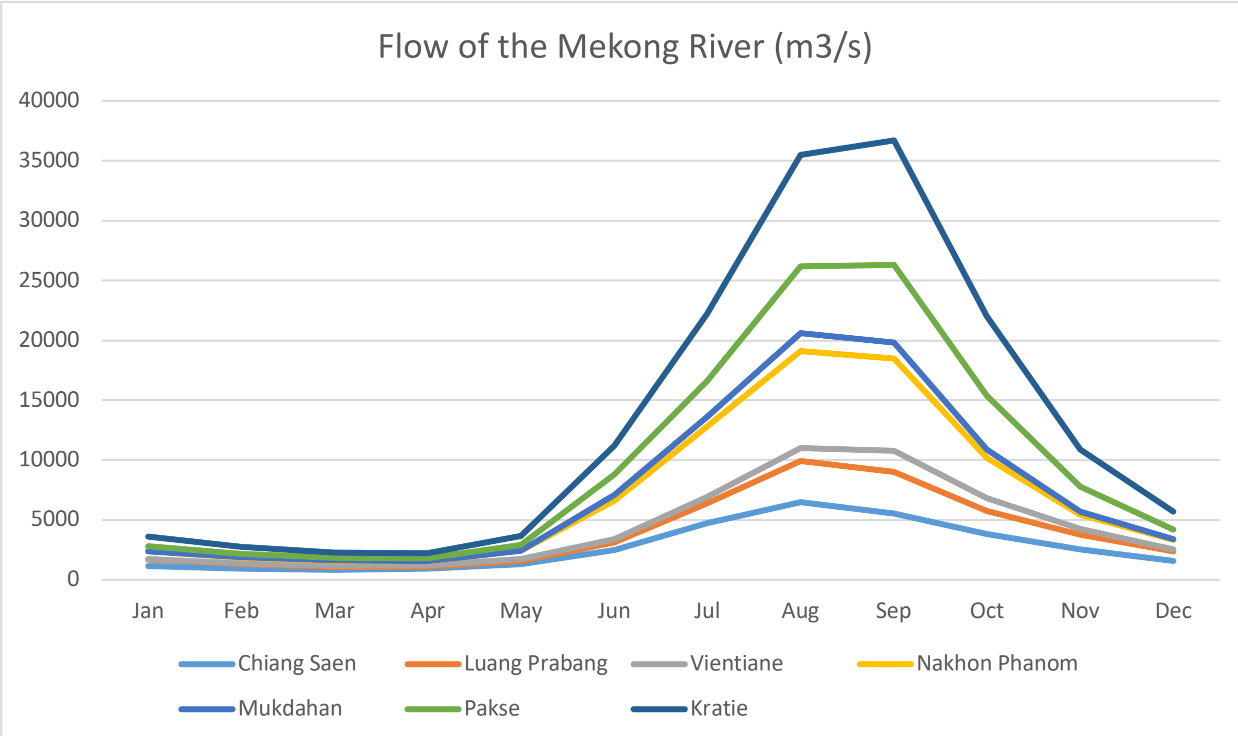

Figure 47: Flow of the Mekong River

D. Appendix 4: Generation and Transmission Cost Estimations

418. Generation cost estimates for the "M_BASE" scenario are given in Table 152. The investment cost of transmission is calculated based on the values shown in Table 153.

Table 152: Generation costs for M_BASE scenario

Type	Lifetime	Invest cost ($/kW)	Fixed O&M ($/kW/year)	Variable O&M ($/MWh)
Gas	20	700	18	3.6
CC	20	700	11	3.6
Coal[31]	50	2,264	72	7.3
Nuclear	50	5,026	103	2.4
Hydro	60	2,493	41	1.4
Solar	25	1,000	22	0
Wind	30	1,500	48	0
Biomass	20	4,060	114	5.7

Table 153: Transmission costs

Type	Lifetime	Line (k$/km)	Transformer (k$/MVA)	Station ($ million/substation)
Circuit	60	463	11	14.1
Point-to-Point HVDC	60	394.365	-	559.125
Back-to-Back HVDC	60	-	-	838.7

[31] The Investment cost used for coal generation in Thailand is 1,887 $/kW.

E. Appendix 5: Comments Matrix

Country/ Company	Comment	Action
Thailand	1. Extend the transmission planning period to 2032	The transmission planning period is extended to 2032
	2. Impact of electrical vehicles	A sensitivity scenario is studied where Thailand has additional demand of electric vehicles added
	3. No-super critical Coal in Thailand	The coal fuel price and investment cost in Thailand is adjusted according to the relative efficiencies and costs of subcritical coal plants compared to supercritical coal plants
	4. Thailand is interested in low gas price analysis	The low gas, aggressive cross-border power trade scenario with medium demand growth is studied as a sensitivity scenario
	5. Import from 1st interconnected country – limited to 14% of maximum demand, 13% of max. demand for each new importing country	Import restrictions are added for all interconnections connecting Thailand, with import from Lao PDR limited to 14% of maximum demand, and imports from other countries limited to 13% of maximum demand
	6. Use $700/kW as investment cost for combined cycle	The investment cost for combined cycle is updated to $700/kW for entire GMS region
	7. 50% of hydro plants in Lao PDR are reservoir type, reservoir type plants in Lao can operate full capacity for whole year	The size of reservoirs in Lao PDR is increased such that they are capable of running at full output for an entire year with just the water from the reservoir
	8. Thailand only has one run of river type hydro plants	Investigation revealed that "Pak Mun Dam" is the only run-of-river hydro plant in Thailand. Thailand hydro types have been updated
	9. In addition to GMS region interconnections, there's a Thailand -Malaysia interconnections	The Thailand - Malaysia interconnection has been modeled as a constant 300 MW load in Thailand
Viet Nam	1. Nuclear scenario obsolete (not build at least until 2030)	The nuclear scenario has been updated such that candidate nuclear cannot be built before 2030
	2. Battery storage not beneficial according to other analysis	Battery storage scenarios are retained as a main scenario

Country/ Company	Comment	Action
	3. Delayed interconnections scenario/ reduced interconnections (assuming countries are not willing and the infrastructure and grid code requirements not satisfied to support interconnections)	A sensitivity scenario is added where the candidate grid-grid interconnections are delayed to 2030
	4. Agreement with LAO to import 1 GW	Interconnection sum constraints have been implemented for Lao PDR - Viet Nam transfer
	5. Import from PRC - from 220 kV lines , 800 MW at present	The import from PRC is included in the model
	6. From Cambodia, import is 250 MW at present using 220 kV lines	The 220 kV line to Cambodia in included in the model
	7. Lao 1GW import by 2020 and plans to import 3GW by 2025 and 5GW by 2030 (MOU)	Interconnection sum constraints have been implemented for Lao PDR - Viet Nam transfer
	8. Consider Low carbon emission scenario	A sensitivity scenario has been added where a carbon cost is included for thermal generation
	9. Consider network upgrade cost to support interconnection	The internal network upgrade costs are described in section VII.D.
	10. Individual country policies about power trade should be considered	The individual county policies about power trade has been included by addressing other comments, which relate to the power trade policies (eg. Thailand import limit, Viet Nam import limits from Lao PDR, Lao PDR grid-grid interconnections delayed, etc..)
	11. Maximum power import limit from a given country and total import limit should be considered	Import limits have been applied for Thailand and Viet Nam in the model
	12. Dry future scenario - low hydro due to climate change or add probability of hydro change (if historical flow rates are available)	A sensitivity scenario is added with -20% hydro inflows throughout the study period
	13. Consider demand side management	Viet Nam demand has been adjusted for to include the effects of demand side management
	14. Consider 7 cents/kWh for power import as a typical value	The power import price used is updated to 7 cents/kWh

Country/ Company	Comment	Action
	15. Send official letters through ADB for inputs from individual countries	Noted
Lao PDR	1. Backbone transmission system in Laos need to be developed for export and general power system strength by 2030 (about 700 km, double circuit 500 kV system) - about $500 million investment	This is part of Lao PDR plan and does not affect the candidate interconnections since grid-grid interconnections are delayed till 2030 due to next comment. Generator - grid interconnections should not be affected since they are part of importing country's grid instead of Lao PDR grid.
	2. No system to system interconnection recommended till 2030 (Lao master plan)	Grid - grid interconnections from Lao PDR have been delayed until 2030 in the delayed interconnections sensitivity scenario, as well as in models 'B' and 'C' described in Chapter VIII
	3. Two interconnection options for Thailand (synchronize by 2030 with Thailand or go for back-to-back HVDC)	Back-to-back HVDC candidates are considered in model 'B' described in Chapter VIII
	4. No governors in some hydro generators. Some IPPs have governors, but use constant power setting (no droop control)	The challenges of interconnecting is described in Chapter VIII
	5. Thailand may increase the power import from Laos and sell more power to Malaysia	An additional scenario is added where the power sent to Malaysia is increased by 1000 MW
PRC	1. PRC no longer has excess power to export from 2023.	The model has been updated to remove generation in PRC. Also, the HVDC candidates from PRC to Thailand and Viet Nam are not considered except for certain sensitivity scenarios
	2. PRC may consider power export or import after 2030.	A sensitivity scenarios are studied with PRC export or import after 2030
	3. There may be new hydro development (about 7 GW) around 2025. Then, PRC may export about 2 GW.	A sensitivity scenario will be studied with 2 GW hydro generation in PRC
	4. PRC presentation mentioned new interconnection possibilities to Thailand, Viet Nam, Loa PDR, Myanmar. However, it did not mention any plans to export.	The candidate interconnections connecting to PRC have been double-checked with latest information
Myanmar	1. New Solar developments are going on. More details are given in country presentation	Myanmar solar modeling has been updated from presentation data

Country/ Company	Comment	Action
ADB	1. Requested to mention why study period end in 2035 (data uncertainty). Requested to mention in the report that study period need to be extended by individual countries when they develop the country master plans	The reasoning for study period end date is explained in Chapter IV.
	2. The study update results may be deviated more or less due to COVID-19 situation	A sensitivity scenario is added to show the impact of decreased demand due to COVID-19
EDF	1. Add a scenario to represent low carbon emissions in the light of Paris agreement	A sensitivity scenario has been added where a carbon cost is included for thermal generation

F. Appendix 6: Terms of Reference

1. TERMS OF REFERENCE - Power System Economist/Team Leader

Contract	131014-S92658
Project	TA-8830 REG: Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade - 01 Power System Economist/Team Leader (47129-001)
Expertise	Power System Economist/Team Leader
Source	International

Objective and Purpose of the Assignment

Under the regional technical assistance TA 8830-Reg "Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade", international consultants will be engaged to provide a comprehensive study on generation and transmission development opportunities for cross-border electricity trade among GMS countries. The services of three international consultants for a total of 12 person-months are envisaged on intermittent basis from January 2017 to December 2017.

The TA 8830 is being executed by the Asian Development Bank (ADB) with the assistance and guidance of the GMS countries. ADB will recruit the three consultants: (i) international power system economist; (ii) power generation planning specialist; and (iii) power transmission planning specialist as individual consultants in accordance with its Guidelines on the Use of Consultants (2013, as amended from time to time). Disbursements will be made in accordance with ADB's Technical Assistance Disbursement Handbook.

ADB, under its previous regional technical assistance TA 6440-REG "Facilitating Regional Power Trading and Environmentally Sustainable Development of electricity Infrastructure in the Greater Mekong Subregion" various studies were completed. In particular: (i) a GMS reference document on performance standards; (ii) a preliminary report on metering arrangement; (iii) review of regulatory framework in the GMS countries; (iv) conceptual design of GMS market. The consultants to be recruited under this assignment will make use of the results achieved under the TA 6440-REG, TA8830-REG and other assistances provided by ADB.

The consultants shall recommend options for GMS regional power trade with infrastructure development needs through generation and transmission system studies, and economic assessments.

The recommendations shall include what are the technical improvements required in the power systems in each GMS country in order to maximize the benefits from the power trading, and preliminary assessment of already identified cross-border interconnection opportunities among GMS member countries. The consultants will:

(i) Identify/develop power generation options and estimate the potential of their energy outputs using both relevant past data and climate change model based future projected data capturing their availability, and transport constraints.
(ii) Develop a regional generation plan up to 2035 expanding on existing national generation master plans and taking into account both renewable and non-renewable energy resources availability. (iii) Conduct primary data collection and analysis and develop a 220 kV and above regional transmission planning dataset for the long term up to 2030.
(iii) Import or convert such data to use with PSS/E or other planning software having a common data format in accordance with international standards, IEEE.
(iv) Develop a Regional Transmission Master Plan up to 2030 with a key focus area to identify economic opportunities for cross-border power exchanges. Take into account country level or sub-country regional power surpluses and deficits (existing and projected), the different peak demand periods (daily and seasonal), different generating capacity mixes and level and timing of peak load/production (daily and seasonal) among the GMS countries. As part of this, include and evaluate already identified cross-border transmission interconnections.
(v) Disaggregate the economic benefits country-wise for each of the transmission links involved.

Scope of Work

The international power system economist will act as the team leader and shall coordinate the overall work program with generation and transmission planning experts engaged under the TA and also facilitate communication with ADB. This consultant will be responsible for consolidating and compiling the inception report, interim report, draft final report and the final report, quality of the reports, and presentations at all the meetings and dissemination activities. The consultants are expected to participate in ADB's mission when required and contribute to preparing all reports. The consultants will be responsible for the quality and timely delivery of the assigned tasks, such as reports, procedures, and related knowledge development activities.

Detailed Tasks and/or Expected Output

The tasks will include, but not be limited, to the following:

(i) Working closely with ADB and prepare a detailed work program for the study;
(ii) Supervise the data collection efforts and closely interact with the generation and transmission planning specialists to ensure consistency of assumptions that form inputs to the planning studies; (iii) Guide Countries to update national network models and system studies for a planning horizon minimum up to 2035 for generation and minimum upto 2030 for transmission with the support of generation and transmission experts;
(iii) Work with the international generation and transmission specialists, monitor and review all their activities, outputs and provide comments and suggestions drawing experience from other regions and international best-practices;
(iv) Undertake a literature review of international best practice in interconnection planning including regulatory processes, planning methods, modelling techniques and implementation of generation and transmission plans for real-life power systems;
(v) Propose strategy criteria for establishing regional network models (scope, methodology, software, data sharing etc.) in coordination with the countries; and taking into account already identified cross-border interconnection opportunities including Lao-Myanmar, People's Republic of China (PRC)
(vi) (Yunnan)-Myanmar, PRC (Yunnan)-Thailand, PRC (Yunnan)-Viet Nam;
(vii) Develop a set of scenarios for regional transmission planning exercise combining an internally consistent set of key parameters around demand growth, fuel price, renewable and non-renewable resource availability, and carbon reduction target;
(viii) Undertake a composite generation and transmission planning optimisation for the GMS to identify economic cross-border power trade opportunities from now til 2030 covering a base case and at minimum three major scenarios;
(ix) Based on the findings of the modelling exercise, develop a detailed cost-benefit analysis of alternative transmission expansion options for GMS regional power trading including benefits disaggregated country-wise for each of the transmission links;
(x) Develop a clear set of recommendations on long term cross-border transmission capacity in the region along with justifications based on benefits to individual countries;
(xi) Act as the team leader and consolidate and compile the inception report, interim report, draft final report and the final report; and quality assurance of all the reports;

(xii) Attend the intergovernmental and other relevant meetings, workshops, dissemination/awareness seminars and technical visits as a resource person and presentations at the meetings and dissemination activities requested by ADB;

(xiii) Lead and prepare a knowledge product related to energy trade in GMS resulting from the TA activities; and

(xiv) Assist ADB in arranging capacity development programs including the meetings related to RPTCCactivities including the establishment of a planning cell to continue the regional master planning studies and yearly updating

Minimum Qualification Requirements

The consultant, should have postgraduate qualifications and a minimum of 15 years experience in power systems engineering and economics together with the ability to understand power system studies (generation and transmission) including good understanding of modeling of renewable resource energy output variation and stochasticity. The consultant shall also have experience in regional power interconnections, control and operations aspects, and the legal and regulatory aspects of a power exchange.

Minimum General Experience	15	**Years**
Minimum Specific Experience (relevant to assignment)	15	**Years**
Regional/Country Experience	Required	

Deliverables	**Estimated Submission Date**	**Type**
Inception Report	01-Mar-2017	Report
Interim Report	31-Aug-2017	Report
Draft Final Report	30-Nov-2017	Report
Final Report	31-Dec-2017	Final Report
Other reports	31-Dec-2017	Final Report

Description A report within 1 week after conducting the dissemination seminar, summarizing its proceedings; and

	A knowledge product on GMS regional power trade opportunities, challenges and benefits using the results of the engagement prepared under the guidance of ADB.

2. TERMS OF REFERENCE - Power Transmission Planning Specialist

Contract	131129-S92641
Project	TA-8830 REG: Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade - 03 Power Transmission Planning Specialist (47129-001)
Expertise	Power Transmission Planning Specialist
Source	International

Objective and Purpose of the Assignment

Under the regional technical assistance TA 8830-Reg "Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade", international consultants will be engaged to provide a comprehensive study on generation and transmission development opportunities for cross-border electricity trade among GMS countries. The services of three international consultants for a total of 11 person-months are envisaged on intermittent basis from February 2017 to December 2017.

The TA 8830 is being executed by the Asian Development Bank (ADB) with the assistance and guidance of the GMS countries. ADB will recruit the three consultants: (i) international power system economist; (ii) power generation planning specialist; and (iii) power transmission planning specialist as individual consultants in accordance with its Guidelines on the Use of Consultants (2013, as amended from time to time). Disbursements will be made in accordance with ADB's Technical Assistance Disbursement Handbook.

ADB, under its previous regional technical assistance TA 6440-REG "Facilitating Regional Power Trading and Environmentally Sustainable Development of electricity Infrastructure in the Greater Mekong Subregion" various studies were completed. In particular: (i) a GMS reference document on performance standards; (ii) a preliminary report on metering arrangement; (iii) review of regulatory framework in the GMS countries; (iv) conceptual design of GMS market. The consultants to be

recruited under this assignment will make use of the results achieved under the TA 6440-REG, TA8830-REG and other assistances provided by ADB.

The consultants shall recommend options for GMS regional power trade with infrastructure development needs through generation and transmission system studies, and economic assessments. The recommendations shall include what are the technical improvements required in the power systems in each GMS country in order to maximize the benefits from the power trading, and preliminary assessment of already identified cross-border interconnection opportunities among GMS member countries. The consultants will:

(i) Identify/develop power generation options and estimate the potential of their energy outputs using both relevant past data and climate change model based future projected data capturing their availability, and transport constraints.
(ii) Develop a regional generation plan upto 2035 expanding on existing national generation master plans and taking into account both renewable and non-renewable energy resources availability.
(iii) Conduct primary data collection and analysis, and develop a 220 kV and above regional transmission planning dataset for the long term up to 2030.
(iv) Import or convert such data to use with PSS/E or other planning software having a common data format in accordance with international standards, IEEE.
(v) Develop a Regional Transmission Master Plan upto 2030 with a key focus area to identify economic opportunities for cross-border power exchanges. Take into account country level or sub-country regional power surpluses and deficits (existing and projected), the different peak demand periods (daily and seasonal), different generating capacity mixes and level and timing of peak load/production (daily and seasonal) among the GMS countries. As part of this, include and evaluate already identified cross-border transmission interconnections.
(vi) Disaggregate the economic benefits country-wise for each of the transmission links involved.

Scope of Work

The international Power Transmission Planning Specialist will act as the team leader, and he/she will coordinate the overall work program with generation and transmission planning experts engaged under the TA. The team leader will also consolidate and compile the inception report, interim report, draft final report and the final report. The consultants are expected to participate in ADB's mission when required and contribute to preparing all reports. The consultants will be

responsible for the quality and timely delivery of the assigned tasks, such as reports, procedures, and related knowledge development activities.

Detailed Tasks and/or Expected Output

His tasks will include, but not be limited, to the following:

(i) Conduct primary data collection and analysis, and develop a 220 kV and above regional transmission planning dataset for the long term up to 2030.

(ii) Import or convert such data to use with PSS/E or other planning software having a common data format in accordance with international standards, IEEE.

(iii) Prepare a model database for transmission planning software used by the power system economist

– team leader (cleaning, inputting and checking all country data);

(iv) Develop a common set of power transmission planning assumptions for the region up to 2030 collating existing plans and any generic assumptions needed;

(v) Guide Countries to update national transmission plans upto 2030 considering load growth and planned system expansions;

(vi) Develop a zonal approximation of the integrated GMS power system suitable for long term planningoptimization;

(vii)Develop alternative cross-border transmission capacity expansion scenarios;

(viii) Recommend most feasible transmission network configuration for interconnections (transmission voltage, alternate current or direct current transmission, modern transmission technologies among other). Provide recommendations on performance standards and grid codes proposed for interconnected transmission system;

(ix) Conduct a regional transmission system study. The study should include different credible operating scenarios, steady state analysis, short circuit analysis and dynamic stability analysis. The regional transmission system study should take into consideration already identified cross-border interconnection opportunities including Lao-Myanmar, People's Republic of China (PRC)

(Yunnan)-Myanmar, PRC (Yunnan)-Thailand, PRC (Yunnan)-Viet Nam among others;

(x) Prepare regional transmission master plan up to 2030 with a key focus area to identify economic opportunities for cross-border power exchanges based on the regional generation plan;

(xi) Review and complete the studies on GMS performance standards, transmission regulations, standard regional metering arrangements, and grid codes operational procedures proposed under TA
6440 and subsequent reviews; and provide recommendations;

(xii) Recommend studies to identify specific grid reinforcements (performance gaps) in each of the transmission systems that are required to maintain grid code compliant operations from both steady sate and dynamic response point of view, and provide indicative terms of reference to engage consultants to undertake such studies; and

(xiii) Prepare the chapters relevant to power transmission in coordination with the team leader for the knowledge product on energy trade in GMS.

Minimum Qualification Requirements

The consultant should have qualifications in electrical engineering/power systems preferably at postgraduate level and a minimum 20 years experience including minimum 15 years experience in power system transmission planning.

Minimum General Experience	10	**Years**
Minimum Specific Experience (relevant to assignment)	15	**Years**
Regional/Country Experience	Required	

Deliverables	**Estimated Submission Date**	**Type**
Inception Report	06-Feb-2017	Report

Description with a detailed work program

Interim Report	30-Jun-2017	Report
Draft Final Report	31-Oct-2017	Report

Description Draft final report which shall include: (a) regional generation master plan, (b) regional transmission master plan including recommendations of the technical improvements required in the power systems in each GMS country for interconnected operation, and regional performance standards and grid codes, (d) and preliminary assessment of already identified cross-border interconnection opportunities among GMS member countries;

Other Reports	31-Oct-2017	Final Report
Description Materials for dissemination seminar		
Final Report	31-Dec-2017	Final Report
Description The final report incorporating responses to comments on the draft final report by GMS countries and ADB;		

3. TERMS OF REFERENCE - Generation Specialist

Project	TA-8830 REG: Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade - 02 Power Generation Planning Specialist (47129-001)
Expertise	Generation Specialist
Source	International

Objective and Purpose of the Assignment

Under the regional technical assistance TA 8830-Reg "Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade", international consultants will be engaged to provide a comprehensive study on generation and transmission development opportunities for cross-border electricity trade among GMS countries. The services of three international consultants for a total of 13 person-months are envisaged on intermittent basis from November 2016 to December 2017.

The TA 8830 is being executed by the Asian Development Bank (ADB) with the assistance and guidance of the GMS countries. ADB will recruit the three consultants: (i) international power system economist; (ii) power generation planning specialist; and (iii) power transmission planning specialist as individual consultants in accordance with its Guidelines on the Use of Consultants (2013, as amended from time to time). Disbursements will be made in accordance with ADB's Technical Assistance Disbursement Handbook.

ADB, under its previous regional technical assistance TA 6440-REG "Facilitating Regional Power Trading and Environmentally Sustainable Development of electricity Infrastructure in the Greater Mekong Subregion" various studies were completed. In particular: (i) a GMS

reference document on performance standards; (ii) a preliminary report on metering arrangement; (iii) review of regulatory framework in the GMS countries; (iv) conceptual design of GMS market. The consultants to be recruited under this assignment will make use of the results achieved under the TA 6440-REG, TA8830-REG and other assistances provided by ADB.

The consultants shall recommend options for GMS regional power trade with infrastructure development needs through generation and transmission system studies, and economic assessments. The recommendations shall include what are the technical improvements required in the power systems in each GMS country in order to maximize the benefits from the power trading, and preliminary assessment of already identified cross-border interconnection opportunities among GMS member countries. The consultants will:

(i) Identify/develop power generation options and estimate the potential of their energy outputs using both relevant past data and climate change model based future projected data capturing their availability, and transport constraints.
(ii) Develop a regional generation plan upto 2035 expanding on existing national generation master plans and taking into account both renewable and non-renewable energy resources availability.
(iii) Conduct primary data collection and analysis, and develop a 220 kV and above regional transmission planning dataset for the long term up to 2030.
(iv) Import or convert such data to use with PSS/E or other planning software having a common data format in accordance with international standards, IEEE.
(v) Develop a Regional Transmission Master Plan upto 2030 with a key focus area to identify economic opportunities for cross-border power exchanges. Take into account country level or sub-country regional power surpluses and deficits (existing and projected), the different peak demand periods (daily and seasonal), different generating capacity mixes and level and timing of peak load/production (daily and seasonal) among the GMS countries. As part of this, include and evaluate already identified cross-border transmission interconnections.
(vi) Disaggregate the economic benefits country-wise for each of the transmission links involved.

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Scope of Work

The international power system economist will act as the team leader, and he/she will coordinate the overall work program with generation and transmission planning experts engaged under the TA. The team leader will also consolidate and compile the inception report, interim report, draft final report and the final report. The consultants are expected to participate in ADB's mission when required and contribute to preparing all reports. The consultants will be responsible for the quality and timely delivery of the assigned tasks, such as reports, procedures, and related knowledge development activities

Detailed Tasks and/or Expected Output

His tasks will include, but not be limited, to the following:

(i) Collect detailed generation expansion planning data for all GMS countries (for example, data from national master plans and other key governmental reports) including: (a) existing generation sources including surplus capacity available for exporting, (b) generation sources down to power station names, capacity, cost etc., (c) demand projections, (d) reliability criteria, and (e) generation development scenarios;
(ii) Develop an analysis of renewable power development in the region including a comparative analysis of national renewable energy targets vis-à-vis regional renewable energy target, taking into consideration the stochastic nature of renewable energy resources;
(iii) Prepare a model database for generation planning software used by the power system economist – team leader (cleaning, inputting and checking all country data);
(iv) Develop a common set of power generation planning assumptions for the region up to 2035 collating existing generation plans and any generic assumptions needed;
(v) Assess sub-country regional power surpluses and deficits (existing and projected), the different peak demand periods (daily and seasonal), different generating capacity mixes and level and timing of peak load/production (daily and seasonal) among the GMS countries;
(vi) Guide Countries to update national generation plans for a planning horizon minimum up to 2035; (vii) Develop power generation options and estimate the potential of their

energy outputs using both relevant past data and climate change model based future projected data capturing their availability, and transport constraints;

(vii) Conduct system studies and prepare regional power generation master plan up to 2035 in consultation with the team leader; and

(viii) Prepare the chapters relevant to power generation in coordination with the team leader for the knowledge product on energy trade in GMS.

Minimum Qualification Requirements

The consultant should have qualifications in electrical engineering/power systems preferably at postgraduate level and a minimum 20 years experience including minimum 15 years experience in power system generation planning. The experience shall include international experience in performing generation planning studies and analyzing different scenarios.

Minimum General Experience	15	**Years**
Minimum Specific Experience (relevant to assignment)	15	**Years**
Regional/Country Experience	Required	

Deliverables	**Estimated Submission Date**	**Type**
Inception Report	30-Dec-2016	Report
Interim Report	31-May-2017	Report
Draft Final Report	29-Sep-2017	Report
Other Reports	01-Nov-2017	Final Report
Final Report	01-Nov-2017	Final Report