Chapter 2

Regional Context and Literature Review

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Chapter 2

Regional Context and Literature Review

1.4. Global and Regional Outlook for Renewable Energy

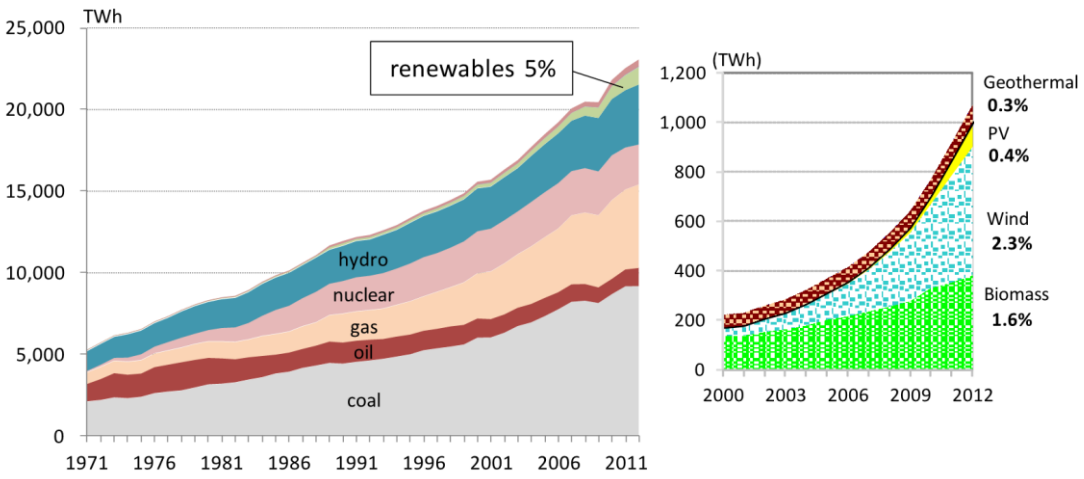
The deployment of renewable energy (RE) is widely considered as one of the major plank for increasing energy access, providing energy security, and reducing carbon emissions. The vast array of RE technologies that are being considered today includes (i) energy technologies using energy sources such as solar and wind, which have substantial variability within a day; (ii) mini hydropower options with storage capacity that are dispatchable but having seasonal variations in generation; (iii) biomass and waste-to-energy power generation operations that are typically available at the community level; and (iv) geothermal options that can be typically dispatched.

Significant progress has been made in the past two decades in improving the performance and efficiency and in reducing the cost of renewables. For example, among the developing countries in East Asia Summit region, China and India account for 2%–3% of renewables in overall electricity generation. In the Association of Southeast Asian Nations (ASEAN), if all types of hydros were included, the contribution of RE accounts for about 15%.

1.4.1. Current status and outlook of RE power generation

In recent years, the volume of wind and solar photovoltaic (PV) power generation is increasing. However, the share of RE (wind power, PV, biomass, and geothermal) in global electric power generation is still around 5% in 2012 (IEA, 2014).

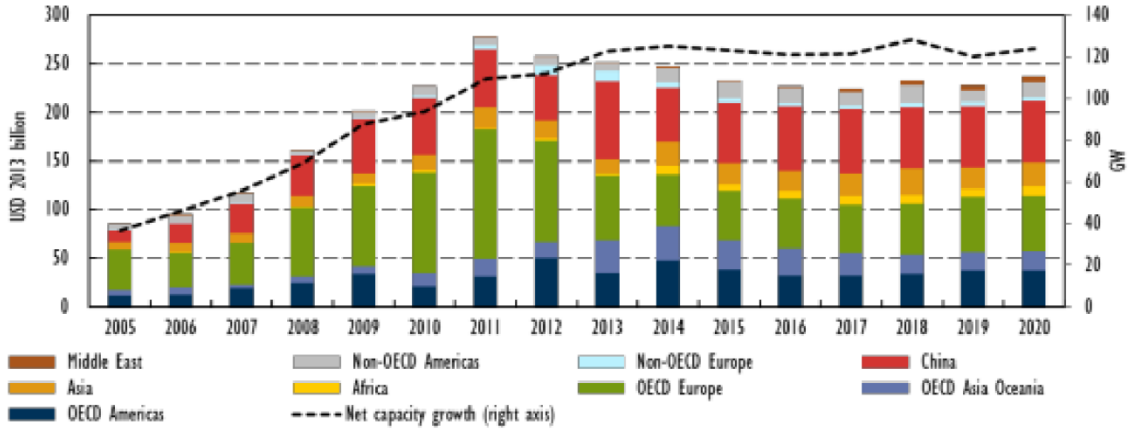
Figure 1: Global Transition in the Electric Power Generation



Source: International Energy Agency (2014).

According to the International Energy Agency (IEA), global investment in RE has declined after peaking in 2011. After leading the RE investment in the past, the decline is particularly prominent in Europe. Accordingly, various countries and regions, including Asia, may have a larger share of investment in RE in the future. However, the steady implementation of RE policies is critically important to maintain a high level of investment.

Figure 2: Record and Prospect of Investment in Renewable Energy



OECD = Organisation for Economic Co-operation and Development.
Source: International Energy Agency (2014), Medium-Term Renewable Energy Market Report.

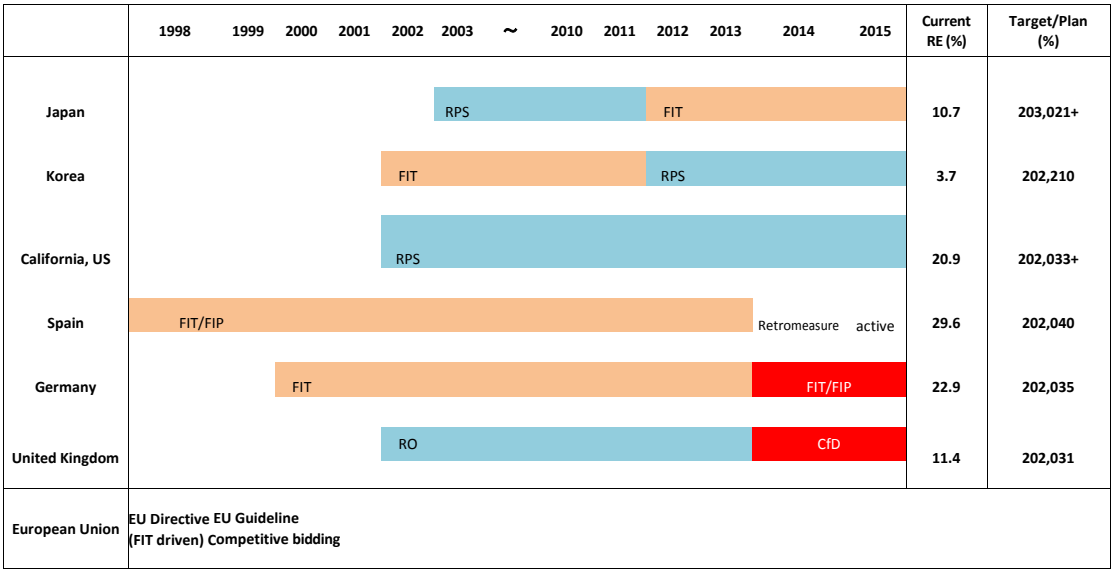
1.4.2. Transition in promotion measures for RE

RE policies adopted can be roughly divided into FIT (in Europe) and Renewable Portfolio Standard (RPS) (in the United States [US]). In Europe, abolition or review of FIT is currently in progress. In Japan, RPS was introduced in 2003, which was then replaced by FIT in 2012. In the Republic of Korea, FIT was first adopted in 2003 and implemented through 2011, and then replaced by RPS in 2012. In California, US, the RPS has been implemented since 2002. To be described later, Europe is reviewing preferential treatment policies under the current FIT, and is in the process of pursuing a new direction for RE promotion aimed at enhancing the linkage with the power market.

Two methods are used to calculate the amount of RE electricity supplied. One is to include all the power generated from RE sources; the other measures only the excess amount after subtracting the self-consumed electric power. In Europe, the former method (all RE generation) is the main method while in the US, surplus feed-in or net metering has been implemented in 43 states.[1]

[1] Database of US Energy Administration, State Incentives for Renewables and Efficiency, as of September 2014.

Table 1: Transition in Renewable Energy Policy at Main Countries and Regions



CfD = Contract for Difference, FIT = feed-in tariff, FIP = feed-in premium, RE = renewable energy, RO = Renewable Obligation, RPS = renewable portfolio standard.

Source: The Institute of Energy Economics (IEEJ).

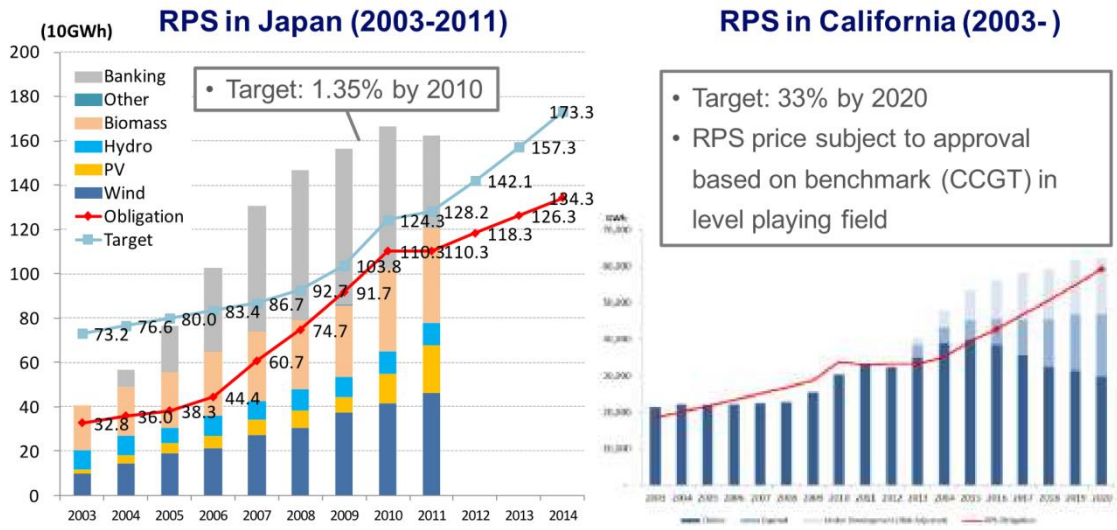
2.1.3. Implementation cases

Looking at the cases of actual implementation, the system and outcome of measures, such as RPS and FIT, vary broadly. For instance, on introducing RPS in Japan (2003–2012), the initial implementation target (overall target: 'national usage target') was specified to be 12.2 billion kWh in 2010 (approximately 1.35% of the electricity sales). However, in the second year after implementation, i.e. in FY2005, it was found that the procured amount, including banking (carry over) from the previous fiscal year exceeded the total of the obligatory amount (amount required to each company: 'standard usage amount')[2] by about 50%. Since then, the RPS power procured by the obliged companies have constantly surpassed the standard usage amount as well as the national usage target and the obliged companies kept carrying over the surplus from one year to another. Even with this continuous situation of oversupply, aspects of the RE power purchase agreement (such as price, purchase term, and others) were left for the market to decide; as a result, investment in RE was dampened. On the contrary, the state government of California established a target to supply 33% of the net system energy demand with RE by 2020, and specified an allocation per company accordingly to this target. The state government also adjusted the system by, for example, examining the procurement price of RPS and giving a certain level of advantage to RE by reflecting the global warming countermeasure cost.

[2] The RPS adopted in Japan stipulated that the obligatory amount (standard use) imposed onto the target business operators shall be adjusted based on the performance of each company to avoid sharp increase in burden. To that end, while the total of standard use did not match the implementation target, the gap between the two was to be filled gradually.

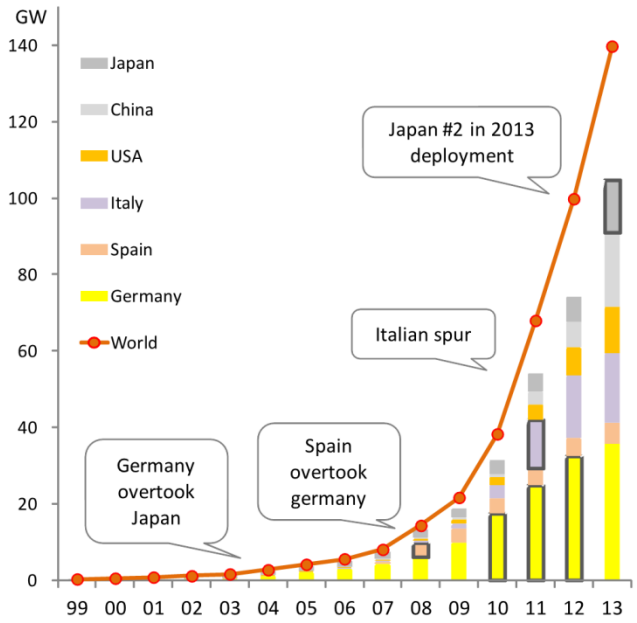
On FIT, the government, in some countries such as Japan, have set a fixed tariff each year. In other countries, such as Spain, generators are given the option to choose between a fixed tariff and a premium added to the market price of power. Despite the differences in the design of the FIT system, as with these examples, the introduction of RE or solar power in particular, rapidly progressed in countries that adopted FIT.

Figure 3: Renewable Portfolio Standard in Japan and California



CCGT = combined cycle gas turbine, GWh = gigawatt-hour, PV = solar photovoltaic, RPS = Renewable Portfolio Standard.
Source: The Institute of Energy Economics (IEEJ).

Figure 4: Development of the Solar Power Plant Capacity in the World



GW = gigawatts.
Source: The Institute of Energy Economics (IEEJ), based on the 2015 data of IEA PVPS (International Energy Agency-Photovoltaic Power Systems Programme).

2.1.4. Common issues

Some issues that surfaced for RE policies centred on RPS and FIT. For RPS, the key is to create demand that encourages the promotion of investment and market competition in RE (target setting). Political initiatives that enable such target setting are important. It is important to recognisethat the market price of power with a policy based onthe RPS is determined by negotiations among relevant parties or market trading, which can contribute to uncertainty over the return on investment and associated risk premiums. As a result, these increase the cost of implementation.

For FIT, where the priority is placed on the certainty of investment, there is a possibility that the subsidy level is too high. In situations where the cost of RE generation has fallen, it may be politically difficult to reduce the tariff to reflect the cost decline, due to vested interests. In the system of FIT, the purchase cost is often passed onto users. However, as has happened in Japan and Germany, passing on such cost (surcharge) sharply increases the electricity tariff along with the expansion of RE power generation purchased under the FIT.

The search for new methods of promoting the use of RE started mainly in Europe. Europe has long promoted the liberalisation of the power market, and, recently, there were criticisms that RE promotion measures based on FIT have distorted the market. For example, the profitability of conventional thermal power plants worsenedsignificantly due to the massive

introduction of RE subsidised by FIT. In response to such situations, EU-wide guidelines were released by the European Commission, stating that measures to facilitate the use of RE shall be compatible with market structure and the power system operation.[3]

An example of specific measure is the Commission's guidelines that abolished the obligatory FIT for new, large-scale RE generation facilities (500 kilowatts [kW] or higher), and stipulated the transition to a feed-in premium (FIP) system where RE generators directly sell power at market price. The difference between the support level (hereinafter 'standard price') and market price is subsidised by a premium. The guidelines also specified that facilities with 1 MW or more should use competitive bidding from 2017 onward to apply the standard price and determine its level.

The United Kingdom has adopted the Contract for Difference system that, in principle, is similar to FIP in that RE generators pay the difference when the market price exceeds the standard price. For electric power from RE source with established technologies (e.g. onshore wind, PV), the standard price is determined by competitive bidding.

Such FIP and bidding systems aim to improve the efficiency of support measures by utilising the market mechanism and, from the viewpoint of encouraging investment in RE, also provide a basis for the long-term stability of the RE system. RPS and FIP both require direct sales of power in the market. However, with RPS, price is determined in the market, whereas the price in FIP is specified by the government or a premium determined through bidding as provided by the government or an organisation established by the government via a long-term contract.[4] As a result, these systems bring a level of certainty and long-term stability to the profitability of RE business. However, it can be politically difficult to raise the electricity tariff in countries where the power generation sector is not liberalised and the electricity tariff is regulated. In such cases, it will be necessary to secure funds to support the use of RE–via methods that are different from the FIT system in Europe or in Japan where the cost is recovered from the users through the electricity tariff. If the cost is to be covered by the national budget, the increase in the state expenditure on RE will require community acceptance. When subsidies are granted to the generation of fuel (especially fossil fuel), it may raise a question on the comparative costs of generation, and policy needs to be considered in view of climate change policies.

[3]See Guidelines on State Aid for Environmental Protection and Energy, 2014–2020 of the European Commission.

[4]For a case of onshore wind power generation, the Contract for Difference or CfD in the United Kingdom is for 15 years, and FIP in Germany or Italy is for 20 years.

2.1.5. Issues in policy support for RE uptake

The RPS, FIT, FIP, and bidding systems described above have the following advantages and disadvantages:

- The effectiveness of FIT is determined by the level of tariff set by the government. Clearly the incentive to introduce RE is high when the tariff is high. However, the burden on the consumers is also high. Thus, it might be necessary to adjust the tariff flexibly based on certain criteria, such as the capacity added.
- FIP that comes with obligatory direct marketing is similar to FIT in making a preferential treatment to RE in terms of providing financial aid, yet FIP is expected to promote power supply according to the demand and competition among RE generators, since the profitability of RE generators depends on market sales. FIP also helps reduce cost by adopting a bidding system to determine the level of premium through market competition. For sectors where the RE technologies and market are established to a certain degree, it may be desirable to recommend a shift to such a system based on market mechanism. Meanwhile, with FIP, project feasibility may be sacrificed because low-price bidding acts as a barrier for small-scale business operators to enter the market.
- RPS is a system where policymakers determine the volume or the share of RE electricity introduced and the market determines the procurement details (e.g. energy source, price, terms, and conditions). Setting the RPS target at an appropriate level is important. RPS also shifts the risk of profitability to RE generators. Adequate demand, investment options, and a relatively competitive electricity e-market are preconditions for the RPS system to achieve its intended effect.

2.2. Regional Literature Review of RE Current Policies and Lessons Learnt

2.2.1. Analysis of the impacts of policy and other support mechanisms in the region (Malaysia, Philippines, and Indonesia–ASEAN-3)

i. Renewable energy policies for power generation

All ASEAN-3 countries have implemented policies promoting RE separately for different RE technologies. FITs are becoming an important policy tool for RE promotion in the region as demonstrated in these three countries. RPS also plays an important role as a policy instrument for RE promotion.

Table 2: Status of Renewable Energy Policies and Targets

	2007–2009	2010–2012	Current RE (2012)(%)	Target (by year) (%)
Indonesia	FIT	FIT	12	26 (2025)
Malaysia		FIT	5	11 (2030)
Philippines	FIT, RPS	FIT, RPS	29	40 (2020)

FIT = feed-in tariff, RE = renewable energy, RPS = Renewable Portfolio Standard.

Source: REN 21 (2014).

Indonesia has used FIT since 2009, through Ministerial Regulation No. 31/2009, which obliges the state-owned company – Perusahaan Listrik Negara or PLN – to buy electricity from RE produced by independent power producers. The Indonesian government allocated FIT only for small hydropower sources. In 2012, Ministerial Regulation No. 04/2012 introduced a FIT for biomass, biogas, and municipal solid waste. Shortly afterward, discussions started about using FIT for geothermal energy generators. FIT payment is available only up to 10 MW for all these energy sources (IEA, 2015). In line with RE development policy, the government announced that wind and solar energy are the next sources that will be included in Indonesia's FIT list. FIT rates in Indonesia differ depending on geographic location, the level of generated voltage, and the time of a plant's commercial operation.

In the Philippines, the FIT scheme was established by the Renewable Energy Act (2008) and implementation commenced in July 2012. As of 2012, tariff rates have been established for run-of-the-river hydroelectric, biomass, wind and solar power, guaranteed for a period of 12–20 years, denominated in Philippine pesos. The tariffs awarded are based on the actual levelised cost of generating electricity from the project (including connecting to the grid), and a set return on invested capital (Halstead et al., 2015). The tariffs were proposed by the National Renewable Energy Board and finally determined by the Philippine Energy Regulatory Commission. In this process, the tariff for ocean energy was not determined. Also, the hydropower reservoir and geothermal supplies were not included in the FIT due to market competitiveness. In addition, the RPS was also set up and applied to RE technologies, including biomass, waste, wind, solar, hydro, run-of-river hydropower, geothermal, ocean, or a hybrid system as determined by the 'Renewable Energy Act (2008)' and as authorised by the National Renewable Energy Board.

In Malaysia, the idea of a FIT mechanism was introduced by the government under the National Renewable Energy Policy and Action Plan (2010). Malaysia's Renewable Energy Act of 2011 introduced the use of a complex FIT system that covers four main technologies—biogas, biomass, small hydropower, and solar photovoltaic systems. Tariff rates distinguish between the type and size of installation, with a maximum installation size of 30 MW that can qualify for FITs. The maximum FIT period varies between 16 and 21 years for different technology categories, and annual degression rates are applicable, based on assessments of technology costs (Halstead et al., 2015).

In addition to the FIT and RPS, a number of incentives also aim to improve profitability by reducing investment and operation costs through subsidies and tax exemptions for certain RE technologies. These facilities are available to developers who are involved in exploration, construction, and operation activities.

Table 3: Status of Renewable Energy Policy Implementation

	Indonesia	Malaysia	Philippines
Renewable Energy Policies and Planning			
Renewable Energy Act		✓	✓
Renewable Energy Policy	✓	✓	✓
Implementation Programme			
Feed-in Tariff	✓	✓	✓
Renewable Portfolio Standard			✓
Biofuel Mandate	✓	✓	✓
Rural Electrification Programme	✓	✓	✓
Incentives			
Subsidies and taxations	✓	✓	✓

✓= Approved and implemented.

Source: Asia-Pacific Economic Cooperation (2012).

Despite having almost the same RE resources, Indonesia, Malaysia, and the Philippines have chosen different methods for implementing FIT. Their objectives are more or less the same – encouraging the private sector to be involved in generating energy from RE sources and developing electricity access throughout the country.

ii. Impact of RE promotional policies

In ASEAN-3 countries, FITs, together with fiscal and financial incentives contributed to the growth of the RE sector. In the Philippines, the Department of Energy is encouraging investors to submit applications for FIT eligibility. Developers who wish to avail of the tariff need to submit their proposals early given the 'first come, first served' policy of the government to make the market for RE very competitive. Between 2008 and 2014, the Department of Energy has approved 325 RE projects. By the end of 2014, the department has given approval to around 500 RE projects to generate 633.5 MW of electricity for the national power grid. The approved projects are under the FIT system, which is one way to provide incentives for more RE projects in the country. To accelerate investment in the sector, the government awards long-term contracts to RE producers at fixed, guaranteed rates. The FIT system guarantees all eligible RE plants the applicable rates for a period of 20 years. Given the guaranteed rate, the government intends to make RE power development a viable investment venture (Salazar, 2014).

In Malaysia, the enactment of Renewable Energy Act 2011, together with the establishment of the Sustainable Energy Development Authority, provided solutions to shortcomings identified during the period of the Small Renewable Energy Power (SREP) Program and greatly improved the prospect of RE development. Up to April 2013, RE projects that can generate a total of 345.35 MW have been approved and 102.43 MW are currently being exported to the grid from the operating facilities. The Malaysia Building Integrated Photovoltaic Technology Application Project, which was launched in July 2005, generated for Malaysia roughly 12.6 MW of the total PV installed at the end of 2010, of which 1.6 MW were connected to the grid (Wong et al., 2014).

On the contrary, incentivising the private sector to invest and increase the deployment of RE technologies – which is commercially more expensive than conventional energy resources – would increase electricity costs due to the implementation of the FIT allowance. In the Philippine case, the Energy Regulatory Commission is set to issue an order for the collection of FIT allowance by the state-owned National Transmission Corporation, amounting to PHP0.40 centavos per kWh covering 2014 and 2015. The FIT allowance will be used to pay RE developers who qualified under the scheme. This fund is expected to result in higher power rates for it will be reflected as a separate line item onthe electricity bills of consumers. The sensitivity of consumers and the business sector to electricity price increase is understandable given that they pay the highest rates in Asia (Salazar, 2014).

iii. Challenges and issues

Recent studies illustrate some of the significant issues associated with FIT, especially in the Philippines and Indonesia. The Philippines implemented FIT in 2008 and Indonesia in 2009 to encourage the green energy production, and to reduce carbon emissions. However, several issues have affected the effectiveness of this mechanism.

- A lack of coordination between central and regional governments often creates uncertainty for RE investment.
- Fuel and electricity subsidies have become a serious burden on Indonesia's state budget. In addition, energy subsidies hamper the development of RE.
- The lack of experience in private (long-term) financing of RE projects remains a significant challenge for RE project development.
- Aside from the fixed FIT price, the lack of built-in inflation adjustment is one of the weaknesses in both countries.
- Some of the most important criteria for attracting investors in the RE sector are the rate of FIT, the period of FIT payment, and the profitability of each project. The tariffs rates are still far too low in the opinion of most RE developers. The profit earned by the RE facilities through the sale of electricity is barely enough to maintain the operation of the facility. As a result, most facilities have to find other alternatives to support operation costs.

- As the field of RE is still new to the local market, most local banks do not have enough knowledges to assess the effectiveness of RE investment projects.Thus, RE developers are unable to get the financial support from banks. Nevertheless, no measures were identified to help project developers apply for finance or to help banks assess RE projects.
- The use of Standardized Power Purchase Agreements based on tariff designed as a function of avoided costs of power generation has been largely unsuccessful in Indonesia because the country's decision to switch from oil- to coal-based generation resulted in further lowering the avoided cost of generation. An uncertain regulatory regime coupled with lowering the tariff below the avoided costs of power generation, especially in the islands that have switched from oil- to coal-based generation, made the Indonesian FIT unsuccessful. Moreover, FITs that are denominated in Indonesian rupiah for biomass and city waste projects are affected by the rupiah inflation. Actually, many investors in RE projects in Indonesia are exposed to variable rate loans from local banks, therefore, the interest rate fluctuation is an additional risk faced by investors.

iv. Lessons learnt

Among the three countries in the region, Malaysia has advanced in terms of promoting RE development. The country has success stories or lessons learnt, especially on how to create and manage the RE fund to pay for the cost of FIT and guarantee payment for the whole FIT contract period.

Setting up a refund mechanism. A fixed-price tariff, which is a minimum payment based on the specific development cost of the technology along with a purchase guarantee, is believed to provide security to investors financing capital-intensive projects with high upfront costs and a high ratio of fixed to variable costs. Tariffs set too low may be ineffective at encouraging investment, while tariffs set too high may be lead to oversubscription and budgetary constraints.

However, in a regulated electricity market such as in Malaysia, the funding source for FIT is limited to a fixed percentage imposed on the Distribution Licensee's total electricity tariff invoices. The question that is often posed is 'who will pay for the FIT'? The most common method for funding the FIT involves sharing the costs among electricity consumers.

The FIT in Malaysia is not financed from tax revenue. Instead, the FIT will be financed by an REfund, which is derived by passing the FIT cost to final electricity consumers. This is essentially a polluter's pay concept – the ones who pollute the most, pay the most into the RE Fund. This form of fund collection has been proven to be an effective tool in overcoming current economic and financial crises as it does not utilise public funds. The spin-off from this RE Fund mechanism is greater acceptance as consumers tend to adopt energy efficiency measures to reduce their electricity consumption. Therefore, the issue of limited funding for subsidy in the form of tariff was also solved by setting up the RE Fund, as end users that used more than 300 kWh per month have to pay 1% of their bills into the RE fund.

Financial governance of the RE Fund. The management of the RE Fund will be under the supervision of the Sustainable Energy Development Authority (SEDA) Malaysia. The RE Fund

can only be used to disburse FIT payment claims made by Distribution Licensees, and to cover any administrative expenses related to the implementation of FIT. Some measures that govern the RE Fund include transparency in disclosing and publishing the financial reports on funding receipts, funding disbursement to Distribution Licensees, and the administrative fees payable to the Distribution Licensees and SEDA Malaysia. The accounts of the RE Fund are presented to Parliament on annually, as mandated by the Renewable Energy Act.

2.2.1 Analysis of renewable energy policies in Viet Nam

Viet Nam is endowed with RE resources such as hydropower, biomass, wind energy, geothermal energy, and solar energy. So far, these RE sources have not been widely used due to the lack of specific policy measures and a supporting institutional framework.

Currently, Viet Nam has inadequate policies and mechanisms to support RE technologies, although there were existing plans or targets that were stipulated in other related documents (Table 4).

Table 4: Renewable Energy-Related Legal Documents in Viet Nam

Legal Document	Date of Approval	Title and Contents
Decision 428/QD-TTg	18/03/2016	**Title: Revised National Power Development Plan period 2011– 2020, with outlook to 2030 (Revised PDP VII)** *Objectives and targets:* - Increase the share of RE in power generation to 9.9% in 2020, 12.5% in 2025, and 21% in 2030 in terms of installed capacity. - Increase the share of electricity generated from renewable resources to 6.5% in 2020, 6.9% in 2025, and 10.7% in 2030 in terms of electricity generation.
Decision No. 2068/QD-TTg	25/11/2015	**Title: The Vietnam Renewable Energy Development Strategy to 2030, outlook up to 2050** *Objectives and targets:* - Wind power to reach 2.5 billion kWh in 2020, representing 1% of total electricity output, and further increase this to 16 billion kWh by 2030, and 53 billion kWh by 2050. - Solar power generation to rise from 10 million kWh in 2015 to 1.4 billion kWh in 2020, then to 35 billion kWh in 2030 and to 210 billion kWh (20% increase) in 2050. - Biomass power to reach 7.8 billion kWh in 2020, 37 billion kWh by 2030, and increase further to 85 billion kWh by 2050. - Hydropowerto provide nearly 90 billion kWh in 2020 and 96 billion kWh per year in 2030, from 56 billion kWh in 2015.
Decision of: 24/2014/QĐ-TTg	24/3/2014	**Title: Mechanisms to support the development of biomass power project in Vietnam** Electricity price of biomass power projects connected to the grid: - For heat cogeneration projects – Power: VND1,220/kWh (excluding value added tax, equivalent to 5.8 US cents/kWh).

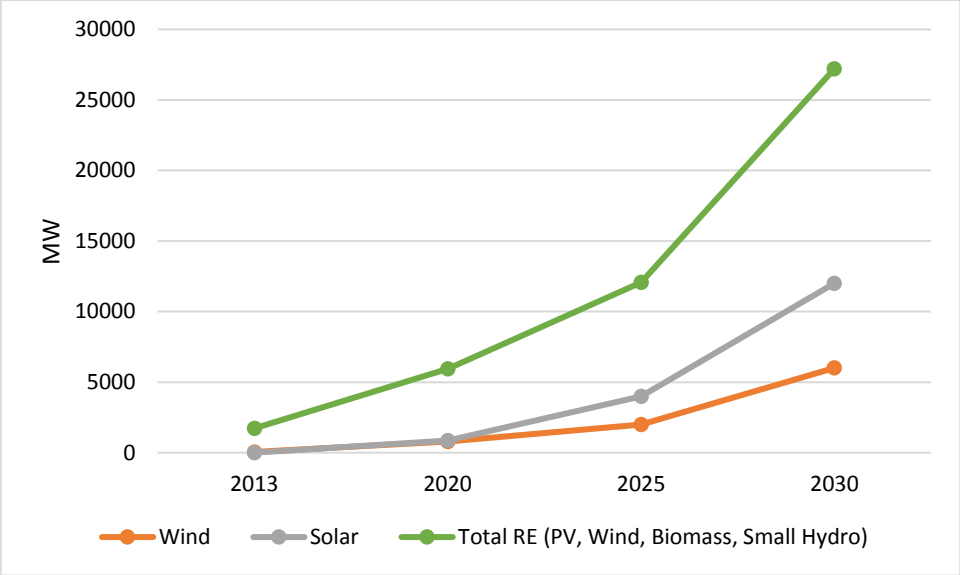
Legal Document	Date of Approval	Title and Contents
		Electricity selling prices are adjusted for exchange rate fluctuations/US$. - For other biomass power projects (not heat cogeneration projects – electricity), electricity price is applicable under the avoided cost tariff applicable for biomass power projects.
Decision of: 31/2014/QĐ-TTg	05/5/2014	**Title: Mechanisms to support the development of power generation projects using solid waste in Vietnam** Electricity price of solid waste power projects connected to the grid: - 10.05 US cents/kWh for incineration technology - 7.28 US cents/kWh for burial of solid waste
Decision 37/2011/QD-TTg	29/06/2011	**Title: Mechanisms to support wind power**(under revision) - 20-year power purchase agreement - Investment incentives, taxes, fees, land infrastructure - Support for electricity prices (grid): purchase price equivalent to 7.8 US cents/kWh
Decision 2149/QD-TTg by Prime Minister	17/12/2009	**Title: National strategy on comprehensive management of solid wastes for the period up to 2025, vision to 2050** *Objectives and targets concerning recycling, reuse, and energy recovery of solid wastes:* - By 2015: 60% - By 2020: 85% - By 2025: 90% - By 2050: 100%
Decision 18/QD-BCT	18/07/2008	**Title: Promulgation of regulation on avoided cost tariff and standardized power purchase agreement for small renewable energy power plants** *Objectives and targets:* Regulation on conditions, procedures, and construction of small RE power plants connected to the national power grid (Small Power Purchase Agreement)
Law 52/2005/QH11	29/11/2005	**Title: Environmental protection law – 2005** *Related contents:* **- Article 6.** Environmental protection actions that encourage development, use of clean energy, renewable energy, GHG emission reduction, reduction of ozone layer destruction. **- Article 33.** Development of clean energy, renewable energy, and environment friendly products. - Organisations or individuals who invest in development, use of clean energy, renewable energy, and production of environment-friendly products get support from the state on tax, investment capital, and land for project construction.

Source: Authors, compiled from various sources.

i. Targets for RE development

The latest Revised National Power Development Plan, 2011–2020 (PDP VII), approved in March 2016, increased the targets for RE capacity from 1,700 MW in 2014 to 27,195 MW in 2030, and the respective RE share are targeted to increase to 9.9% by 2020 and 21% by 2030. Figure 5 illustrates the following three phases planned for RE deployment – inception, takeoff, and market consolidation. If the targets specified in PDP VII are reached by 2030, Viet Nam will come to the end of take off phase for RE deployment.

Figure 5: Renewable Energy Generation Target of Viet Nam



MW = megawatt.
Source: Revised National Power Development Plan, 2011–2020. Decision No.428/2016

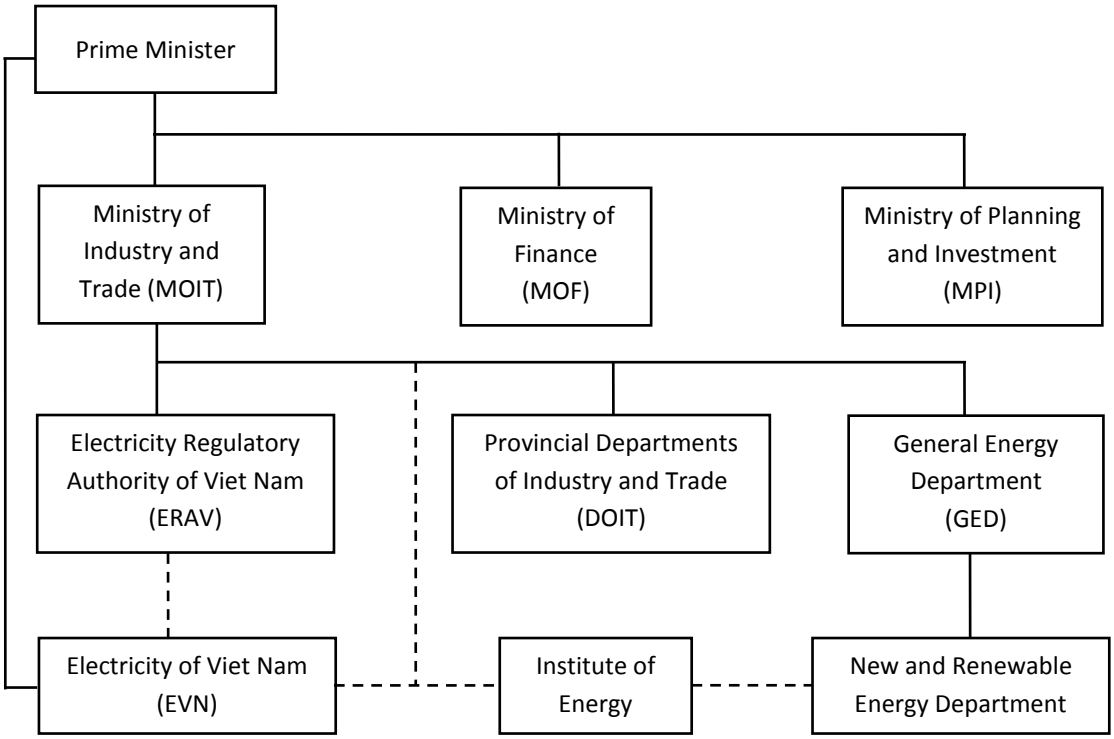
ii. Existing institutional framework for RE development

Viet Nam has a complex institutional structure in the energy sector. Some ministries are directly involved in formulating or implementing RE policy at the national level, while local governments and a number of other government agencies also have influence over either policy or its implementation, as described below and in Figure 6.

- The Government of Viet Nam and the Prime Minister are responsible for policies, regulations, strategies, and plans for the development of the RE sector.
- The Ministry of Industry and Trade (MOIT) manages all energy sectors, such as coal, oil, gas, electricity, nuclear energy, and REs. The ministry is responsible for policy design and national plans subject to the Prime Minister's approval.
- The Ministry of Planning and Investment takes the lead role in coordinating and allocating funds for energy projects submitted by line ministries and agencies, for consideration and approval by the Prime Minister.

- The Ministry of Finance is responsible for taxation and energy tariff policies applied to the energy sector.

Figure 6: Government Management Structure for Renewable Energy



Source: International Institute for Sustainable Development (2012).

- The Electricity of Vietnam (EVN) is the most important institution in implementing policies and regulations for RE development.
- The General Energy Department (GED) is under the control of the MOIT. This department helps MOIT to manage functions related to the energy sector.
- Under GED, the New and Renewable Energy Department is in charge of managing and designing plans for RE development.
- The Electricity Regulatory Authority of Viet Nam is a department under the MOIT. This department manages and regulates electricity market-related activities, including electricity from RE sources.
- At the provincial level, the provincial Departments of Industry and Trade are responsible for implementing state management directives for energy sector, including those for RE.
- The Institute of Energy conducts research on RE issues, such as RE planning and policymaking, and undertakes the preparation of investment reports.

iii. Existing legal documents

Over the years, the development of RE has received much attention from the state, as evidenced by policies, laws which were enacted. Table 4 summarises the legal documents related to RE development.

The legislations cited in Table 4 show the government's ambitious targets for RE development. However, some issues remain to be considered, including financial arrangements, detailed action plans, incentive mechanisms, and the assigning of responsibility to organisations that will need to implement the strategy on a mandatory basis.

The targets that were set up in the revised PDP VII appear realistic in terms of finance and implementation plans. Therefore, these will be considered in Alternative Policy Scenario (APS) with additional policies, measures, and action plans proposed.

Viet Nam has set RE targets in its various development planning, strategies, and decisions. However, to specify the targets, they need to be attainable, economically efficient, and sustainable and not simply quantities without any justification and/or elaboration. To have targets that are technically justifiable, economically verifiable, and financially sustainable is still a long way to go for Viet Nam stakeholders.

iv. Market price support and regulation

There is currently no standardised comprehensive legal framework for FITs for RE projects in general in Viet Nam. The main instrument currently used to promote renewables is the standardised (not negotiable) Special Power Purchase Agreement for power plants less than 30 MW and a standard tariff for small generators based on the avoided costs of the Electricity of Viet Nam (EVN). In addition, three FITs for grid-connected RE projects are in place – promulgated in 2011 for wind power and in 2014 for biomass cogeneration and solid waste to energy (Table 4). The FIT for solar energy is under consideration. Although these FITs are relatively modest compared with the return required by private sector investors, it does show the government's commitment to the clean energy development roadmap. The FIT for wind power generation offers a fixed purchase price and a variable additional subsidy from the environment protection fund paid through EVN. Some wind power projects are being implemented, and regulations for wind power integration are currently being revised to attract more private sector investment.

v. Fiscal incentives and other subsidies

Fiscal incentives are provided through tax provisions. These are typically intended to reduce costs related to investment and plant operation. Fiscal incentives also provide preferential treatment for RE enterprises as regulated by the Investment Law, including importation duties, corporate income tax and other tax exemptions as the following:

- Exemption from import duties for imported materials, equipment, and machinery that are not yet manufactured in Viet Nam.
- Corporate income tax exemption and/or reduction for RE enterprises.

- Tax exemption for the first years, 50% tax reduction for the next 9 years.
- Possibility of 10% tax rate being extended up to 30 years, if the RE projects are classified as using high or new technology and in special need of investment.

Other RE subsidies may be available to investors. For example, RE projects are exempt from land-use fees, environment protection fees and others include the following:

- Exemption and reduction of land use/rent for power plant area according to regulation, for transmission grid, and transmission substations.
- Exemption from environment protection fee.
- Soft loan and use of Clean Development Mechanism (CDM): Low-interest rate (according to the regulations of the Vietnam Development Bank).

vi. Policy effectiveness

To assess the effectiveness of the RE policy, the team has drawn the Table 5 showing the existing policy (effective policy), and the current status of the RE power plants in operation. It shows that the policy instrument on avoided cost tariff for small hydropower is very effective, while other FITs (for wind, biomass) are still under take-off phase and moderate.

Table 5: Existing Policies and Effectiveness

Area/Sub-area	Existing Policies	Effectiveness
Powers from Renewable Energy	FIT for wind power (Approved in 2011; under revision)	• 55 MW currently operating • 101 MW under construction • Many more undergoing application
	FIT for biomass power	250 MW under operation
	FIT for MSW	Not effective
	FIT for solar PV	Under consideration for approval, no assessment available. Many developers and investors have expressed interest.
	Avoided cost tariff for small hydropower	Increasing installed capacity 6 times (from 350 MW in 2009 to 1,984 MW in 2014)
Biofuels	Biofuel programme	6 ethanol plants are operating, providing 535 million litres of ethanol per year. However, many plants are having difficulties due to high production costs.

FIT = feed-in tariff, MSW = municipal solid waste, MW = megawatts, PV = photovoltaic.
Source: Authors, compiled from various sources.

vii. Comments on existing policy and institutional framework for RE development

From the status of policy implementation and institutional framework for RE development, some comments could be drawn, as follows:

- Viet Nam still does not have a clear legal framework to guide policies on RE projects. Policies are separately stipulated in different laws leading to confusion in their application.
- The EVN purchases electricity from RE projects at a price that is currently lower than electricity production costs for the wind or small hydropower. This is a major issue among investors and affects returns on investment. Also, it appears that investors in biogas and biomass power projects do not currently receive price support from the government.
- Procedures for establishing and operating RE projects often require the involvement of a number of authorities, resulting in high transaction costs as project developers must submit the same information to several government authorities at different points of time.
- Government officials often lack adequate experience in establishing and operating investment incentive policies supporting the RE sector.

- In many cases, the investors have encountered difficulties in seeking loans for their RE projects although legal documents confirm that they are eligible to access available soft loans.

New policy instruments were proposed in the document 'The Vietnam Renewable Energy Development Strategy to 2030, Outlook Up to 2050' issued in 2015 where it proposed several innovative measures, such as

- A Sustainable Energy Development Fund;
- Power purchase agreement of the type "Take or pay";
- Cost recovery through increasing electricity tariff;
- RPS for the generation of >1,000MW and for the distributor: The share of RE generation must be >3% by 2020 for generator, increased to>10% by 2030, and to >20% by 2050; and
- Net metering.

However, these measures will need to be elaborated for their practical implementation, by a concrete roadmap, and Government's degrees on application guides that will require a few years for preparation.

2.2.3. Myanmar's renewable energy status and policy

i. Renewable energy status in Myanmar

Myanmar has huge RE potential that could be leveraged to overcome the shortage in energy supply, improve energy security, and develop cost-effective access to energy in rural and remote areas. Investment in RE would also relieve budget pressure arising from fossil-fuel subsidies, which represent 9% of total government expenditure, and to foster foreign direct investment in Myanmar (OECD, 2014). Table 6 shows the resource potential and installed capacity of RE in Myanmar.

Table 6: Renewable Energy Resources Potential and Installed Capacity in Myanmar

Resources	Installed Capacity (MW)	Resource Potential (MW)
Solar	530 (ongoing)	52,000
Wind	5.4 kW	635
Small hydro	112.05	324
Biomass	18	600
Biogas	650MWh	3,600

kW = kilowatts, MW = megawatts, MWh = megawatt-hours.

Sources: World Bank/ESMAP and International Energy Agency (2013).

Myanmar has set an RE target to generate 15%–20% of its total electricity from RE sources by 2020. It is apparent that a large share of this would come from hydropower due to its enormous potential and availability, but the plan does not specify the shares of individual RE technologies. The Government of Myanmar and the New Energy and Industrial Technology Development Organisation of Japan signed an agreement in 2013 to support the process of introducing RE technologies in Myanmar. The government has signed a memorandum of understanding with a Thailand-based RE developer for the installation of a 210MW solar power plant in Minbu, Myanmar (OECD, 2014). In September 2015, a US$400 million loan was approved by the World Bank to support the National Electrification Plan, which aims for universal electricity access by 2030. The plan aims to extend electricity to over 1 million households, of which 60% will be connected to the grid network while the remaining 40% will obtain off-grid electricity by 2021 (Ross, 2015).

Large-scale solar projects are taking shape in Myanmar, as the government aims to connect the vast rural population to electricity sources. Green Earth Power, a Thailand-based RE company, plans to build a 220MW solar power plant in Magway Region at the cost of US$350 million, which is due for completion in 2017. ACO Investment Group, a US-based investment fund, have signed a memorandum in 2013 with the Government of Myanmar to build a 300MW solar facility at the cost ofUS$480 million in Mandalay Region in Central Myanmar. SPCG Public Company Limited, another Thai company, is considering building and operating a solar farm of several megawatts (Matsui, 2014). Currently, solar systems in the 1.5 W–500W range are being used throughout the country to assist local and rural communities. The government also formed a ministry-level committee of 'Rural Electrification & Water Supply' under the Rural Development and Poverty Alleviation Policy to increase households' electricity access through RE. Also, the current energy policy reform processes are planning to support the deployment of RE. Table 7 shows the proposed plan for 2015–2016 fiscal year.

Table 7: Proposed Plan for Electrification Using Renewable Energy, 2015–2016

FY Years	Total Villages	Electrification Systems				Budget	Impact	
		Grid Extension	Solar	Hydropower	Diesel Engine	(Million US$)	Households	Population
2014–2015	2,308	223	139	34	1	36,298	146,123	750,000

Source of data: Department of Rural Development, Myanmar, 2015.

viii. Renewable energy target

The government has not officially established RE targets although the Ministry of Electric Power aims to develop 472MW of installed capacity (about 15% of total generation capacity) from small hydropower generation plants by 2016. According to reports, the government also plans to use domestically produced biodiesel and bioethanol as substitutes for 10% of imported oil and gasoline by 2020.

At present, Myanmar has no specific RE incentives but investors can draw on the incentives provided in the new Foreign Investment Law (2012). These include the following:

- Income tax holiday for foreign investors;
- Exemption from a tax on profits if the profits are maintained in a reserve fund and reinvested in Myanmar within one year;
- For RE exported goods, income tax relief of up to 50% of the profit;
- Allocation for research and development expenses; and
- Exemptions from customs duties for the importation of machinery, equipment, instruments, machinery components, spare parts, and materials required for the enterprise.

The new law also assures investors that their investments will not be nationalised during the contract period, their permits will not be terminated without good reason, and their foreign currency can be repatriated in the same foreign currency.

ix. Analysis of effectiveness of current policies

A number of publications provide a list of barriers to the development and uptake of RE in general (Beck and Martinot, 2004; Painuly, 2001), and in ASEAN countries (Beck and Martinot, 2004; Painuly, 2001; Lidula et al., 2007; Luthra et al., 2015). According to international investors in wind energy and solar PV generation, the risk factors to implement projects are (i) legal security, (ii) negative policy changes affecting renewables, and (iii) the main financial support scheme and total revenues received (ESMAP, 2015). The main barriers to increase the uptake and development of RE in ASEAN countries include the following: (Beck and Martinot, 2004; Lidula et al., 2007; Painuly, 2001; Luthra et al., 2015; Das and Ahlgren, 2010; Umar et al., 2013; Umar et al., 2014a; Umar et al., 2014b; Urmee et al., 2009).

- Technological and/or infrastructure barriers,
- Economic and financial barriers,
- Administrative and/or regulatory barriers (usually at take-off stage),
- Market-relatedbarriers,
- Political and institutional barriers, and
- Social and cultural barriers.

To overcome these barriers, appropriate policy instruments need to be developed to facilitate the development of RE technologies in Myanmar. These policies should aim to increase the competitiveness of RE technologies with conventional energy technologies, create a business-enabling environment so that there are interests in RE investment, and increase energy security by reducing dependence on external and conventional energy resources. A few of these issues are discussed below.

x. Ramping up renewable energy technologies

With only 13% of the population being connected to the national grid (UNDP, 2013), and such electricity access being available mostly in urban areas, off-grid electrification using RE is not an option but is a must for Myanmar. In addition, RE would offer a multitude of other benefits, including ensuring energy security, reducing expenditure on fossil fuel subsidies, and increasing economic development in rural areas. Tapping the country's extensive RE resource potential (hydro, solar, and wind) could provide the much-needed source of electricity both for the grid and for the off-grid areas. It is recognised that the lack of affordability is a key hindrance to offeringRE technologies, such as solar home systems, in rural areas. Carefully developing microfinancing mechanisms for the promotion of rural energy systems can address this issue. Bangladesh has demonstrated true leadership in developing and implementing affordable financing mechanisms for RE-based rural electrification using microfinance (IDCOL, 2015). Lessons from Bangladesh could lead to implementing affordable and sustainable financing options for the poor.

xi. Mobilising private investment

Myanmar needs to foster private investment to hasten the introduction and deployment of RE technologies in Myanmar and improve the country's energy security. For this to happen, the government needs to create an enabling environment that would help private investors thrive in RE business. Some developments are already happening along this line; however, improvement in the domestic economic, legal, and regulatory regime can further strengthen private investment. Several things can be done to create and strengthen an investment-enabling environment in Myanmar and these include the following:

- Develop long-term, practical, and credible targets for RE. These targets will need to be broken down into technologies to create a trusting platform for private investors. In 2011, at the third ASEAN Energy Outlook, Myanmar set a target to generate 15%–20% of its total energy from RE sources by 2020. This target, by itself, is insufficient for the investors to make any commitments, as it does not indicate the shares of the different technologies.
- Develop and implement appropriate incentive mechanisms for RE and energy-efficient technologies to send a clear market signal to investors. This can include FIT, fiscal incentives, tax breaks, and others.
- It is also important to create a sound and unbiased market that allows fair competition among the operators, such as between independent power producers and state-owned enterprises. Sound and competitive policies, such as electricity market structure and removal of discrimination in accessing finance, can support innovation and develop an environment that is conducive to private investment in the energy sector, particularly to promoting new and alternative energy technologies.

xii. Regional cooperation

Regional cooperation can greatly improve energy security in a sustainable way, and enhance economic return by optimising the infrastructure and resources. There are examples of effective regional cooperation in the ASEAN, including those in the energy sector. An example is the existing cross-border power trade among Lao PDR, Thailand, and Viet Nam. Myanmar is also in cooperation with China and Thailand in terms of power trade. Broader cooperation among member states in the energy sector is currently being discussed. These include adopting a uniform technical standard, such as synchronising frequency, village control, and transient stability for the interconnected power grid (ADB, 2015).

Being a GMS country, Myanmar has a lot to gain from regional economic cooperation to develop its immature RE sector. Many other GMS countries, such as Thailand, have progressed far in developing their RE portfolios. Through regional cooperation, Myanmar can access already developed technical skills, technologies, and other benefits that are imperative for the development of RE projects.

xiii. The way forward

Development of effective policies requires in-depth research, as solutions are not often obvious. Most of the existing research in Myanmar often focuses on mapping potential hydrocarbon reserves. The issues that need to be addressed are (i) accessing electricity, (ii) pricing electricity, (iii) making it cleaner, and (iv) structuring the market. These issues need to be studied further, along with the implementation of new policies. The research can be prioritised and categorised as short-term priorities and longer-term objectives. Short-term policy priorities are those that require action within the next 3 years. These are focused on providing affordable and reliable electricity to all with the view of having immediate positive impact. Policy changes over the next 5–10 years will decide the path the energy sector will take as it matures. These are all fundamental for the long-term sustainability of the sector. From the above analysis, the following researches are recommended:

- What are the best options for increasing installed generation capacity in a short period? How can cross-border trading of electricity help in enhancing electricity access in Myanmar?
- What financial incentives can the government provide for the adoption of off-grid technologies, such as small-scale hydro and solar PV?
- What institutional structure is appropriate for Myanmar to provide electricity access using RE? Can these policies encourage more foreign direct investment into the energy sector?

2.2.4 Lao PDR's renewable energy status and policy

i. Review of the current status of RE utilisation and targets

Lao PDR has large hydro projects aimed at meeting the country's export electricity targets and increasing the number of consumers connected to the domestic grid. The country is also

developing other RE sources, such as small hydropower (SHP), solar, wind, biomass, biogas, and municipal solid waste (MSW) to supplement supply to on-grid users as well as to satisfy electricity demands in rural areas (off grid). Despite the huge potential of these RE sources, their current utilisation (as of 2013) is rather low as shown in Table 8.

Table 8: Renewable Energy Potential and Current Utilisation, Lao PDR (MW)

	Small Hydro	Solar	Wind	Biomass	Biogas	Solid Waste	Total
Potential	2,000	511	40	938	313	216	4,070
2011	28	0.2	0.0	0.0	0.0	**0.0**	28.2

Sources: UNDP (2013).

The RE development strategy target specifies that 30% of the total domestic energy consumption will be generated by RE by 2025 as illustrated in Table 9.

Table 9: Renewable Energy Potential, Past and Projected Utilisation until 2025 (MW)

	Small Hydro	Solar	Wind	Biomass	Biogas	Solid waste	Total
Potential	2,000	511	40	938	313	216	4,018
2011	28	0.2					28.2
2020	134	36	12	24	19	17	242
2025	400	33	73	58	51	36	651

Source: ADB (2013).

xiv. Existing RE laws, regulations, policies, strategies, and development plans

The Government of Lao PDR has passed legislation and issued policies, strategies, and plans for the development of the power sector – including large hydro, and RE resources. The current strategy and planning approach is essentially concentrated on the country's potential hydroelectric power development to meet domestic and export demands. RE use and technology development, on the other hand, are explicitly covered in the national RE development strategies.

The existing laws, regulations, policies, strategies, and development plans are summarised as follows:

- ***Law on Electricity*.** The Law on Electricity dated 8 December 2008 was amended in 2011 and enacted on 20 December 2011. The Law on Electricity specifies the principles, rules, and measures on the organisation, operation, management, and inspection of electrical activities to ensure the effectiveness of electricity generation and business operation. The law specifies the principles and guidelines for conducting electricity generation, transmission, and distribution business in the Lao PDR; and recommends strategies for developing the rural electrification network and methodologies for the pricing of electricity.
- ***Water and Water Resources Law*.** The law recognises eight different categories of water sources according to purpose, including water sources allocated for the production of electric power. The Water and Water Resources Law has features that help ensure sustainable hydropower development. One of these is the requirement to undertake environmental and social impact assessments for large-scale hydropower reservoirs, and approval for small-scale hydropower reservoirs.
- ***Law on Investment Promotion***. Issued and enacted in 2004, the Law on Promotion on Foreign Investment was renamed and enacted in 2009 as Law Investment Promotion. It recognises the concession issued by the state for using ownership rights and other rights of the state that is according to regulations, for the purpose of developing and undertaking various business operations, particularly the concession right relating to land, minerals, electric power, and others (Article 15).
- ***National Socio-Economic Development Plan, 2011–2015***. The main objectives include rapid economic growth and poverty eradication; achievement of the Millennium Development Goals by 2015; and sustainable economic, social, and environmental development. The plan also identifies the energy sector as a strategic development sector, both for the short and longer terms. Its performance is vital in meeting the country's energy requirements, notably for the still-elusive goal of nationwide electrification. Developing the energy sector is central to the modernisation and industrialisation of the country, which is the primary platform for raising the living standards and eradicating poverty.
- ***Renewable Energy Development Strategy*.** The National Renewable Energy Development Strategy issued in October 2011 is the main policy framework for the development of RE in the country. The strategy sets a target of increasing the share of RE in total energy consumption to 30% by 2025. The government also aims to replace 10% of transport fuels by biofuels during the same period. Target details for each RE are illustrated in Table 9.
- ***Policy on Sustainable Hydropower Development in Lao PDR*.** The policy applies to all hydropower projects larger than 15 MW throughout the project development process (planning, construction, operation, and transfer/closure stages) and incorporates technical, engineering, economic and finance, and environment and social impacts aspects. At present, this is undergoing revision conducted by the Ministry of Energy and Mines.

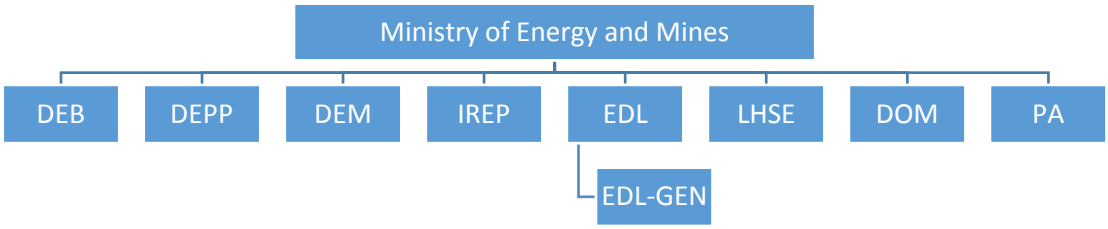
- ***National Policy on the Environmental and Social Sustainability of the Hydropower Sector.*** Issued by the government in 2005, the policy encourages the sustainable development of the hydropower sector (based on the principles of economic sustainability), maintenance of the renewable resource base, social sustainability (based on the principles of mutual understanding and consensus), and ecological sustainability (avoidance of irreversible environmental impacts).
- ***Power Development Plan (PDP).*** Article 9 of the Electricity Law states that the electricity enterprise shall prepare the electricity development plan. The Electricité du Laos (EdL) has been preparing the PDP every 3 to 5 years. EdL formulated the PDP 2010–2020 in August 2010, revising the former PDP 2007–2017. In August 2011, EdL updated PDP 2010–2020 by reflecting the latest electricity demand forecast and prospective project developments in the generation and transmission sector.
- ***Development of Regulation/Law on Biofuels.*** Lao PDR is developing a national programme for biofuel development with a vision to introduce 10% biofuel in the transport sector by 2025. The (draft) Decree for Regulation and Utilisation of Biofuels in Lao PDR, dated 11 September 2013, classified the size of biofuel production and level in accordance with the level of business purpose – family business, small to medium-sized, business, and large-scale business.

The various policies, strategies, and development plans listed above can only be put in place by means of policy instruments.

xv. Organisation of the energy sector

The Electricity Law of Lao PDR, amended in 2011, prescribes that the Ministry of Energy and Mines is responsible for making the policy and strategy for the country's electricity sector, supported by various ministries, e.g. Ministry of Finance, Ministry of Planning and Investment, and Ministry of Natural Resources and Environment. Various departments under the Ministry of Energy and Mines as well as at provincial level undertaking tasks and responsibilities of policy development and implementation are shown in Figure 7.

Figure 7: Organisational Chart of the Ministry of Energy and Mines



DEB = Department of Energy Business, DEPP = Department of Energy Policy and Planning, DEM = Department of Energy Management, IREP = Institute of Renewable Energy Promotion, EDL = Electricité du Laos, EDL-GEN= EDL Generation Public Company, LHSE = Lao Holding State Enterprise, DOM = Department of Mining, PA = Provincial Authority.
Source: ADB (2013).

Department of Energy Business. This department oversees private sector investments in the power sector. While it is involved in planning, development, and appraisal of project proposals, its main role is in negotiating project development agreements, concession agreements, and power purchase agreements.

Department of Energy Policy and Planning. This department is in charge of policymaking and planning, and is responsible for energy policymaking and energy/electricity supply planning.

Department of Energy Management. This department is in charge of drafting energy-related laws, regulations, guidelines, and technical and safety standards. It also monitors government agencies, state-owned enterprises, and private operators to ensure their compliance with the rules and regulations.

Institute of Renewable Energy Promotion. The institute is mainly responsible for promoting RE and conservation by implementing the Renewable Energy Policy and Strategy prepared in 2011. In support of RE, it is tasked with developing small-scale hydro, biodiesel, and biogas projects, and is responsible for preparing a manual on RE production and use. The institute also formulates and implements a rural electrification master plan.

Electricité du Laos (EdL). The EdL is a state-owned electric power utility, supplying electricity to domestic consumers through its transmission and distribution lines. EdL also manages the import and export of electricity.

EdL-Generation Public Company. The main objectives of EdL-Gen are to (i) generate energy for EdL for wholesale, and in the future,for export (this includes development of transmission lines and substations, as necessary); (ii) invest in or set up joint ventures with other electricity generation projects; and (iii) provide management and maintenance services for other electricity projects.

Lao Holding State Enterprise. This state-owned stock-holding enterprise is tasked to hold and manage the shares of the projects of independent power producers.

In addition to these departments and companies, the Government of the Lao PDR has also set up provincial departments of energy and mines and district energy and mines offices, which all work under the Ministry of Energy and Minesat the provincial and district levels.

xvi. Financial incentives and mechanism[5]

Investments in RE projects – whether on grid-connected or isolated systems, off-grid projects, and individual systems – are entitled to investment incentives under the Investment Law of the Lao PDR. The financial incentives include the following:

- Import duty free on production machinery, equipment, and raw materials;
- Profit tax exemption for a certain period depending on activities, investment areas, and size investment; and

[5] See the Renewable Energy Development Strategy in the Lao PDR.

- Subsidies on unit product price depending on energy type and times period.

In addition, investors can also obtain non-fiscal incentives, such as

- Up to 75 years leasing term (for enterprise construction land),
- Permission to expatriate earnings to home or third countries, and
- Right to employ foreign workforce (not more that 10% of the enterprise's total labour).

As to the financial mechanism, the government will seek assistance from international organisations, commercial banks, and sources of low-interest loans to fund RE projects. The government will also seek to improve the understanding of RE projects among private commercial banks to encourage investment in RE projects.

Retail tariff determination of electricity is guided by the socio-economic conditions of consumers, their sector, and type of use. The electricity tariff is set in nine categories for low voltage supply, and in four categories for medium voltage supply. The tariff for residential use and irrigation are set at a lower level than those for other categories of consumers. The residential tariff and agricultural tariff are cross-subsidised to some extent by the industrial and commercial consumers.

The incentive mechanism, such as FIT, is not practised[6] in determining the generation tariff for the RE sources of energy. Currently, the tariff for selling and buying electricity from RE power projects are agreed based solely on the negotiations between investors and the EdL.

xvii. Public–private partnership

To date, some forms of the public–private partnership are currently operating in the Lao PDR. The Pro-Poor Public–Private Partnership (5P) approach promoted by the Economic and Social Commission for Asia and the Pacific (ESCAP) aims to leverage the strengths of the government, the technical and financial advantages of the private sector, and the socio-economic development interests of rural communities. In partnership with the Institute of Renewable Energy Promotion, ESCAP implemented the 5P pilot project and widened the access of rural communities to modern energy services during 2011–2015.

Another form of public–private partnership is the work carried out by Sunlabob. Established in 2001, Sunlabob is a Lao PDR-based company dedicated to off-grid energy and clean water solutions. The company offers a range of products and services, providing rural electrification solutions to governments, multinational development agencies and companies, nongovernment organizations, and individuals. For the 5P project, Sunlabob serves as a technical advisor, providing advisory services to support technical system designs and implementation of the pilot project.

Another one is the off-grid rural electrification programme, which is supported by the World Bank. The SHS (Solar Home System) pilot programme was implemented by small private

[6] See the Lao PDR National Sustainable Energy Strategy Report on Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options by APCTT and UNESCAP, 2014.

companies based in the respective provincial capitals. Under the model adopted by the village off-grid promotion service, these private companies – or PESCOs – work in cooperation with the Provincial Department of Energy and Mines offices that are responsible for rural electrification. PESCOs have a participatory planning process designed by the village off-grid promotion service, which identifies villages that meet the off-grid criteria, procures equipment, and employs village energy managers who are responsible for installing and maintaining the systems and collecting bill payments. Payments to the PESCOs and village energy managers are linked to their actual achievement (rebate based) in planning, installation, payment collection, and reporting.[7]

xviii. Effectiveness of current policies

The Renewable Energy Development Strategies aim to increase the use of RE potential in the Lao PDR and to supplement supply to meet domestic electricity demand. The proposed RE target is shared by three energy types – electricity (28%), biofuel (44%), and heat energy (28%). Table 10 illustrates the plan, together with the past achievements in 2011 and 2013.

Table 10: Renewable Energy Potential and Development Status in the Lao PDR (MW)

	Small Hydro	Solar	Wind	Biomass	Biogas	Solid Waste	Total
Potential	2,000	511	40	938	313	216	4,070
2011	28	0.2					28.2
2013[a]	30	0.9					30.9
2015	80	22	6	13	10	9	140
2020	134	36	12	24	19	17	242
2025	400	33	73	58	51	36	651

[a] Scaling-up off-grid rural electrification in the Lao PDR.
Source: ADB (2013).

As seen in Table 10, when compared to the target stated in the development strategies, the overall RE utilisation of around fivefold will be augmented from 2011 to 2015. However, from 2011 to 2013, the increase was less than 10% (from 28.2 MW to 30.9 MW). Moreover, when compared to the available potential, the RE target for 2020 accounts only for 6.0% and in 2025 for 16.2%.

Domestic consumption of electricity was estimated to grow to 2,863MW[8] by 2025, attaining 820 MW in 2011, 1,200 MW in 2013, 1,950 MW in 2015, and 2,670MW by 2020 (ADB,

[7] See the Report on the National Assessment Framework of Enabling Environment and Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible (2014).
[8] See the Renewable Energy Development Strategy in the Lao PDR.

2013).Projecting the RE contribution in 2011, 2013, 2015, 2020, and 2025 to the electricity demand forecast by 205 yields the results illustrated in Table 11.

Table 11: RE Contribution to Domestic Electricity Demands Forecast

Year	Demands (MW)	RE Contribution (%)						
		Small Hydro	Solar	Wind	Biomass	Biogas	Solid waste	Total
2011	820	3.41	0.02					3.44
2013	1,200	2.50	0.08					2.58
2015	1,950	4.10	1.13	0.31	0.67	0.51	0.46	7.18
2020	2,670	5.02	1.35	0.45	0.90	0.71	0.64	9.06
2025	2,863	13.97	1.15	2.55	2.03	1.78	1.26	22.74

RE = renewable energy.
Source: ADB (2013).

It can be observed from Table 11 that for 2013, the RE contribution to the domestic electricity demand is increasing from 2011 to 2025. However, by 2025, the total RE contribution accounted only for 23%, which is less than the anticipated figure (28%). This discrepancy is due to an unsystematic planning and lack of supporting assessment.

The existing policies and policy instruments used are, in general, less effective due to the followings reasons:

- Although several laws, regulations, policies, and plans have been issued and in use, the Lao PDR does not have a comprehensive national energy policy that sets out a systematic approach to energy planning, policy formulation, and sector development.
- There is no independent regulatory authority for tariff determination purpose. The incentive mechanism, such as FIT, is not practiced in determining the generation tariff for the RE sources of energy. Currently, the tariff for selling and buying electricity from RE power projects are solely based on agreements between investors and the EdL.
- There is no tangible and integrated national policy, strategy, and plan for using RE as part of the country's power development plans. A nationwide approach to systematically assess area-specific RE potential has yet to be put in place. Similarly, various RE appropriate technologies, e.g. distributed generation and micro-grids, are still at their infancy stage and not well known among implementing organisations and agencies.
- Most of RE development have been carried out following the needs of respective provinces without cooperation among them. No clearly described and well-coordinated approach exists for allocating responsibilities among agencies and ministries undertaking energy production-related activities.

- A workforce with knowledge, know-how, experiences, and skills in strategic planning and implementation is lacking and is considered a serious constraint.
- Most of the public–private partnerships on the renewable energy target (RET) development in the Lao PDR are based on the cooperation among donors, ministerial and provincial agencies, and private companies with some involvement from educational and research institutions.

vii. Recommendations

A comprehensive national energy policy should set out a systematic approach to energy planning, policy formulation, and sector development. There is a need to have clear RE policies stating the periodic targets for grid-connected and off-grid RE projects. In line with this, RE development must be integrated yet considered as a separate sector and its associated budget to be allocated in the Five-Year National Socio Economic Development Plan.

An independent regulatory authority needs to be established to look after financial incentives and issues such as FIT for the RE sources of energy.

There is a need for a systematic assessment of area-specific RE potential throughout the country. There is also a need to prepare distributed generation and various micro-grid configurations used in accordance with specific areas and needs.

RE development in provinces should be carried out in line with the area-specific RE potential and use of appropriate forms of distributed generation. Well-defined roles and responsibilities must be established and implemented among government organisation and agencies implementing RE and RE technology development.

It is also important to include knowledge on strategic planning, implementation know-how, experiences, and related skills at all levels of education – from technical schools to the universities.

Public–private partnerships should be encouraged to promote RE technology development through cooperation with research and educational institutions. This will enhance and improve the operation and maintenance of RE projects, which include micro-grids that supply rural areas with electricity, and/or connect them to national grids for the marketing of energy surplus.

2.2.5. Cambodia's renewable energy status and policies

i. Review on potential and current status of RE utilisation

Cambodia is lagging other Southeast Asian countries in the development of RE resources, partly because of a lack of experience, funds, and data. RE initiatives mainly take the form of research and demonstration projects. While RE is strongly encouraged by the government, appropriate policies and financial support are still evolving.

Electricity prices in Cambodia are very high, thereby opening opportunities for the development of small hydro, solar, wind, and biogas technologies for power generation.

Cambodia has an estimated hydro potential of 10,000 MW, with less than 10% currently developed. Approximately 50% of these resources are in the Mekong River Basin, 40% on tributaries of the Mekong River, and the remaining 10% in the southwestern coastal areas. By the end of 2014, approximately 830 MW of installed hydropower capacity had been in operation, approximately 800 MW was under construction, and another 198 MW being considered for feasibility.

Cambodia is considered to have high solar energy potential, which has been estimated to be at least 8,074 MW according to the latest ADB study on the GMS RE development opportunities in 2015 (ADB, 2015). Solar development in Cambodia is at the pilot stage. As of 2012, the country had about 2 megawatt peak (MWp) of solar PV installed (Poch, 2013).

Cambodia does not have vast wind resources. On average, wind speeds across the country are under 3 metres per second (m/s). The technical potential represents an upper limit and shows 1,380 MW categorised at or above good wind speeds (WWF, 2016).The development of wind resource is in the early stages. A few projects have been piloted in the northeastern and southwestern provinces. The first wind turbine, costing roughly US$1.74 million, is in Preah Sihanouk province. It is co-funded by Cambodia's Sihanoukville Port Authority (48%), Belgium (28%), the EU (24%), and was inaugurated in January 2010 (Poch, 2013).

Cambodia has significant biomass resources from forests, plantation forests, rice husks, and palm trees. Biomass can be used for power requirements or converted into other fuels. The 2015 ADB study estimated Cambodia's theoretical biomass energy generation potential at 15,025 gigawatt-hour (GWh) per year while technical biogas potential from livestock manure is estimated at 13,590,766 kWh per day. Several large- scale projects are planned at various sugarcane and palm oil plantations. There are also smaller biomass pilot projects at rice mills, ice factories, brick factories, and garment factories – around 40 projects – with capacities between 150 kW and 700 kW.

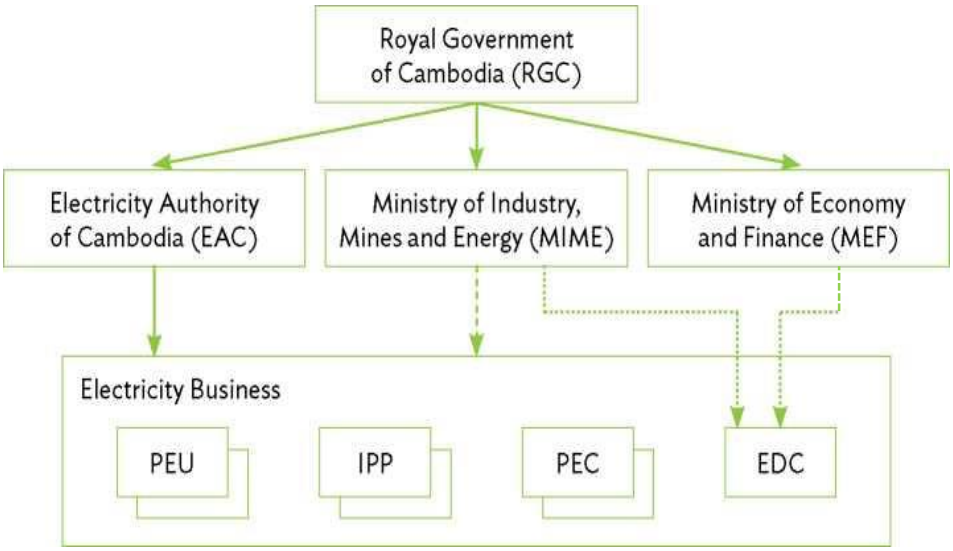
ii. Existing laws, regulations, policies, strategies, and development plans

Institutional Framework

The General Department of Energy of the Ministry of Industry, Mines and Energy is the main agency responsible for energy policies, plans, development strategies, and technical standards in Cambodia.

The Electricite du Cambodge is a state-owned utility responsible for power generation, transmission, and distribution. It is owned jointly by the Ministry of Industry, Mines and Energy and the Ministry of Economy and Finance. The Electricite du Cambodge accounts for more than 50% of installed generating capacity, but its coverage is largely limited to the country's major centres. It serves 16% of households in Cambodia, mostly in Phnom Penh. About 600 rural electricity enterprises provide electricity to off-grid customers. These enterprises are usually small, locally owned enterprises serving local households and businesses with diesel-powered low-voltage distribution systems. In addition, a number of rural electricity enterprises provide battery-charging services to local households and businesses. Figure 8 shows the institutional framework for the power sector in Cambodia.

Figure 8: Power Sector Institutional Framework: Cambodia



EDC = Electricite du Cambodge, IPP = independent power producer, PEC = Private Electricity Company, PEU = provincial (or joint with private) electricity utility.
Source: Ministry of Industry, Mines and Energy.

Renewable Energy Development and Rural Electrification Policies and Targets

Cambodia's RE development and rural electrification policies are linked. The government's energy policy is aimed at (i) supplying adequate energy at affordable rates, (ii) ensuring the reliability and security of electricity supply to facilitate investments and advance national economic development, (iii) encouraging the socially acceptable development of energy resources, and (iv) promoting the efficient use of energy and minimising detrimental environmental effects resulting from energy supply and consumption.

The goals of the government's rural electrification programme are as follows:

- Provides safe, reliable, and affordable electricity to rural communities in a way that minimises negative impact on the environment;
- Provides a legal framework that encourages the development of RE sources by the private sector to supply electricity to rural communities;
- Supports RE initiatives;
- Promotes the adoption of RE technologies by setting electricity rates in accordance with the Electricity Law (2001);
- Promotes the use of least-cost forms of RE in rural communities through research and testing of grid and off-grid options; and
- Supports electrification in disadvantaged rural communities through funding assistance, training, and other means.

The government is targeting to achieving full electrification of villages by 2020, and 70% household electrification by 2030. The village electrification target involves about 14,000

villages (with almost 2.5 million households). The main components of rural electrification are (i) an expanded power grid; (ii) diesel stand-alone, mini-utility systems; (iii) cross-border power supply from neighbouring countries; and (iii) RE (solar, wind, mini and micro hydro, biogas, and biomass). In the short- and medium-terms, small village hybrid grid systems will also have an important role (ADB, 2015).

Incentive Framework

To help meet its rural electrification targets, the government has established the Rural Electrification Fund with the help of a loan from the World Bank and a grant from the Global Environment Facility. The fund administers grants in support of rural electrification, using both conventional technology and RE technologies, such as solar, mini and micro hydro, and biomass. Since 2008, the Rural Electrification Fund was created and then integrated with the Electricite du Cambodgein 2012 and they are now implementing three joint programmes:

- Solar home system programme, retaining the above incentive mechanism;
- Power to the Poor Program, which provides interest-free loans of $120 per household to cover the expenses for connection, deposit, meter installation, and wiring, to be repaid in 36 monthly instalments; and
- Assistance for the improvement of existing electricity infrastructure in rural areas or the development of new infrastructure, involving loan guarantees, interest-free loans of up to US$100,000, or a combination of grants and interest-free loans.

2.2.6. Thailand's renewable energy status and policy: Lessons learnt

i. Renewable Energy Resources in Thailand

Hydro and biomass are the two main sources currently used at a greater extent. The country has already exploited almost all economically viable hydro for electricity generation. The maximum potential of solar is estimated at 6,000 MW and wind at 3,000 MW (DEDE, 2015). Maximum exploitable potential of agricultural residues is estimated to be 15 million tonnes of oil equivalent (Mtoe). Plantation-based biomass is also estimated to supply an installed capacity of up to 10,000 MW. The total availability of municipal solid waste (MSW) is estimated at 2,064 kilotonnes of oil equivalent (ktoe) and biogas is estimated at 570 ktoe. The use of solar, wind, plantation-based biomass, MSW, and biogas are considered for power generation while agricultural residues are considered for cogeneration and residential cooking in the future. It is assumed that biomass-based energy resources used for power generation will be supplied by energy plantations grown on a sustainable basis, hence, the CO_2 emissions for biomass is assumed zero.

Table 12: Composition of the Thailand Power System (as of December 2014)

Classified by technology	(MW)	(%)
- Combined cycle	21,145	56.2
- Thermal	7,538	20.0
- Renewable	8,476	22.5
- Gas turbine/Diesel generator	153	0.5
- EGAT-TNB linkage	300	0.8
Total	**37,612**	
Classified by power producer		
- EGAT	15,482	41.2
- Independent power producers (IPPs)	13,167	35.0
- Small power producers (SPPs)	4,530	12.0
- Very small power producers (VSPPs)	2,029	5.4
- Power imports	2,404	6.4
Total	**37,612**	

EGAT-TNB: Electricity Generating Authority of Thailand – Tenga National Berhad
Source: PDP 2015 (EGAT, 2015).

ii. Thailand's Alternative Energy Development Plan

The Government of Thailand has been trying to push forward the Alternative Energy Development Plan (AEDP) as part of a strategy to be a low-carbon society. In the past, to attract investors, the Adder System was used to encourage renewable power generation. Currently, a FIT system is planned to be implemented to reflect the real cost of renewable power generation and specify the timeframe of purchasing. Previously, the timeframe of RE promotion – according to the PDP2010 revision 3 and the previous AEDP – was during 2012–2021. Called the AEDP-25% the target was to substitute fossil fuel consumption by 25% in 10 years. In the AEDP2015, the RE promotion schemes were designed to strengthen the community, lessen the dependence on fossil fuels, and address social problems such as MSW and agricultural waste. Thus, the 2015 plan intended to encourage waste, biomass, and biogas power generation as the first priority. This is in line with the policies of Thailand's Ministry of Agriculture and Cooperatives to increase the plantation areas of sugarcane and palm and raise the productivity of cassava from 3.5 to 7.0 tonnes per rai per year – increasing the potential by 1,500 MW. In addition, area by area zoning and power generation capacity-limitation measures were adopted to avoid the constraints from the previous plan.

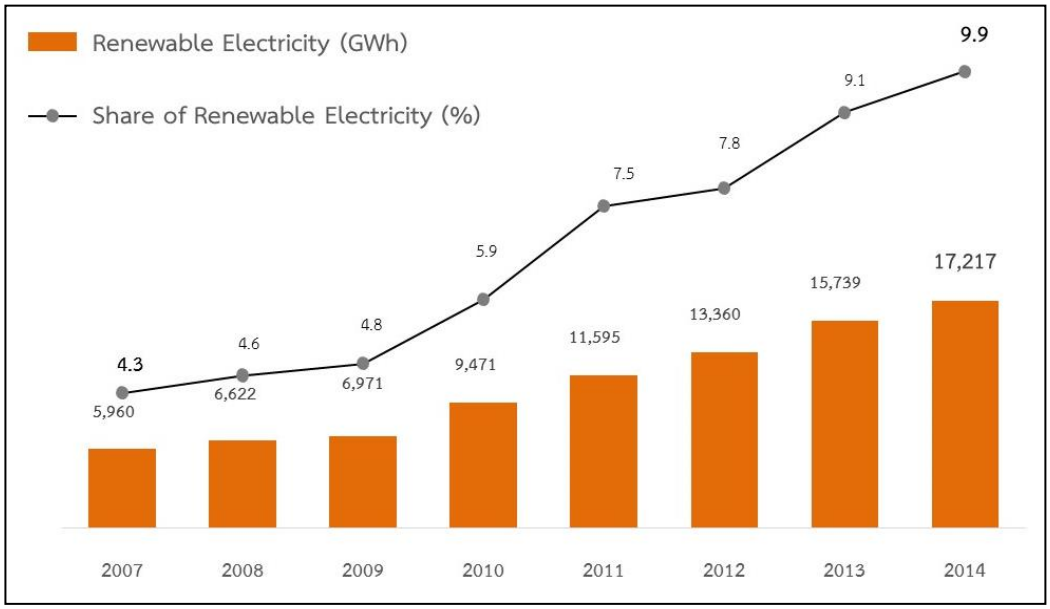
The main target of the AEDP2015 is to increase the portion of RE generation from the current 8% (in 2014) to 20% (by 2036) of the total power requirement, which accounts for 19,634.4

MW as shown in Table 13. In 2014, the share of natural gas in the fuel mix was 64%, which had decreased due to energy security concerns over imported gas. The AEDP2015 and PDP2015 aim to diversify fuels in power generation. By the end of the PDP2015, the aim of AEDP2015 is to cut natural gas to a share of 30%–40% from the current level of 64%. The proportion of RE is expected to rise to 15%–20% from the current 8%. An unspecified amount of coal capacity is supposed to be delivered as 'clean coal' by carbon capture and storage technology (which is currently at 0%. Hydropower should deliver 15%–20%. Consequently, shares of imported hydropower, clean coal/lignite, RE, and natural gas will be balanced in the long term.

iii. Renewable energy utilisation in Thailand

It is expected that technology improvement would build up the competitiveness of RE technology. Consequently, the nationwide RE electricity generation in Thailand has been increasing its share from 4.3% (5,960 GWh) in 2007 to 9.87% (17,217 GWh) in 2014 (Figure 9).

Figure 9: Progress of Renewable Energy Electricity Generation in Thailand



Source: PDP 2015 (EGAT, 2015).

The RE generation capacity of 17,217 GWh in 2014 included 1,298.51 MW solar PV, 2,451.82 MW biomass, 311.50 MW biogas from waste water, 224.47 MW wind power, 142.01 MW small hydro, and 65.72 MW MSW (Table 13). The Thailand's RE learning curve in Figure 9implies that the target of 20% RE generation in 2036 will be achieved. This RET achievement mainly comes from private investment.

In the AEDP2015, the high capacity target of 6,000 MW solar PV and 3,000 MW is due to a private proposal under consideration. It is advisable for the government to limit the ceiling

capacity before launching RET policy. In Thailand, the capacity factor of solar is about 15% while wind power has a capacity factor of 20%. However, both solar and wind power have low capacity factors when compared to 40% for hydro and 80% for biomass. These figures also imply that incentives or subsidies are needed to make these RETs competitive with conventional power generation.

Table 13: RE Generation in 2014 and the AEDP2015 Target

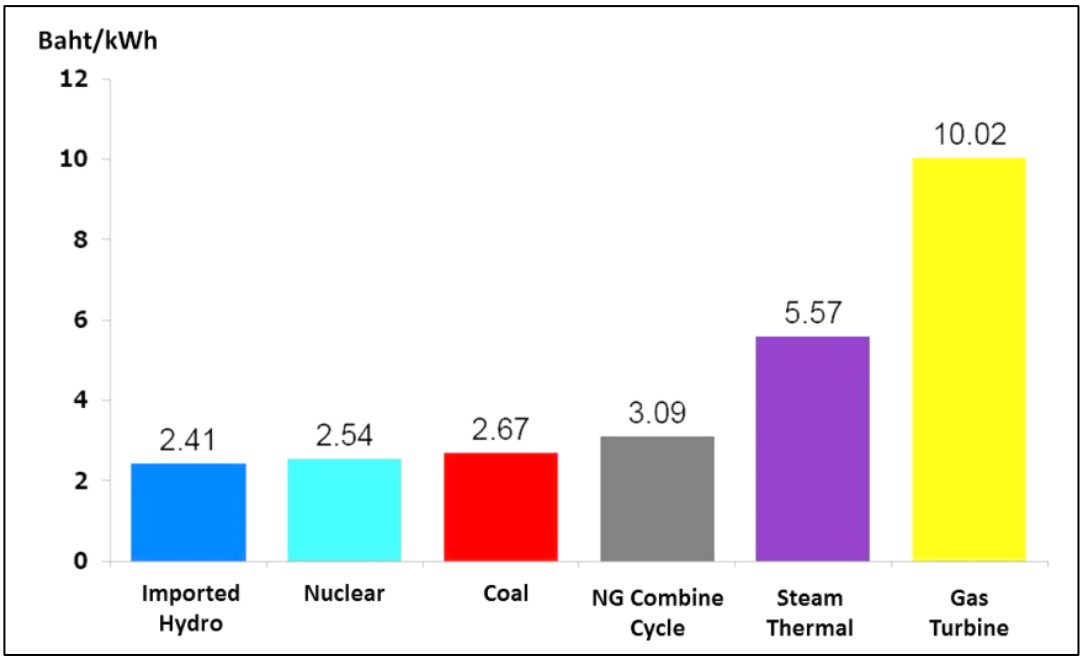
Type	Situation in 2014 (MW)	Target in 2036 (MW)
1. MSW	65.72	500
2. Industrial waste	-	50
3. Biomass	2,451.82	5,57
4. Biogas from waste water	311.50	600
5. Small hydro	142.01	376
6. Biogas from biomass	-	680
7. Wind	224.47	3
8. Solar photovoltaic	1,298.51	6
9. Hydro (storage)	-	2,906
Total(MW)	**4,494.03**	**19,684**
Electricity (GWh)	**17,217**	**65,588**
National Electricity Demand (GWh)	**174,467**	**326,119**
Share of RE (%)	**9.87**	**20.11**

AEDP = Alternative Energy Development Plan, GWh = gigawatt-hour, MSW = municipal solid waste**,** MW = megawatts, RE = renewable energy.
Source: MOEN, 2015.

iv. Policies and Instrument Promoting RET Deployment in Thailand

Power generation costs from RE resources in Thailand are higher than those of conventional energy resources such as coal, natural gas, and hydro (Figure 3). RE has been promoted to address global warming and climate change issues linked to greenhouse gas (GHG) emissions. The most well-known GHG is carbon dioxide (CO_2), mostly emitted from the combustion of fossil fuels in industrial sectors and electricity power generation. RE generation is competitive only at system peak generation for few hours. Therefore, to promote the fast growth of RET deployment, incentives are needed.

Figure 10: Levelised Generation Cost in Thailand (PDP2015)



Note: Exchange rate, 32 Baht = US$ 1
Source: EGAT, 2015.

Thailand is the first country in the ASEAN that promoted RET deployment through RPS, Adder tariff, and FIT mechanisms. Thailand introduced the RPS scheme in 2004, and then changed the policy by introducing the Adder tariff scheme in 2007 that provided a direct incentive to RET investors. As earlier noted, solar PV in Thailand has a very low plant capacity factor and is not economically and financially feasible. Therefore, Adder for solar PV was first set at B8.0 per kWh in 2007. Analyses of the Adder scheme show that all RETs are financially viable under an internal rate of return of 10% (Table 14). These internal rates of return confirm that RE generation, with Adders, will be financially competitive with conventional power generation from fossil-based plants.

The 'Adder' added a premium to the wholesale electricity price. Though the wholesale price is volatile and the premium was guaranteed for periods of only 7–10 years, on the RE learning curve of Thailand, Adder tariffs for all RETs are adjusted over time since 2007 to reflect the competitiveness of such RET. Solar PV shows a drastic decrease in its Adder over time (Table 15).

Table 14: Economics of Renewable Energy Generation in Thailand, With and Without Incentives

RET	IRR, without Adders (%)	IRR, with Adders (%)
Biogas	9	14
Small hydro	5	12
Biomass	4	11
Wind	2	11
Solar	NA	9

IRR = internal rate of return, NA = not applicable, RET = renewable energy target.
Source: Estimated by the Study Team

Table15: Thailand's Renewable Energy Electricity Adders

RET	2007 (B/kWh)	2009 (B/kWh)	2010 (B/kWh)	Diesel Substitute (B/kWh)	3 South Provinces (B/kWh)	Years
Biomass						
< 1 MW	0.30	0.50	0.5	1.00	1.00	7
> 1 MW	0.30	0.30	0.3	1.00	1.00	7
Biogas						
< 1 MW	0.30	0.50	0.5	1.00	1.00	7
> 1 MW	0.30	0.30	0.3	1.00	1.00	7
MSW						
Landfill	2.50	2.50	2.5	1.00	1.00	7
Thermal Process	2.50	3.50	3.5	1.00	1.00	7
Wind						
< 50 MW	3.50	4.50	4.5	1.50	1.50	10
> 50 MW	3.50	3.50	3.5	1.50	1.50	10
Small hydro						
50 kW–200 kW	0.40	0.80	0.8	1.00	1.00	7
< 50 MW	0.80	1.50	1.5	1.00	1.00	7
Solar PV	8.00	8.00	6.5	1.50	1.50	10

B = baht, kW = kilowatts, MSW = municipal solid waste, MW = megawatts, PV = photovoltaic, RET = renewable energy target.
Source: DED, 2013.

In addition to the revised Adder tariffs for all RETs since 2007, Thailand also increased the RET deployment target, step by step. Table 14 presents the 1st Renewable Energy Development Plan (REDP20%) launched in 2009, changed to AEDP25% in 2012, and finally changed to AEDP30% in 2015 in AEDP2015. Please note that the share of RE in final energy consumption as set in REDP or AEDP includes RE electricity generation and biofuels in transport sector, and others.

Table 16: Development of RET in the AEDP

RET	REDP-20% in 2022 (ver. 2009)		AEDP-25% in 2021 (ver. 2012)		AEDP-25% in 2021 (ver. 2013)	
	MW	ktoe	MW	ktoe	MW	ktoe
Wind	800	89	1,200	134.36	1,800	201.54
Solar PV	500	56	2,000	223.93	3,000	335.90
Small hydro	324	85	84.65	84.65	324	84.65
Pump storage			670.90	670.90	-	-
Biomass	3,700	1,933	1,896.70	1,896.70	4,800	2,508.04
Biogas	120	54	268.72	268.72	600	268.72
Napier			-	-	3,000	1,791.46
Waste to energy	160	72	71.66	71.66	400	179.15
New RE	3.5	1	0.90	0.90	3	0.90
TOTAL	**5,608**	**2,290**	**3,351.81**	**3,351.81**	**13,927**	**5,370.33**

AEDP = Alternative Energy Development Plan, ktoe = kilotonnes of oil equivalent, MW = megawatts, PV = solar photo voltaic, RE = renewable energy, REDP = Renewable Energy Development Plan, RET = renewable energy target.

Source: AEDP2015 (DEDE, 2015)

In 2014, Thailand acknowledged the principle for employing a new FIT developed by the Ministry of Energy, which replaced the former Adder programme that had been in place for several years. The full policy for the FIT for very small power producers of less than 10 MW installed capacity was approved in 2014. The Ministry of Energy explained the introduction of the FIT for very small power producers as a first step because of the limited capacity of the transmission system.

The new FIT will be granted for 20 years, but landfill gas will receive support for 10 years only. The FIT rates differ greatly depending on power plant size and fuel types; different bonuses are granted for certain systems.

The Adder tariff mechanism expired on 31 December 2015 and was substituted by a FIT plus a premium model, which was especially supportive of projects up to 10 MW, especially for PV projects of up to 50 MW. Table 17 shows the 2016 FIT scheme of Thailand.

Table 17: New FIT for RET Deployment in Thailand

Capacity (MW)	FIT (B/kWh)			Duration (Years)	FIT Premium (B/kWh)	
	FIT_F	FIT v. 2017	FIT[(a)]		Biofuel projects (first 8 years)	Project in Southern Border Province [(b)] (lifetime project)
1. Waste (integrated waste management)						
Installed capacity ≤ 1 megawatt	3.13	3.21	6.34	20	0.70	0.50
Installed capacity > 1 – 3 MW	2.61	3.21	5.82	20	0.70	0.50
Installed capacity >3 MW	2.39	2.69	5.08	20	0.70	0.50
2. Waste (landfill)	5.60	-	5.60	10	-	0.50
3. Biomass						
Installed capacity ≤ 1 MW	3.13	2.21	5.34	20	0.50	0.50
Installed capacity > 1 – 3 MW	2.61	2.21	4.82	20	0.40	0.50
Installed capacity > 3 MW	2.39	1.85	4.24	20	0.30	0.50
4. Biogas (waste water/ waste material)	3.76	-	3.76	20	0.50	0.50
5. Biogas (energy plants)	2.79	2.55	5.34	20	0.50	0.50
6. Hydro						
Installed capacity ≤ 200 kW	4.90	-	4.90	20		0.50
7. Wind	6.06	-	6.06	20	-	0.50

B = baht, FIT = feed-in tariff, kW = kilowatts, kWh = kilowatt-hours, MW = megawatts.

Notes:

[a] This FIT rate applies to a project that delivers power into the grid in 2017, the FITv rate will be increased based on the core inflation rate. This only applies to waste (integrated waste management), biomass and biogas (energy plants) projects.

[b] Projects located in Yala, Pattani, Narathiwat and four sub-districts in Songkla (Kana Sub-district, Tapha Sub-district, Sabayoi Sub-district, and Natawee Sub-district only.

Source: AEDP, 2015.

The new FIT is composed of three components: FIT = FIT(F) + FIT(V) + FIT Premium.

FIT(F) is a portion of remuneration that is fixed throughout the whole period, while FIT(V) is a portion that varies according to the inflation rate. Variable portions are applicable only for certain technologies for which the feedstock price is considered to be volatile, such as for

biomass and biogas from energy crops, and for waste-to-energy projects (excluding landfill gas projects). The FIT(V) rates were fixed for projects that dispatch electricity to the grid in 2017 FIT(V2017); after that, FIT(V) will be revised on an annual basis in accordance with the core inflation to reflect actual feedstock costs. The last component is the FIT Premium, which again is split into two categories: (i) additional FIT granted to promote the use of the certain renewable fuels and granted for the first 8 years of project lifetime, and (ii) a premium that is granted for the whole project duration for very small power producers located in three southern border provinces and four districts of Songkla province (i.e. Chana, Thepa, Saba Yoi, and Na Thawi).

v. Review on Barriers Incentive and Disincentive Mechanisms

Renewable Portfolio Standard (RPS)

In 2004, Thailand launched the RPS to encourage fossil-based power producers to increase their investment in renewable power plants by 3%–5%. Unfortunately, the RPS failed. It did not encourage RE deployment nor stimulate investment in RE. Thus, in 2009, the Government of Thailand changed the RPS policy to Renewable Energy Development Plant (REDP) and introduced strong subsidies in the form of Adders to most RET. Solar power received the largest subsidy of B 8.50 per kWh resulting in fast investment in RE.

Barriers on Limited T&D (Transmission and Distribution) Capacity

The AEDP would be integrated with the power demand forecasting to formulate the PDP2015. However, many limitations should be considered, for instance, the RE potential and power demand of each region. The transmission and distribution system has not been planned for the large amount of power generated from very small power producers, therefore, there is a possibility of reverse power flow problems, which would increase losses in the power system. This problem has occurred in the northeast part of Thailand where many solar and wind farms are located.

Role of the Energy Regulatory Commission

Currently, the Energy Regulatory Commission (ERC) of Thailand plays very small role in the AEDP, which was set by the implementing agencies. Consequently, the cost of subsidies in the form of Adders and FITs has been embedded in total national generation cost, which represents a burden to electric customers nationwide. In the future, the renewable purchase schemes would play a vital role in implementing the AEDP, thus, ERC will be responsible for monitoring the country's RE status, and revising the AEDP depending on the situation. As a result, private investors would have a clear picture of the country's RE development.

Benefits of RET Deployment in Nationwide CO_2 Reduction

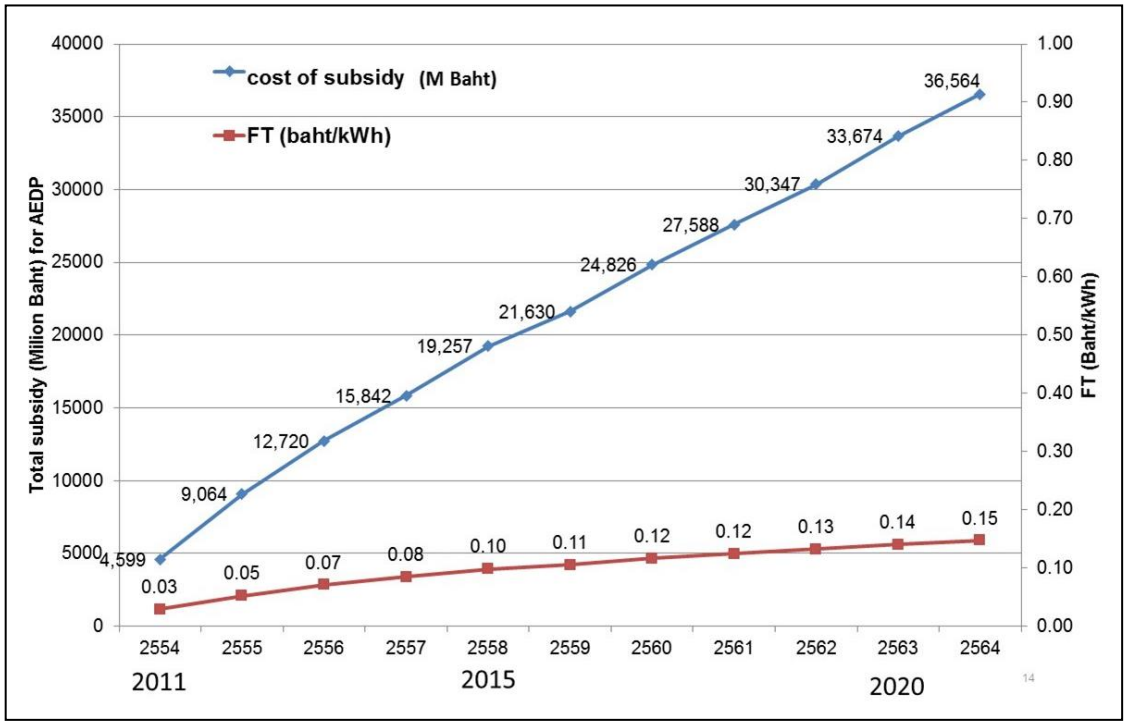
The PDP2015 is inline and complies with AEDP2015, and if the new FIT is implemented successfully, the RE electricity generation will shift Thailand towards the so-called low-carbon society. CO_2 intensity in power generation is expected to decrease from 0.506 kg-CO_2/kWh in 2014 to 0.319 kg-CO_2/kWh in 2036. This target is quite ambitious for Thailand when compared with the previous power development plan. In terms of kt-CO_2 from the power sector, it will

slightly increase from 89,678 kt-CO_2 in 2014 to 104,075 kt-CO_2 in 2036. The amount of CO_2 emissions from the power sector is almost stable due to the benefits of RET deployment in Thailand. This lesson in RET deployment is expected to help Thailand decouple economic growth from CO_2 emissions in the near future.

Impact of RET Deployment on Electricity Generation Cost

Both Adder and FIT schemes result in increasing electricity generation cost to the power producers and then this incurred cost is passed on to all electric customers in Thailand. With the 2013 Adder tariff, it is expected that the cost of subsidy to RET will be B36,564 million per year in 2021, resulting in increasing the retail tariff to customers at B0.15 per kWh when compared to the retail tariff of B3.50 per kWh in 2013. This burden cost will mainly come from subsidy to solar PV at higher Adder tariff. It is recommended that such impacts should be analysed before introducing Adder or FIT.

Figure 11: Impact of RET Deployment on Electricity Generation Cost

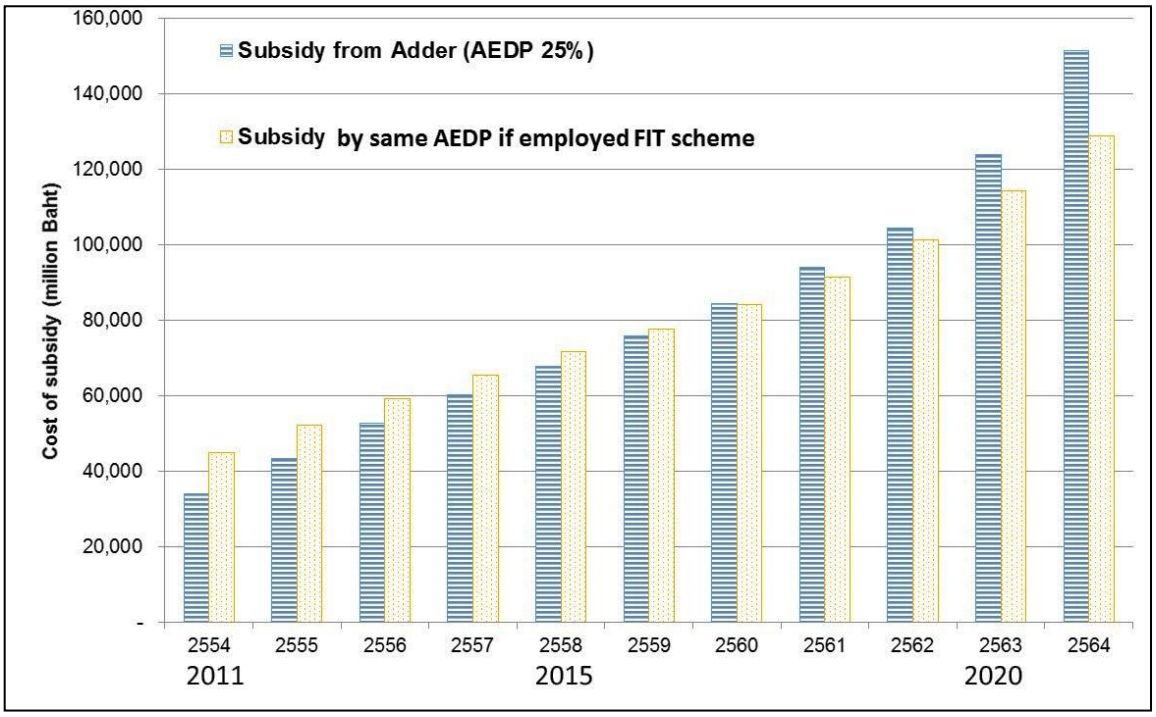


RET = renewable energy target.
Source: Estimated by the Study Team.

Adders vs. FIT – Which is better?

Thailand has employed Adder tariff for all RETs since 2007, and it was found that this subsidy cost will be go higher in the near future. Several studies have examined this mechanism. It was found that under the same target of RET capacity in the AEDP, the subsidy will be go lower when the FIT scheme is used to promote RET deployment (Figure 12). Finally, Thailand stopped the Adder scheme by the end of 2015, and started the FIT scheme for all RETs in 2016.

Figure 12: Impact of Renewable Energy Deployment under Adder vs. FIT Schemes



AEDP = Alternative Energy Development Plan, FIT = feed-in tariff.
Source: Estimated by the Study Team

2.2.7. Interregional cooperation for RE development

The region as a whole generally has a high potential for RE development. Some countries have high potential and relatively high penetration of RE capacity. However, the cooperation and harmonisation for RE development was very limited. Certainly, there is room to increase cooperation and harmonisation for both individual countries and the region. Expansion of renewables such as wind, solar, biomass, and geothermal would lead to an increase in diversity, assuming these do not completely displace another fuel source. However, increased RE share in power generation may have alternative impacts. For example, it could result in a higher cost of electricity or less jobs. Expansion into thermal is likewise not as clear-cut from a general perspective.

There are few initiatives in renewable energy regional cooperation, including joint studies on Renewable Energy Support Mechanism for Bankable Projects, Off-grid Rural Electrification Approaches, Renewable Energy Technical Standards in ASEAN, and the establishment of Energy Research Institutes Network. The online ASEAN Renewable Energy Information was established to provide key ASEAN information on RE studies, country profiles, and reports. The RE Business Directory and RE Permit Procedures were also completed and published. To help shape influential RE policies and increase deployment of RE projects in the region, several focus group discussions were organised, such as (i) on CO_2 reduction – Greater Role of RE in ASEAN Power Generation Sector, (ii) Impacts of Renewable Energy Integration through Grid Connection, (iii) RE Lending Guidelines, (iv) Business Models for Rural Electrification, (v) Technical Standards for PV Hybrid System, and (vi) Recommendation on RE Permit Procedures.

Since countries in the region were at different levels of RE policy regulation framework, interregional cooperation on RE standards, on exchange of information and lessons learnt, and on pilot and demonstration projects, it was seen that best practices and benchmarking would facilitate rapid RE deployment. There is a good opportunity for Cambodia, Lao PDR, and Myanmar to benefit from the experiences of Thailand, Malaysia, and Viet Nam in successfully implementing RE policy through interregional cooperation.

RE policy and planning in the region has developed individually given that these are at different stages of development. Hence, the level of integration in RE policy and planning in the region is still nascent among the countries and much need to be done to raise the expertise in this area.

From the review above, it appears that the most applicable instruments for the development of RE projects are (i) FIT with relevant level of tariff, (ii) simplified procedures for RE development permission, (iii) economic incentives, and (iv) financial support schemes. These instruments have been applied in the Greater Mekong Subregion countries with various levels of incentive. The interregional power exchange and cooperation in policy experiences may push further the improvement and refinement of these instruments for RE deployment in the region.