A Review of Thailand's Efforts towards Climate Change Mitigation and Strategic Energy Policy Plans

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Abstract: Thailand is a Non-Annex I country that ratified the Kyoto protocol in 2002. It produced its Nationally Appropriate Mitigation Actions (NAMA) in 2014 and committed at the conference of parties in Lima (COP20) to reduce its GHG emissions by 7-20% by 2020 based on 2005 level. At COP 21 in Paris, Thailand announced in its intended National Determined Contribution to reduce GHG emissions by 20% by 2030 and a maximum target of 25% as compared to the 2005 level with a particular emphasis on the energy sector, including transportation. In line with these climate change related targets, Thailand has produced a Climate Change Master Plan (2015 - 2050) providing a series of guidelines, measures and actions for climate change mitigation (and adaptation) in line with its INDC. The energy sector being a major contribution to GHG emissions, renewable energy has been strongly promoted along with energy efficiency as means to contribute to climate change mitigation and to alleviate dependency on imported fossil fuels. With regard to renewable energy, policy measures are detailed in the Alternative Energy Development Plan 2015-2036 (AEDP 2015) which provides targets covering electricity, thermal energy and biofuels (transport). Renewable energy is targeted to contribute 30% of final energy consumption in 2036 (131,000 ktoe). Achieving the AEDP 2015 targets would lead to reducing power-related GHG emissions by 20% compared to business-as-usual by 2030, and a maximum target of 25% as indicated in the INDC of Thailand.

1. Introduction

With a population of 67 Million people and a GDP per capita of 6175 USD, Thailand is the second largest economy in ASEAN (Association of Southeast Asian Nation). In 2012-13, its emissions per GDP (US$ million) were at 409.54 tons CO_2eq and its per capita GHG emissions at about 4 tCO_2eq, lower than the world average of 5 tCO_2eq [1-2].

Thailand has been aware since early on of the necessity of tackling climate change due to the anthropogenic emissions of greenhouse gases (GHGs). Hence, it ratified the United Framework Convention of Climate Change (UNFCCC) in 1994 and the Kyoto Protocol in 2002. Although Thailand is a Non-Annex I country and so has no obligation to reduce its GHG emissions, it has since then established a number of firm policies to achieve ambitious targets of GHG emissions reduction. The country has been very active in particular in establishing energy policy plans addressing the issue of climate change while dealing with the increasing challenge of energy security, the country being heavily reliant on fossil fuels to satisfy its energy demand.

This paper provides a review of Thailand's involvement in addressing the issue of climate change and its mitigation, with a focus on its energy situation and related policy efforts to achieve challenging targets of GHG emissions reduction.

2. Thailand's Contribution to Climate Change Mitigation

2.1 Involvement in UNFCCC

Climate change is an important environmental problem caused by enhanced GHG emissions from anthropogenic activities. The UNFCC was adopted as the basis for a global response to the problem. The ultimate objective of the Convention is the stabilization of GHG emissions into the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate systems. To achieve this goal, in 1997, the Kyoto Protocol was adopted at the Third Conference of the Parties to the UNFCCC (COP 3) in Kyoto, Japan. The Convention requires the member countries to achieve their GHG emissions reduction, especially the industrialized countries which are legally bound to stabilize GHG emissions. Thailand ratified the UNFCCC on 28 December 1994 and the Kyoto Protocol on 28 August 2002. Thailand submitted its first National Communication (NC) in 2000 documenting the 1994 inventory of GHGs [3]. The second NC of Thailand was submitted in 2011 and describes Thailand's inventory status over the period 2000-2004 [4]. In 2017, the country was in the process of submitting its third NC. In 2014, at the COP 20 in Lima, Thailand announced its plan to reduce national GHG emissions by 7 to 20% by 2020 based on the year 2005 (business-as-usual scenario). Thailand via the Ministry of Natural Resources and Environment (MNRE) was the 58th developing country to voluntarily submit its Nationally Appropriate Mitigation Actions in 2014 through a formal letter to UNFCC [5]. In this document, it declares its intent to achieve the above mentioned ambitious mitigation targets in line with its national development plans. The measures cover:

- Development of alternative and renewable energy sources
- Energy Efficiency improvement in buildings, industries, transportation and power sector
- Biofuels in transportation
- Environmentally sustainable transport system

2.2 INDC-based GHG Emission Reduction Targets

In the run-up to COP21 that was held in Paris in December 2015, Thailand submitted its Intended National Determined Contribution (INDC) to the UNFCCC. In this document, an ambitious plan of GHG emissions reduction is presented, which concerns mainly the energy and transport sector in accordance with national policy plans. Thailand specifies its intention to reduce greenhouse gas emissions by 20% compared to business-as-usual (BAU) by 2030 (550 million tons CO_2eq), and a maximum target of 25% [1]. The document informs that in 2012 Thailand's national GHG emissions represented 0.84% of global emissions. In 2000, the country reported in its second NC that GHG emissions amounted to 281 million tons. Taking into account a sink of 52 million tons by the forest sector, the net GHG emissions reached

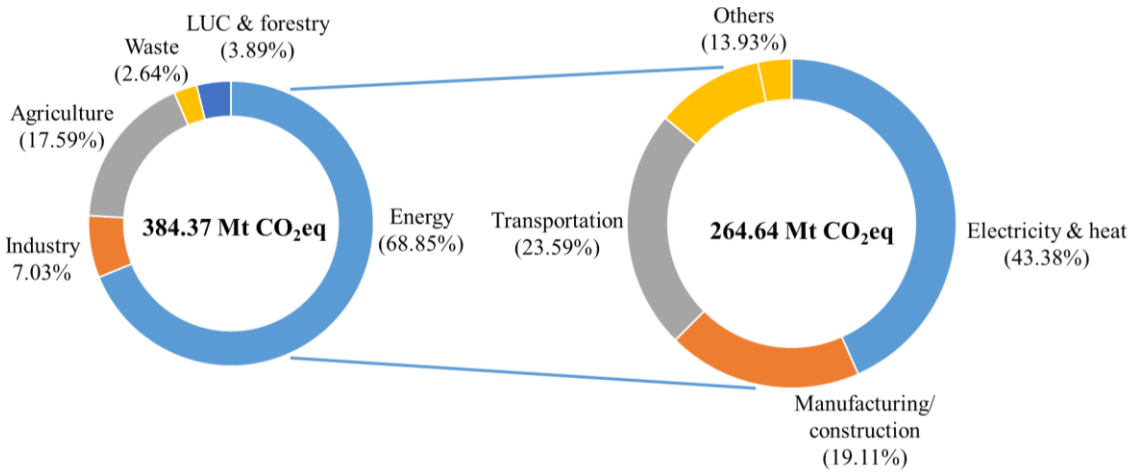

Figure 1. Greenhouse Gas Emissions by Sector (Source: Based on WRI [6]).

Table 1 Primary Energy Supply in ktoe

Primary Energy Supply	Domestic Production	Imports	Exports	Stock Change	Total
Coal and its Products	4,459	10,852	7	(1,492)	13,812
Crude Oil and NGL	7,363	43,322	1,606	4,153	53,232
Condensate	4,509	1,206	-	(244)	5,471
Natural Gas	36,405	10,470	-	-	46,875
Petroleum Products	-	3,186	13,694	(884)	11,392
Electricity	-	1,071	109	-	962
Renewable Energy	9,993	-	-	-	9,993
Traditional RE	13,739	125	29	-	13,835
Biofuels	1,609	-	48	(41)	1,520
Total	78,077	70,232	15,493	1,492	134,308

Source: Based on DEDE [7]

229 million tons. From this amount it was estimated that 67 % were contributed by the energy sector, 23% by the agricultural sector and the remaining 7% shared by the industry, forestry, and waste management sector, respectively [4]. In 2013, data from WRI [6] showed that over 369 million tons GHGs were emitted (excluding forestry and land use change), 72% of which were contributed by the energy sector (see Figure 1) [6]. This confirms that GHG emissions in Thailand have continually been increasing (about 2.9% per year) with economic development, the country having heavily relied on imported fossil fuels as also pointed in the National Communication. Therefore efforts in the INDC are emphasized on mitigating emissions from energy, including the transport sector. At present, it has been reported that Thailand has already achieved a 4% reduction in GHG emissions from the projected 2020 BAU. Therefore it is well on track to reach the 7% minimum target of GHG emission reduction set to be achieved as voluntary domestic efforts by 2020 according to the targets set out in the NAMAs of Thailand and presented at the COP 20.

3. Thailand's Energy Efforts for Climate Change Mitigation

3.1 Energy Status

As reported earlier, following the ratification of the Kyoto Protocol in 2002 the country has been very active in establishing energy policy plans aiming at contributing to reducing GHG emissions. Thailand's energy situation and policy plans set out to achieve its INDC ambitious targets are discussed below.

In 2013, Thailand's total primary energy supply (TPES) reached 134 million tons oil equivalent (Mtoe). With a total domestic energy production of 78 Mtoe in that year, Thailand remained a significant producer of energy (see Table 1). From this amount over 46% were contributed by natural gas (national reserves are expected to last for another 6 years only), 32% by renewables (traditional and alternative renewable sources, and biofuels), 15% by crude oil (including natural gas liquid and condensate), and almost 6% by coal. In terms of TPES, crude oil accounted for almost 40% of the share. As 85% were imported and with reserves predicted to last only for a few years, this makes Thailand highly sensitive to global market and price fluctuations [2]. Natural gas was the next major contributor to TPES with 35%. With fast depleting reserves and over 77% of the production of natural gas coming from domestic supply, a shift in the prevailing sources of energy contributing to the mix primary energy supply in Thailand is expected in the next few years. Remaining contributors to TPES included mainly renewables (19%) and coal (10%). Total energy exports amounted to almost 15.5 Mtoe in 2013, made up almost entirely of petroleum products (88.5%) and crude oil (10%). Exports increased by 73.6% in the ten years to 2013, growing faster in relative terms than total production of energy, which increased by 58.3% over the same period. Total energy imports reached 70.2 Mtoe in 2013. It was mainly contributed by crude oil (64%), coal (15%), natural gas (15%), petroleum products (4.5%), and electricity (1.5%). Imports to Thailand have increased by almost 40% in the ten years to 2013 [7-8].

As observed from Figure 2, final energy consumption reached 75 Mtoe in 2013. About 48% were contributed by petroleum products (95.5% fossil based and 4.5% biofuels), followed by electricity with 19% (fossil fuels: 80%, renewable energy: 9%, hydropower: 11%), renewables with 18% (traditional and alternative renewable sources), coal with 8%, and natural gas with 7%. Based on this data, Thailand's energy consumption appears therefore to be dominated by fossil fuels (about 80%) and to be dependent on crude oil importation.

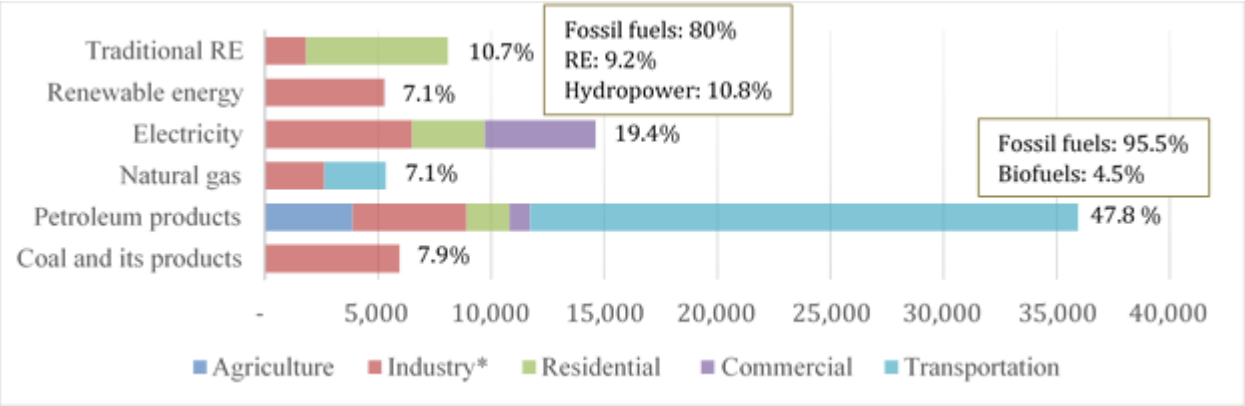

Figure 2. Final Energy Consumption by Fuels and by Economic Sectors in ktoe
Source: Based on DEDE [7]

Table 2 Renewable Energy Target by 2036

Energy	Share of Renewable Energy Targets	Final Energy Consumption (ktoe)
Electricity	15-20%	27,789
Heat	30-35%	68,413
Biofuels	20-25%	34,798
Final Energy Consumption	30%	131,000

Source: Based on DEDE (2015) [10]

The dominant economic sectors in terms of energy consumption include the industrial and transportation sector with 36% each. This is followed by the residential (15%), commercial (8%) and agricultural (5%) sectors. Therefore strong emphasis by the Thai government has been placed on the energy (Industry) and transport sectors for the promotion of renewable energy to enhance energy security and contribute GHG emissions reduction (climate change mitigation).

3.2 Energy Policy Plans

As mentioned earlier, the energy sector, including transportation, is a major contributor to GHG emissions at the national level. The promotion of renewable energy is one of the main components upon which the INDC of Thailand is based on to contribute to climate change mitigation. As mentioned before, INDC presents an economy-wide contribution covering the timeframe 2021 to 2030. The INDC was established based on the following plans:

- National Economic and Social Development Plans
- Climate Change Master Plan B.E. 2558-2593 (2015-50)
- Power Development Plan B.E. 2558-2579 (2015-36)
- Thailand Smart Grid Development Master Plan B.E. 2558-2579 (2015-36)
- Energy Efficiency Development Plan B.E. 2557-2579 (2015-36)
- Alternative Energy Development Plan B.E. 2558-2579 (2015-36)
- Environmentally Sustainable Transport System Plan B.E. 2556-2573 (2013-30)
- National Industrial Development Master Plan B.E. 2555-2574 (2012-31)

From the above plans, the promotion of renewable energy is specifically presented in the Alternative Energy Development Plan 2015-2036 (AEDP 2015) which provides targets covering electricity, thermal energy and biofuels (transport). Since the AEDP 2015 deals notably with power, it is also linked to other energy plans also listed above, including, the Energy Efficiency Development Plan 2015-2036 (EEDP 2015) and the Power Development Plan 2015-2036 (PDP 2015). According to EPPO [9], the EEDP 2015 indicates a reduction in the country's energy intensity by 30% below the 2010 level in 2036. Based on the year 2015, this would amount to 51,700 ktoe energy saving where around 15 percent would be contributed by the power sector and 85% by the thermal sector. Based on this, final energy consumption in the year 2036 would reach 131,000 ktoe. In accordance with this information and looking at the electricity demand forecasted in the PDP 2015, targets involving contribution from renewable energy were established in the AEDP 2015. Thus, for instance, the PDP 2015 indicates that in 2036, net electricity demand will reach 27,789 ktoe and sets a target to achieve a 15-20% share of power generation from renewable sources by that time [9]. The heat demand in 2036 is forecasted at 68,413 ktoe with a 30-35% share from renewable source and the fuel demand in the transportation sector is forecasted at 34,798 ktoe with a 20-25% share from renewable sources (biofuels) [10]. Based on the final energy consumption of 131,000 ktoe forecasted in 2036, renewable energy would contribute a 30% share as specified in the AEDP 2015 (see Table 2). This relates to the minimum target of reducing power-related GHG emissions by 20% compared to BAU by 2030, and a maximum target of 25% as indicated in the INDC of Thailand.

4. Conclusions

Over the past 2 decade Thailand has been deeply involved in addressing the issue of climate change, identifying its contribution to GHG emissions and possible mitigation pathways. The energy sector is one major contributor to GHG emissions. As a result of its growing economy and increased demand in energy, along with a dependency on imported fossil fuel that is threating the country's energy security, Thailand has focused on developing energy policy plans with specific targets to be achieved over the next 20 years. This includes in particular enhancing energy efficiency and promoting renewable energy. These plans should enable the country to meet the GHG emissions reduction targets it has committed to achieve as stipulated in its INDC with a 20% reduction compared to BAU by 2030 and a maximum target of 25%.

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