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## Do Electric Vehicles Really Reduce GHG Emissions in Thailand?

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### Abstract

Transport sector is the highest energy consuming sector. It has consumed more than 35 percent of total energy consumption in Thailand, and accounted for about 27 percent of Thailand's GHG emissions. Nowadays, many policies and strategies are promoted and supported in order to reduce the energy consumption as well as the emissions in all entire sectors, especially the transport and industrial sectors. In the transport sector, regarding to the Energy Efficiency Plan (EEP) 2015, both energy efficiency improvement and advanced transport technology have been implemented such as improving fuel economy of gasoline and diesel engines as well as increasing share of electric vehicles. In fact, per energy efficiency of the engine, even if EVs consume less energy than the conventional gasoline and diesel engines, EVs emit no tailpipe pollutants however the power plants which generate electricity to power EVs still emits GHG except electricity from alternative energy sources such as nuclear, biomass, hydro, solar, and wind. This study aims to investigate the influence of EVs implementation on changes of GHG emissions in the transport sector related to the power generation in Thailand during the period of 2015 to 2036. Moreover, optional area to achieve target of EVs implementation as EEP2015 with environmental recovery aspects is proposed. The results indicate that even EVs could reduce energy consumption in the transport sector, it would effect on increasing GHG emissions in the power sector. Therefore, the policy makers or related organizations should take this consequence into the consideration under the implementation of energy related environmental policy for making the most benefits of both sides.

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## Nomenclatures

20RE	20 percent of RE achievement in the power generation sector
DEDE	Department of Alternative Energy Development and Efficiency
EEP	Energy Efficiency Plan
EVs	Electric Vehicles
HSL	Higher Standard Label
GDP	Gross Domestic Product
GHG	Greenhouse Gas
LPG	Liquefied Petroleum Gas
CNG	Compressed Natural Gas
PDP	Power Development Plan
RE	Renewable Energy

## 1. Introduction

Thailand's energy consumption increased from 62,395 ktoe in 2005 to 75,214 ktoe in 2013, resulting in increasing GHG emissions about 26 Mt-CO<sub>2eq</sub> during the time span [1, 2]. Transport sector is the highest energy consuming sector. It has consumed more than 35 percent of total energy consumption in Thailand, and accounted for about 27 percent of Thailand's GHG emissions. Nowadays, Department of Alternative Energy Development and Efficiency, Ministry of Energy of Thailand has attempted to promote and support many policies and strategies in order to reduce energy consumption as well as the emissions in all entire sectors, especially the transport and industrial sectors. In the transport sector, regarding to the EEP2015, both energy efficiency improvement and advanced transport technology have been implemented such as improving fuel economy of gasoline and diesel engines as well as increasing share of EVs. In fact, per energy efficiency of the engine, even if EVs consume less energy than the conventional gasoline and diesel engines [3], EVs emit no tailpipe pollutants however the power plant which generates electricity to serve them emits GHG except electricity from alternative energy sources cause no GHG emissions.

In 2014, electricity was mainly generated from natural gas and coal (including lignite) by 64 and 20 percent, respectively while those from the renewable energy including hydro power was only about 8 percent and diesel generator as well as imported electricity from neighboring countries were the remaining. Thus, carbon dioxide grid emission factor for Thailand is 0.457 kgCO<sub>2</sub>/kWh in 2014. Nonetheless, based on the PDP of Thailand; PDP2015, it is expected that the share of electricity generating from RE will increase to 15-20 percent of total electricity generation system in Thailand in 2036 which results in reduction of grid emission factor to 0.319 kgCO<sub>2</sub>/kWh [4].

Regarding the above information, this study aims to investigate the influence of EVs implementation on changes of GHG emissions in the transport sector related to the power generation of Thailand during the period of 2015 to 2036. Moreover, proposed measures to achieve target of EVs implementation as in EEP2015 is proposed.

## 2. Thailand's energy policy

In order to move toward Thailand's energy system development, in the present, long-term direction of energy strategy is enacted throughout Thailand's Integrated Energy Blueprint in terms of security, economy and ecology are taken into the consideration. It includes five integration master plans: power development plan, energy efficiency plan, alternative energy development plan, gas plan and oil plan [5]. Main objective of power development plan is to formulate Thailand's power generation system development. Energy efficiency plan communicates about the setting of energy improvement target of Thailand. Potentials of RE, oil and gas development are established in the rests. However, only two plans of EEP and PDP, explained in the next section, are used in analysis in this study.

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