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A Scenario Analysis of Road Transport Sector: the Impacts of Recent Energy Efficiency Policies

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Abstract

The objective of this study is to evaluate the impacts of energy efficiency policies on Thailand road transport sector. Obviously, the recent energy efficiency policies are implemented on the largest energy consumed sectors, e.g. private passenger car, small pickup truck and motorcycle which almost contributed to half of road transport energy demand. In this work, the considered policies of energy efficiency improvement include the Electric Vehicle (EV) supported measure and the CO₂-based motor vehicle taxes which was implemented together with Eco-sticker labeling. The developed scenarios were defined by various successive of those considered energy saving measures and compared to baseline scenario in Business As Usual definition. Moreover, the private vehicle interdependence and regional economic difference which involve on vehicle ownership projection were also included in this study. By applied scenario analysis, the developed model shows that considered energy efficiency measures can help reduce 37.87% of total energy demand from road transport sector in 2036. Moreover, 19.04% addition of energy demand reduction can be achieved if private vehicle interdependence and regional economic difference are considered.

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Keywords: road transport; energy efficiency; energy demand model; scenario analysis; private vehicle interdependence

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1. Introduction

As one of many emerging economic countries, Thailand energy demand is continuously growing up with according to development of economic products in various sectors, e.g. transportation, commercial building, residential, industrial, agricultural etc. However, the energy resource of Thailand is mainly relied on imported energy, especially for the transport sector as shown in Fig. 1, while the road transportation is responsible for the biggest segment.

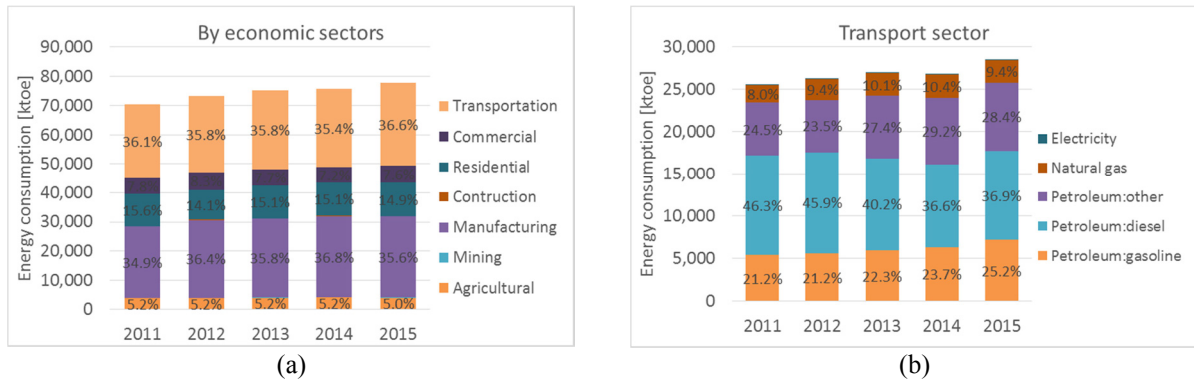


Fig. 1. Thailand energy demand [1]

In addition, the trade-off of energy consumption is air pollutions from combustion process which is affected on both living health and global warming crisis. With concerning on these issues, the Thai government continuously promotes national energy plans which focus on various definitions and implementation strategies. The Thai government has shown their intention on mitigating global warming crisis by signing in the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) [2]. Recently, five national energy plans are integrated and harmonized with time frame of the National Economic and Social Development plan as the long term 20 years national plans (2015–2036), called the Thailand integrated Energy Blueprint (TIEB [3]). Considered that the biggest volume of Thai vehicle stock are shared by private passenger vehicles which are private passenger car, small pickup truck and motorcycle with biggest annual sale volume, two energy saving measures in the Energy Efficiency Plan 2015 (EEP2015, [4]) are focused in this work. Those are the new CO₂-based car taxation (EEP2015 Transport-2) and the Electric Vehicle (EV) supported measure (EEP2015 Transport-10).

The first considered EEP2015 measure is implemented on both private passenger car and small pickup truck. Two limited levels of tail-pipe CO₂ emission are announced e.g. 100 g/km for passenger car and 150 g/km for small pickup truck. The vehicles which produced CO₂ emission lower than this limits will have lower tax rate. In a fact that vehicle with lower tail-pipe CO₂ emission must have better fuel economy, it is expected that the fuel economy of new car and new pickup truck will be improved (FE). The EV supported measure aims on both new- and on-road-vehicles (with promoting EV retrofit kit for on-road), for the passenger car, motorcycle, bus, etc., and the EEP2015 expected that there are new 1.2 million EV in passenger car (PcEV) within 2036. Considered that the electric motorcycle is also possible for Thai road transport, regarding to the previous EEDP plan (EEP2011–2030, [5]). Therefore, the electric motorcycle penetration will be also included in this study (eMC).

Considered that the private passenger vehicles which include private passenger car, small pickup truck and motorcycle are the biggest volume of Thai vehicle stock, therefore the sensitivity of vehicle numbers are also evaluated in this study, followed to our previous works [6 and 7]. The new projection model of private vehicle numbers defines that the private vehicle ownerships are not solitary but independence with the others, in an assumption that the owners of motorcycle or pickup truck will change to own passenger car for their prestige, comfort and safety if economic situation of vehicle owners improve with national economic wealthy as shown in Fig. 2. In addition, the different economic levels in various regions are also taken into account in this model.

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