



## Potential of greenhouse gas emission reduction in Thai road transport by ethanol bus technology

Nuwong Chollacoop<sup>a,\*</sup>, Peerawat Saisirirat<sup>a,\*</sup>, Sittha Sukkasi<sup>a</sup>, Manida Tongroon<sup>a</sup>, Tuenjai Fukuda<sup>b</sup>, Atsushi Fukuda<sup>c</sup>, Siriluck Nivitchanyong<sup>a</sup>

<sup>a</sup>National Metal and Materials Technology Center (MTEC), 114 Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani 12120, Thailand

<sup>b</sup>Asian Transportation Research Society (ATRANS), Klongtoey-Nua, Wattana, Bangkok 10110, Thailand

<sup>c</sup>Department of Transportation Engineering and Socio-Technology, College of Science and Technology, Nihon University, Chiba 274-8501, Japan

### H I G H L I G H T S

- ▶ Energy demand modeling in Thai road transportation sector was developed.
- ▶ Such model was used to assess environment impact by ethanol bus technology (ED95).
- ▶ Ethanol bus technology (ED95) shows beneficial impacts to Thailand.
- ▶ Increase in ethanol demand and decrease in GHG emission in Thailand by ethanol bus.
- ▶ Ethanol bus (ED95) has been successfully demonstrated in Thailand.

### A R T I C L E I N F O

#### Article history:

Received 14 February 2012

Received in revised form 1 June 2012

Available online 13 September 2012

#### Keywords:

Energy demand modeling

Bioethanol

Ethanol bus

Scenario analysis

Greenhouse gas reduction

### A B S T R A C T

Over decades, Thailand energy consumption has been concentrated in three main sectors, namely manufacturing, power and transportation. Energy consumption in transportation sector has also been dominated by road transport due to limited coverage by rail and water transportation. Hence, road transport has been a major contributor for greenhouse gas emission in Thailand over recent years. Along with global warming concern throughout the world, Thailand has taken various adaptation and mitigation measures, especially the strong policy push to use carbon-neutral biofuel in transportation sector due to Thailand competitive advantage in agriculture sector. National Renewable Energy Plan (2008–2022) has set challenging targets of 9 and 4.5 million liters/day of ethanol and biodiesel consumption by 2022, respectively. Various blends of ethanol in gasoline (10%, 20% and 85%) and biodiesel in diesel (up to 5%) have been commercially available. However, since current consumption of diesel is twice as much of gasoline, ethanol blend in gasoline would widen the imbalance consumption of gasoline and diesel. The present study however offers an insight into a possibility to use ethanol as diesel substitute. A case study of ethanol bus technology was investigated by recourse to energy demand modeling. Necessary data, such as a number of vehicles (NVs) for various vehicle types, vehicle kilometer of travel (VKT) and fuel economy (FE) were collected, with reasonable assumptions made for those unavailable data, to construct predicative energy demand model. Scenario analysis on ethanol bus introduction was conducted to assess reduction of fossil fuel and greenhouse gas emission by increasing the use of ethanol to achieve ethanol consumption target in 2022. Successful demonstration of ethanol bus operation in Thailand will be briefly mentioned to give confidence for larger project implementation in the future.

© 2012 Elsevier Ltd. All rights reserved.

### 1. Introduction

As shown in Fig. 1a, Thailand final energy consumption has been dominated by industry and transportation economic sectors [1]. Within transportation sector, Fig. 1b shows that it is dominated

by diesel and gasoline, with diesel being twice of gasoline [1]. As a net oil-importing country facing energy crisis experiences, Thai government has initiated four energy policies and strategies for sustainable development, namely to improve energy efficiency, promote new and renewable energy, enhance energy security and intend to become the “Regional Energy Center” [2]. The strategy to promote new and renewable energy has been announced as the 15 Years Renewable Energy Development Plan (REDP 2008–2022), which was illustrated as shown in Fig. 2. The biofuel targets

\* Corresponding authors. Tel.: +66 2564 6500x4700; fax: +66 2564 6403.

E-mail addresses: [nuwongc@mtec.or.th](mailto:nuwongc@mtec.or.th) (N. Chollacoop), [peerawas@mtec.or.th](mailto:peerawas@mtec.or.th) (P. Saisirirat).

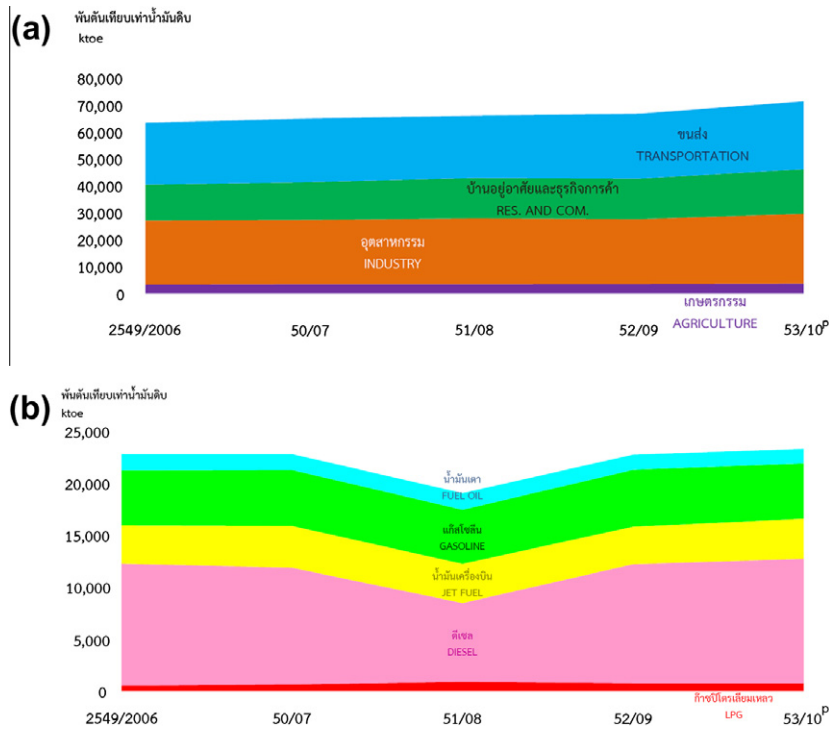


Fig. 1. (a) Thailand final energy consumption by economic sectors (2006–2010) with (b) breakdown details of fuel types in transportation sector (2006–2010).

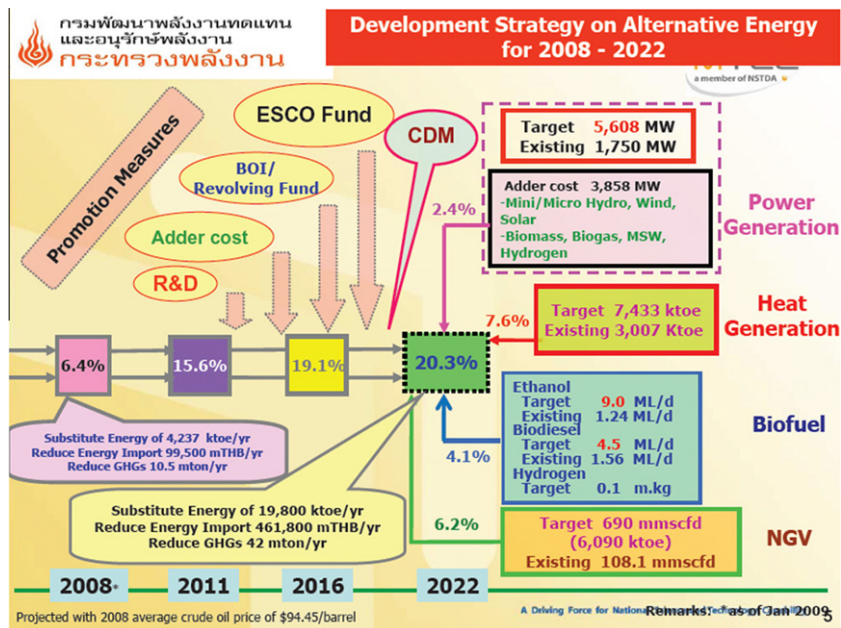


Fig. 2. Thailand alternative energy strategic plan (2008–2022).<sup>1</sup>

for transportation sector were set by production capabilities and land availabilities, having biodiesel and bioethanol targets for consumptions of 4.5 and 9 million liters/day (ML/d), respectively, by 2022 [3]. Moreover, a new plan for renewable energy has been recently announced including alternative diesel-replacement fuel in transportation sector, such as jatropha oil, algae, fatty acid ethyl ester (FAEE), diesohol, bio-hydrogenated diesel, ED95 and biomass-to-liquid (BTL) [4]. ED95 is defined as technology to use 95% hydrous ethanol and 5% ignition improver additive in modified compression-ignition (CI) engine. Under this new plan, the biodiesel target was increased further to 5.97 ML/d; and

compressed natural gas (CNG) was excluded due to energy security issue. At the present, CNG fuel currently contributes 76% of electricity generation.

However, the biofuel targets cannot be easily achieved in Thailand. Up till now, averaged biofuel consumption can achieve only 1.25 and 1.72 ML/d for bioethanol and biodiesel in 2011, respectively [5,6]. The obstacle of biodiesel consumption was the palm oil shortage between March and April in 2011 due to the flooding in the southern part of Thailand at the end of 2010, which reduced

<sup>1</sup>Revised Alternative Energy Development Plan (AEDP 2012-2021) [4].

Download English Version:

<https://daneshyari.com/en/article/6693897>

Download Persian Version:

<https://daneshyari.com/article/6693897>

[Daneshyari.com](https://daneshyari.com)