



Stakeholders' perceptions on challenges and opportunities for biodiesel and bioethanol policy development in Thailand



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HIGHLIGHTS

- Integrated SWOT–AHP–TOWS analysis for first generation of biofuel.
- Stakeholders' perceptions on biodiesel and bioethanol development in Thailand.
- Biofuel promote energy security which reduce reliance on oil import.
- Increasing yield and cultivation area are important for feedstock of biofuels.

ARTICLE INFO

Article history:

Received 24 March 2015
Received in revised form
21 December 2015
Accepted 10 January 2016

Keywords:

Stakeholders' perceptions
Biodiesel
Bioethanol
Thailand

ABSTRACT

Thailand is Southeast Asia's largest promoter of biofuels. Although, Thailand promotes the use of biofuels, it has yet to achieve its policy targets. This paper focuses on the first generation biofuel development in Thailand and examines the perceptions of seven stakeholder groups to guide further policy development. These stakeholders were feedstock producers, biofuel producers, government agencies, car manufacturers, oil companies, non-profit organizations and end users. It combines a Strengths, Weakness, Opportunities and Threats (SWOT) framework with an Analytical Hierarchy Process (AHP) framework and a TOWS Matrix for analysis of stakeholder's perceptions to propose priorities for policy development. Five policies were of high priority for development of biofuel. These are: (1) promoting biofuel production and use in long term through government policies, (2) revising government regulations to allow sale of biofuel products to other domestic industries while keeping retail prices of blended biofuels below those of regular ethanol and biodiesel, (3) improving farm management and promoting contract farming, (4) expanding cultivation area and yield without affecting food production and environmental sustainability, and (5) balancing biofuel feedstock use between the food and energy industries.

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1. Introduction

Due to growing concerns over fossil fuel-based energy systems and energy security, interest in biofuels and their development has intensified in recent years. Global production and trade in biofuels expanded rapidly beginning in 2004, spurred by new policies and incentives to create and support increasing demand (United States Agency for International Development, 2009). The key instruments widely used to promote production and consumption are mandatory blending targets, tax exemptions and subsidies.

Moreover, many governments facilitated the production chain by supporting feedstocks and subsidizing factors of production, i.e., labor, capital, and land (Sorda et al., 2010). Biofuels positively contribute to energy security by reducing dependence upon imported fossil fuels and saving foreign exchange. Furthermore, it can improve the agricultural development by offering better prices, creating new jobs and mitigating greenhouse gas emissions by replacing fossil fuels (Ali et al., 2013; Demirbas, 2009; Yan and Lin, 2009). With proper policies and safety-nets for the poor, biofuel can, in the long-run, promote economic growth and alleviate poverty in the agriculture sector (Huang et al., 2012; Yan and Lin, 2009). In 2013, the total world production of biofuel was 65,348,000 tonnes of oil equivalent (toe). North America has highest production followed by South America, Europe and South East Asia sharing 45%, 28%, 16% and 7% of the world production, respectively (BP, 2015).

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Since 2003, companies in Southeast Asia (SE Asia) have produced biofuels commercially from feedstocks such as sugarcane, cassava, and oil palm. Since then, the production levels have steadily increased benefiting from the region's favorable climate (ölz and Beerepoot, 2010). In the last decade, a variety of policy efforts were directed towards promoting the development and use of biofuels throughout Thailand. For example, the Renewable and Alternative Energy Development Plan (AEDP) (2012–2021) aimed to increase targets of ethanol and biodiesel consumption to 9 and 6 million liters per day, respectively, by 2021 (Ministry of Energy, 2012). The AEDP plan relies heavily upon renewable energy for the future. Biofuels are expected to significantly contribute towards reducing Thailand's reliance on fossil fuels. A variety of national level policies related to agriculture, land, food and forest-based biofuel development have been established. In Thailand, approximately 65% of all energy consumed in 2012 was derived from fossil fuels such as coal, lignite and petroleum products (Energy Policy and Planning Office, 2013). Thailand has a large and demonstrated potential for biofuel production and use. Its contribution in the domestic energy mix is already significant. Although the Thai government is promoting biofuel from both demand and supply sides, the results are not achieving their targets as in AEDP. In mid-2015, the total consumption of biodiesel and bioethanol were only around 48% and 35% of 2021's target (Preechajarn and Prasertsri, 2015). The government has already realized that meeting target is not possible and are revising the policies now. The main reasons are; (1) limitations of supply infrastructure such as biofuel stations (Bureau of Fuel Trade and Stockpile, 2013), (2) insufficient planting areas for feedstocks (National Science and Technology Development Agency, 2011; Office of Agricultural Economics, 2014) and (3) lack of sustained campaign to the public to create understanding on benefits of biofuels (Salvatore and Damen, 2010), and (4) unpredictable productivity (Jupesta, 2012; Kumar et al., 2013b) due to limited cultivation areas as a result of biofuels' competition with rubber (Jupesta, 2012; Kumar et al., 2013). Promoting bioenergy is still a relatively new policy strategy in Thailand. Many policy efforts, on-ground actions, and new policies to promote biofuel development in Thailand have remained fuzzy. While there are many ways to identify and prioritized policies, a comprehensive view and stakeholders' feedback are needed to chart-out the policy pathway for further biofuel development. This is instrumental in identifying barriers, generating new ideas for implementing existing policies and for designing new ones (Catron et al., 2013; Scott et al., 2012).

The existing approach in Thailand is largely top-down, lacks integration across different government agencies and fails to integrate stakeholders and the dynamic change in external factors influencing biofuels. The bottom-up approach which takes periodic stakeholders opinions for biofuel development is important for developing new policy frameworks in Thailand. Therefore, the overall aim of this paper is to provide bottom-up perspectives on future biofuel development in Thailand complementing the top-down approach. The specific aims are to (a) determine the prevailing strengths, weaknesses, opportunities and threats to Thailand's biofuel sector, (b) identify the most important factors among these that can be useful for the biofuel policy development and, (c) identify the effective strategies in Thailand. This paper differs from past research in the following three ways. First, previous studies collected data from a limited number and types of stakeholder groups, e.g., NGOs, government agencies, industry and academia (Dwivedi and Alavalapati, 2009), NGOs, government agencies and industry representatives (Darshini et al., 2013), as well as state and federal agencies (Catron et al., 2013). Second, this work provides a holistic biofuel perspective while previous studies examined only biodiesel (Darshini et al., 2013), or forest biomass-based bioenergy (Dwivedi and Alavalapati, 2009). Third, they

mostly used SWOT–AHP–TOWS analysis not for energy sector (Şeker and Özgürler, 2012; Sevkli et al., 2012; Yavuz and Baycan, 2013). Lastly, the case of Thailand is particularly interesting where further policy development must take place to meet policy targets for production and use of biofuels.

2. Policies for biofuel development in Thailand

In the last decade, a variety of policy efforts were made for promoting the development and use of biofuels throughout Thailand. The AEDP (2012–2021) has been launched by Ministry of Energy for promoting usage of renewable energy including biofuels. This plan aimed to increase targets of ethanol and biodiesel consumption to 9 and 6 million liters per day, respectively, by 2021. The AEDP plan relies heavily on renewable energy for the future. Biofuels are expected to significantly contribute towards reducing Thailand's reliance on fossil fuels. On the supply side, the focuses is still on increasing the supply of existing feedstocks by improving an average yield of sugarcane above 15 t/rai (94 t/hectare) with total production of 105 million tons/year, and that of cassava of above 5 t/rai (31 t/hectare) with total production of 35 million tons/year by 2021. In case of biodiesel, the plan focuses on both supply and demand sides. Government will promote the expansion of oil palm area to a targeted 5.5 million rai (880,000 ha) with total oil palm harvested areas of 5.3 million rai (848,000 ha). Average yield is targeted at 3.2 t/rai/year (20 tons/hectares/year) and the crushing rate of crude palm be above 18 percent by 2021. The plan aims to increase the production capacity of crude palm oil above 3.05 million tons/year (Ministry of Energy, 2012).

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For biodiesel the main policies are, to manage the proportion of bio diesel blending relative to the domestic palm oil production, implementing the pilot fueling of B10 or B20 in Fleet Trucks or proper Fishery Boats and preparing the biodiesel standard of FAME to gain the blending share up to 7 percent in diesel oil.

For bioethanol, use of 91 benzene is already terminated. The price differential of E20 is at 3 baht/liter lower than 95 gasohol and market value of E20 is set to higher than 91 gasohol at not less than 0.50 baht/liter as incentive. Other measures are encourage the extension of E20 service stations, supporting the manufacturing of Eco-Car and E85 Car through reducing excise tax to car makers of 50,000 baht for E85 Car and 30,000 baht for Eco-Car.

Although the Thai government has tried to promote biofuel from in both the demand and supply sides, it has not achieved the targets. In 2015, the total consumption of biodiesel and bioethanol were lower than 50% of 2021's target and unlikely to catch up to full target by 2021 (Preechajarn and Prasertsri, 2015). For biodiesel, the oil content, plantation areas and yield has only met 63%, 50% and 81% of the target (Chanthawong and Dhakal, 2015).

3. Methodology

Energy planning is as a roadmap for meeting the energy requirement of the nation and is accomplished by considering multiple factors such as economy, environment, society and technology that impact the national energy issues (Prasad et al., 2014). Prasad et al. (2014) reviewed energy planning models and divided into five groups namely; econometric models, optimization models, simulation models, framework for energy planning model and computer-assisted tools. All of the models are rather technical in nature and lack stakeholder perceptions in creating

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