Energy Policy 98 (2016) 210–220

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Has energy conservation been an effective policy for Thailand? An input–output structural decomposition analysis from 1995 to 2010

Tharinya Supasa [a], Shu-San Hsiau [a,*], Shih-Mo Lin [b], Wongkot Wongsapai [c], Jiunn-Chi Wu [a]

[a] Institute of Energy Engineering, Department of Mechanical Engineering National Central University, Jhong-Li 32001, Taiwan
[b] Center for Applied Economic Modeling, College of Business, Chung Yuan Christian University, Jhong-Li 32023, Taiwan
[c] Department of Mechanical Engineering, Chiang Mai University, Chiang Mai 50200, Thailand

HIGHLIGHTS

- The hybrid IO technique was employed to analyse energy intensity of Thailand.
- No clear evident of EI improvement in most of industries, thus fail to achieve the policy target.
- Household and export sector had played a crucial role in energy consumption increase.
- IO SDA method found that energy efficiency was not an offset factor for consumption increase.
- Policy barriers were conflicting economic plans, fuel subsidy policies and inefficient process.

ARTICLE INFO

Article history:
Received 12 November 2015
Received in revised form
3 August 2016
Accepted 24 August 2016

Keywords:
Hybrid input-output
Embodied energy decomposition
Energy efficiency
Structural decomposition analysis

ABSTRACT

Thailand has depended heavily on imported fossil fuels since the 1990s, which hindered the nation's economic development because it created uncertainty in the nation's fuel supply. An energy conservation policy was implemented in 1995 to require industries to reduce their energy intensity (EI) and consumption immediately. This study investigates the effectiveness of the policy between 1995 and 2010 using the hybrid input–output approach. Surprisingly, EI improvement was observed in only a few sectors, such as transportation, non-metallic, paper, and textile. An embodied energy decomposition analysis revealed that while households were the largest energy consumer in 1995, energy consumption in exports exceeded that of households in 2000, 2005 and 2010. In addition, structural decomposition analysis revealed the final demand effect was the strongest factor in determining the efficacy of energy conservation, whereas the energy efficiency effect was not an effective factor as expected for decreasing energy consumption. Policy barriers and conflicting economic plans were factors that affected the outcome of these energy policies.

1. Introduction

Among the 10 members of the ASEAN (The Association of Southeast Asian Nations), Thailand has been playing a crucial role in the growth of the region in terms of economic growth and energy consumption, and is one of the primary producers of fossil fuels. According to the U.S. Energy Information Administration (EIA, 2015), Thailand's domestic primary energy production is the third highest in the ASEAN from 2010 to 2012, following Indonesia and Malaysia.

The country has indigenous natural gas (NG), crude oil, and lignite resources. Reserves of NG and crude oil are in the Gulf of Thailand (EPPO, 2013), and lignite and coal reserves are the third-largest in Southeast Asia (IEA, 2013). It produces approximately 149 kb/d of crude oil and has a refining capacity of approximately 1000 kb/d. NG and lignite production reaches up to 3994 million standard cubic feet and 18 million tons per day, respectively.

Although the volume of Thailand's domestic energy production has been remarkable, it still faces supply problems because the production could not keep up with the increase in demand. Thailand is the second-largest energy consumer in the region after Indonesia. The country was one of the world's fastest-growing economies from 1986 to 1990, achieving average GDP growth of more than 11.5%. This rapid economic growth was driven mainly by export-oriented trade policies. Although economic growth was interrupted by the 1997 Asian financial crisis and the 2007–2008 global financial crisis, the statistics from the National Economic and Social Development Board (NESDB, 2015a) illustrated in Fig. 1

* Corresponding author.
E-mail address: sshsiau@cc.ncu.edu.tw (T. Supasa).

http://dx.doi.org/10.1016/j.enpol.2016.08.028
0301-4215/

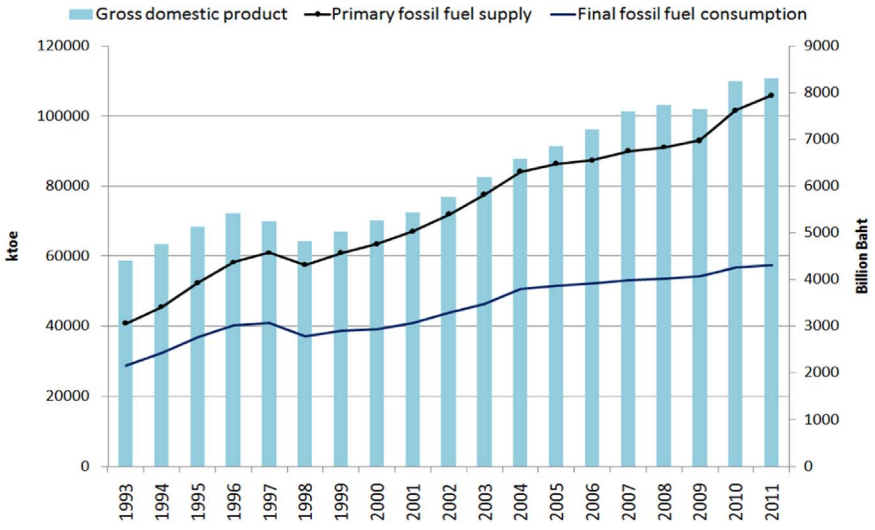

Fig. 1. Fossil fuel consumption and GDP growth (EPPO, 2013; NESDB, 2015a).

show that economic growth has continued to demonstrate an upward trend.

Additionally, Thailand relies on fossil fuels for economic growth, using them for generating output and transporting products. The relationship between fossil fuel consumption and GDP growth is shown in Fig. 1. The primary fossil fuel that Thailand consumed is crude oil. Higher oil prices result in higher costs of commodity production and higher product prices, thereby reducing the competitiveness of products made in Thailand (ADB, 2005; IMF, 2000).

Since indigenous energy resources have been insufficient to satisfy energy needs following the rapid growth in domestic demand. Thus, over the past two decades, Thailand has sharply increased its reliance on imports and become a net importer of energy. Most imported energy is crude oil, NG, and coal. The share of imported energy accounted for approximately 30–40% of primary commercial energy consumption during the 1980s, but this increased to more than 50% in the 1990s (Fig. 2). Among the fossil fuels, crude oil accounts for approximately 80% of total energy imported (EPPO, 2013).

Such import dependency exacerbates energy supply insecurity and makes economic development more sensitive to fluctuations in global oil prices. Hence, the government of Thailand implemented an energy conservation policy aimed at reducing the energy consumption of large factories and buildings and thus decreasing the country's dependence on imported oil. Specifically, on 3 April 1992, the Energy Conservation Promotion Act was introduced to conserve energy and reduce pollution. National energy conservation programs (ENCON programs) were also established under the Act. ENCON is a rolling five-year program, which has continuously been evaluated and revised in order to ensure effective outcomes from its policies. The first phase of ENCON covered the 1995–1999 period, the second phase was conducted from 2000 to 2004, and the third phase included the 2005–2011 period.

The ENCON program initially included encouraging producers to replace low-energy efficiency machinery and equipment with energy efficient technology in order to reduce their energy intensity (EI), the energy consumed directly in production process to produce a dollar of output. The program provided low-interest loans and grants for energy-efficiency projects to the designated factories and large-scale buildings; also establishing minimum energy performance standards for air conditioners, refrigerators, and lighting equipment. Moreover, the program established regulations for building material and control systems, facilitated the

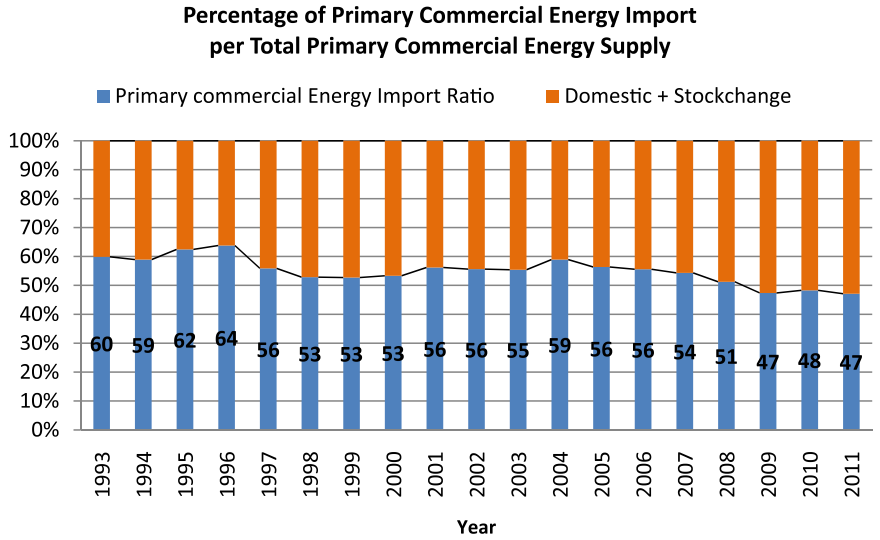

Fig. 2. Ratio of primary commercial energy imports (net) per total primary commercial supply (EPPO, 2013).