

## Energy efficiency indicators comparison in Thailand, OECD and EU 28 countries

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### **Abstract:**

Some energy efficiency indicators for Thailand and OECD and EU 28 countries are analyzed in the period from 1990 to 2012. Both Thailand and mentioned regions have enacted and implement energy policies which have many common elements and which are by all means devoted to the increase of energy efficiency and wider use of renewable energy sources for the purpose of reducing GHG emissions and to achieve sustainable development. However, the results of the implementation of these policies are very different and point out to the great influence of economic, social and political factors. Energy efficiency depends on numerous mutually independent factors but the greatest problem is in the fact that most important factors cannot be affected by individual countries. This leads to the need to constantly control the implementation of the energy efficiency policy and to make adjustments to it. Very often, these changes are imposed by rough effects of external factors which are the consequence of globalization and the pressure of those who enforce this globalization. This paper offers some answers to possible reasons for the deviation of values and trends of energy indicators in the most developed regions in relation to Thailand.

**Keywords:** energy policy; energy efficiency; energy indicators; energy consumption and production

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### **1. Introduction**

There is no doubt that the efficient use of energy is a matter of general interest and it is particularly relevant to the struggle against climate change therefore, amendments need to be made to energy efficiency policy in order to remove market barriers for the implementation and improvement of energy efficiency (Morvay and Bukarica, 2010). Energy policy instruments for the improvement of energy efficiency need to stimulate the market to higher efficiency but in such a way to achieve cleaner environment, higher standard of living, more competitive industry and more reliable energy supply. In addition, they should be in line with actual market requirements and adjustable to changing market demands so that objectives are reached in an optimal way (Hasanbeigi et al., 2010; Bhattacharyya and Ussanarassameeb, 2005; Martchamadol and Kumar, 2012).

Energy efficiency is determined by a large number of mutually independent factors with different individual effects. For that reason, there is no ideal energy indicator on the basis of which it is possible to estimate the energy efficiency of a region or a whole country. For example, *energy intensity* also depends on the structure of national economy, which determines the Gross Domestic Product (GDP) and all other economic factors relating to analyzed activity (Gvozdenac and Simić, 2012; Gvozdenac et al., 2014; Gvozdenac-Urošević, 2010).

There are excellent energy policies all over the world led by the European Union (EU), which is an undisputed leader in energy efficiency and in the fight against climate change. However, attempts at the global level to reduce energy consumption have given no significant and expected results. Therefore, the promotion of energy efficiency requires new, innovative approaches, the main characteristic of which is flexibility. This means that energy policy should be adaptable and innovative and it should be created, revised and implemented on an ongoing basis.

This paper analyzes values of five indicators for Thailand, OECD and EU 28 countries. The analysis refers to the period from 1990 to 2012. The change trends of energy indicators and their values significantly deviate from values in OECD and EU 28 countries.

## 2. Evaluation of energy efficiency in Thailand, OECD and EU 28 countries

Information obtained from the database of the International Energy Agency ([www.iea.com](http://www.iea.com)) is used for the computation of energy indicators. The values in Thailand are compared with the values of these indicators in OECD countries and with the values in EU 28 countries. The OECD countries are the most developed countries in the world and it seems that measures for the increase of energy efficiency and the utilization of renewable energy sources in EU 28 countries have generated the best results.

It can be said that the goals of the energy policy are very similar in all countries but the ways of achieving them are very different. In other words, drivers and environments in which energy efficiency is to be implemented differ significantly worldwide. The EU, together with some other OECD countries, is the leader in the fight to reduce the impacts of climate change and in related energy efficiency activities. The USA and BRIC<sup>1</sup> countries are the most vocal in defense of their national interests and oppose any firm obligation related to the reduction of CO<sub>2</sub> emissions. Developing countries need support. Energy efficiency is for them a *win-win* situation since the reduction of GHG emissions and energy costs significantly improve their fragile economies. Therefore, energy efficiency in developing countries needs to be immediately integrated into energy policies with a strong supporting mechanism for their implementation.

Energy indicators used are:

1. Energy intensity [toe/thousand 2005 USD]<sup>2</sup>,
2. Total primary energy supply (TPES) per population [toe/capita],
3. Electricity consumption per population [MWh/capita],
4. CO<sub>2</sub> emission per population [tCO<sub>2</sub>/capita],
5. GDP (ppp) per population [2005 USD/capita] (Purchasing Power Parity (ppp) calculations).

There is no universal energy indicator and the analysis which is the subject matter of this paper should be based on several indicators. The first and the fifth indicator concern energy intensity and they represent the combination of energy consumption and economic activities and the second and the third indicator are physical values since they are reduced to per capita. The fourth indicator reflects the situation of the environment well and the fifth indicator reflects the economic trend in countries. The changes of these indicators in the period 1990 – 2012 are given in Figs. 1-5.

The Fig. 1 shows the dependence of energy intensity. In OECD and EU 28 countries, this indicator shows stable growth and small scatter in relation to the trend line. However, when Thailand is concerned, there is a distinctive growth of energy indicators and also a big scatter. Big scatter indicates that the Thai growth of the GDP is still largely decoupled from the energy consumption growth. Energy intensity increase is not in compliance with the official Thai energy policy and has probably occurred as the consequence of large investments into the growth of the energy sector. The big scatter of this indicator in case of Thailand is primarily because of the turbulent political situation. Developed countries have managed to completely stop the growth of TPES/population and in this way, among other things, they have reduced necessary investments into the energy sector. The Fig. 2 shows changes of TPES/population. In addition to the growth of TPES/population in Thailand and stagnation in OECD and EU 28 countries, it can also be noticed that there is significantly lower TPES/population in Thailand. The difference in the consumption of primary energy per population can be explained by bigger industrial production in OECD and EU 28 countries in relation to Thailand.

The consumption of electricity per population is growing in all three analyzed cases. It should be noticed that the consumption of electricity/population in EU 28 countries is significantly lower in

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<sup>1</sup> Brazil, Russia, India and China.

<sup>2</sup> Constant 2005 US\$. Constant series show the data for each year in the value of a particular base year.

relation to OECD countries irrespective of the fact that the GDP(ppp)/population in these countries is similar. This can be explained by higher energy efficiency in EU 28 countries due to the fact that investments in energy efficiency and renewable energy sources are the highest in EU 28 countries (Morvay and Bukarica, 2010). In Thailand, the consumption of electricity/population, as well as TPES/population, is much lower in relation to above mentioned two groups of countries.

Changes in CO<sub>2</sub> emission per population are shown in Fig. 4. It should be noticed that only in EU 28 countries this indicator is falling, which is in line with the statement that the development of energy efficiency and the utilization of renewable energy sources is the highest there. Also, it can be concluded that the effects of the implementation of the official energy policy in Thailand are still insufficient.

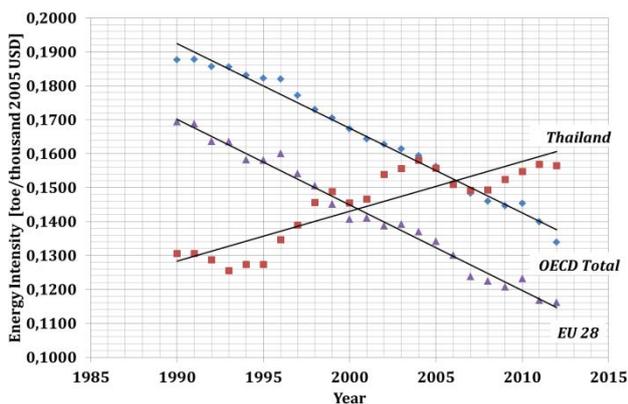


Fig. 1 Energy intensity.

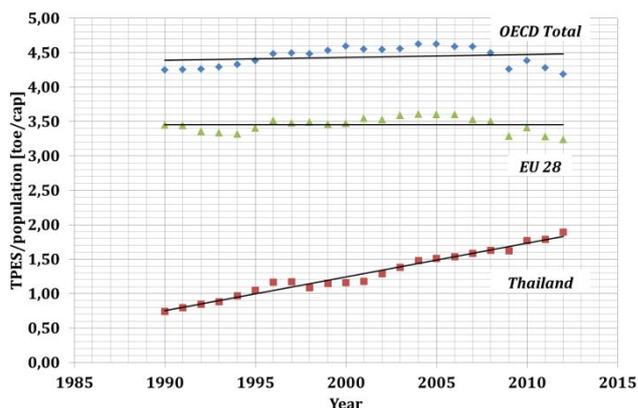


Fig. 2 Total primary energy supply (TPES) per population.

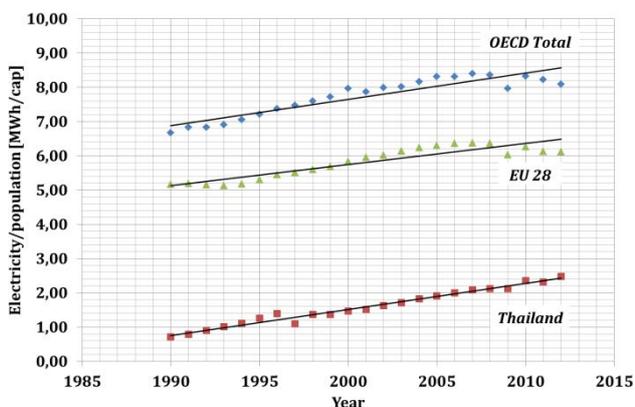


Fig. 3 Electricity consumption per population.

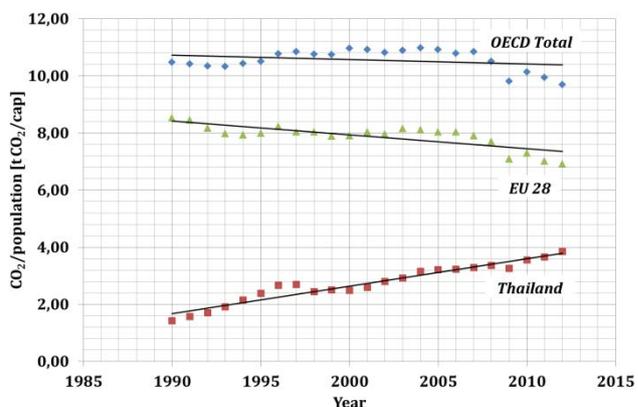


Fig. 4 CO<sub>2</sub> emission per population.

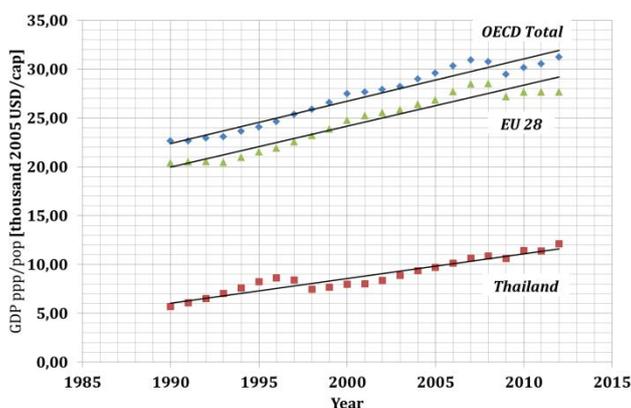


Fig. 5 GDP(ppp) per population.

The Fig. 5 shows changes in GDP(ppp) per population. There is a big difference in the level of this indicator between Thailand and OECD and EU 28 countries. Also, its growth is smaller. Low value of this indicator explains not only large energy intensity but also still insufficient investments into the sectors of energy efficiency and renewable energy sources. On the other hand, the growth of energy consumption requires investments into energy facilities, which is additional burden for the economy. Since the growth of primary energy consumption per population in developed countries has been brought to a standstill, the investments into new energy plants are slowed down.

### **3. Conclusions**

The paper analyzes some of energy indicators and compares their values with the values of these indicators in the most developed countries in the world. The analysis shows that there is a lot of space for the improvement of energy efficiency in Thailand in order to reach the level of these and other indicators prescribed by the official energy policy that have already been achieved in OECD and EU 28.

Considering the role that energy efficiency has in achieving the global goals of combating climate change, it is obvious that actions need to be coordinated at all levels – international, regional and national – in order to secure the environment for improving energy efficiency. The real force for change is at the local level and policies should be such that they can be implemented locally – in households, public services and companies.

### **4. Acknowledgement**

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