ANALYSING IMPACTS ON RENEWABLE ENERGY DEVELOPMENTS IN ASEAN USING THE REGRESSION DECOMPOSITION METHOD

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Overview

The Association of South East Asian Nations (ASEAN) consists of 10 countries and has emerged as a growth center of the global economy. In the face of dramatic economic growth, dependence on fossil fuel in ASEAN countries is increasing steadily. This is likely to bring more damage to the environment in the near future, especially in the context of climate change. In contrast, renewable energy– wind, solar, geothermal and biomass– promises a future with clean energy sources, and would lessen the region's dependence on (partly imported) fossil fuels and limit the environmental damage. Most renewable energy investment is spent on materials and workmanship to build and maintain facilities, which means that the fossil energy budget could be used to create jobs and promote local economies.

Furthermore, ASEAN is facing a significant movement in human population within their countries, in which masses of people are shifting to cities, leading to rapid energy consumption and emission increases. While the demographic problem is increasing along with urbanization in the region, governments are experiencing problems in dealing with local energy shortages and greenhouse gas (GHG) emissions from high-density transportation and traffic jams. These problems need to be untangled before they worsen.

Methods

The method called Regression Decomposition is the combination of Regression Analysis and Decomposition Analysis. The model uses a multiplicative model for cross-classified data. It employs renewable energy cross-classified by renewable energy types and renewable energy users. The concept of the model is described in Fig 1.

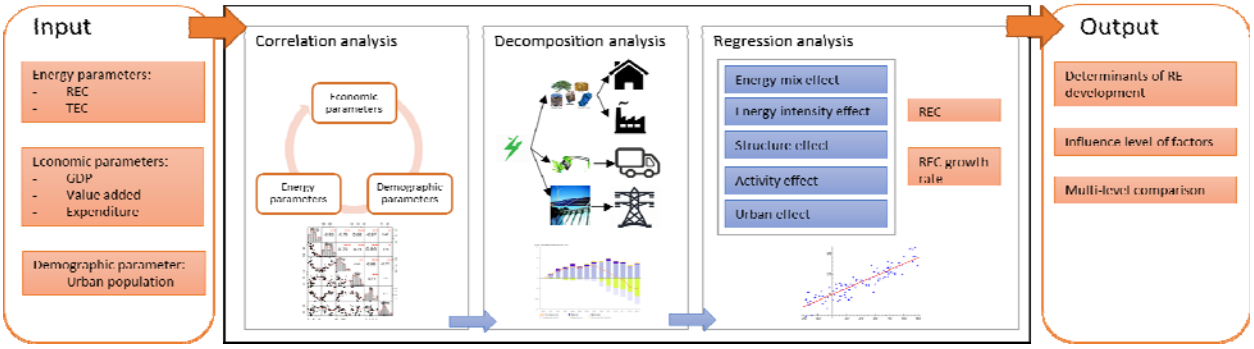

Fig 1. Overview of modelling concept

First, a correlation analysis is used to access the relationship between the different parameters, which include energy parameters (renewable energy consumption, total energy consumption), economic parameters (GDP, Value added, Expenditure), and demographic parameters such as Urban population.

The formula for the sample correlation coefficient is

$$r = \frac{Cov(x,y)}{\sqrt{s_x^2 s_y^2}}$$

where Cov(x,y) is the covariance of x and y defined as

$$Cov(x,y) = \frac{\sum(X - \overline{X})(Y - \overline{Y})}{n-1}$$

s_x^2 and s_y^2 are the sample variances of x and y, defined as

$s_x^2 = \frac{\sum(x-\bar{X})^2}{n-1}$ and $s_y^2 = \frac{\sum(y-\bar{Y})^2}{n-1}$

the variances of x and y measure the variability of the x scores and y scores around their respective sample means ($\bar{X}$and $\bar{Y}$, considered separately).

After determining whether the relationship exists, the total change in the renewable energy is decomposed into the contributions of the various factors included in the model, to varying levels of influence of each factor. This method separates effects into five indicators that affect renewable energy development including activity change (activity effect), modification of activity composition (structure effect), changes in sectorial energy intensity (intensity effect), adjustment of the share of RE consumption in total energy consumption (energy mix effect) and especially urbanization changes (urban effect). The renewable energy changes function is expressed as

$\Delta RE_{(i)}=f(\Delta E_{mix}, \Delta E_{int}, \Delta E_{str}, \Delta E_{act}, \Delta E_D)+ E_{rsd}$

The interaction between the effect indicators with renewable energy growth and the renewable energy growth rate is revealed through regression to describe the level of influences of energy indicator changes (energy mix and energy intensity), economic indicator changes (economic structure, expenditure, and income) and urban changes. These interactions differ by renewable energy consumption factors. By identifying the distribution of the interaction, the model allows comparisons across countries and sectors.

Results

From the correlation analysis, the trend of using renewable energy in total energy consumption cannot be denied. The primary results provide a very weak interdependency between renewable energy consumption and economic growth in ASEAN However, the regression results highlight the urbanization and energy consumption relationship. The regression results were conducted to capture the effect of the changes in energy intensity, productivity growth, urbanization growth on renewable energy consumption. They show that the coefficient of renewable energy extensions with urbanization is quite significant at the 5% level in the long-term period (see in Fig.2).

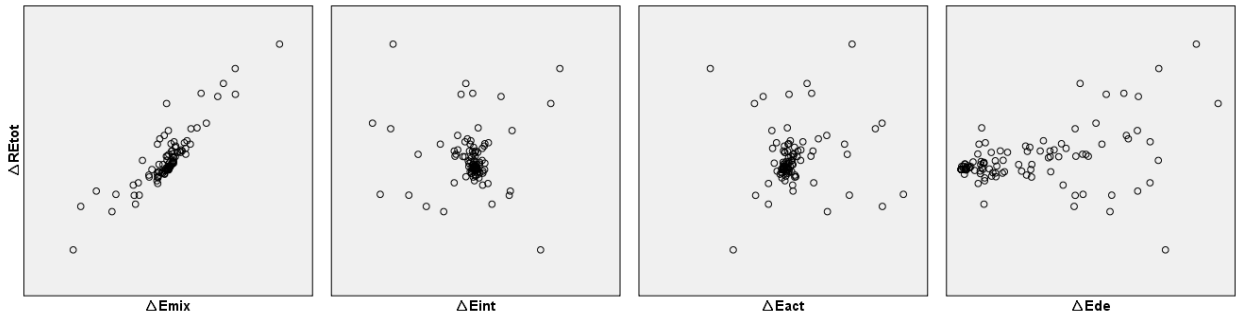

Fig 2. The correlation analysis between the renewable energy consumption change and the changes of considered factors (Emix-energy mix, Eint-energy intensity, Eact-producivity, Ede-urbanization) in electricity sector in Vietnam from 1995 to 2013.

Conclusions

In recent years, ASEAN governments have created many schemes to develop renewable energy. ASEAN as a whole, as well as individual countries, set up the schemes based on renewable energy development targets. The targets seem achievable in the longer term, but will require a significant acceleration of renewable energy deployment over the coming decade. While some particular studies concludes economic growth plays an important role to encourages the use of more renewable energy in particular regions, this research reveals evidence of urbanization having a more important effect on enhance renewable energy usage in ASEAN countries. Thus, the government-established schemes to encourage investment in this field might not be efficient for encouraging the use of renewable energy. It could be more efficient to develop schemes to encourage private or household investment in renewable energy, for example. Further results and conclusions will allow the elaboration of policy recommendations in terms of green economics and supporting renewable energy development in ASEAN.

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