The Development of Energy Mix in the EU under the Influence of Energy Competition

A Research Proposal Presented to

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Abstract

The energy market of the European Union has undergone changes related to the production and consumption of resources, and these modifications have been continuing under the strong influence of inter-fuel competition. However, the thorny question of whether natural gas will become a new leader in the EU's energy market and displace its competitors in the future or will be replaced by other energy resources still remains open. The present study aims to identify primary development directions of the EU's energy mix in the 21st century and predict eventual competition between the key energy sources. To achieve this goal, we will conduct quantitative research, which will include cluster analysis for the countries of the European Union based on essential energy development indicators. The study will attempt to present the current picture of the EU's energy market and will benefit those energy consumers whose lives are usually affected by changes in fuel prices.

Keywords: energy sources, EU, climate policy, inter-fuel competition, natural gas

Introduction

There is an inextricable link between the history of energy and the intensification of inter-fuel competition due to the development of new energy sources. While in the energy markets of some countries one source of energy leads for a long time, in other regions energy production is diversified. The European Union is a good illustration of the second model of energy structure.

The European Union has entered a new era in energy production and consumption becoming a recognized world leader in the development and implementation of renewable resources. At the same time, climatic problems have begun to occupy one of the main places in the EU's energy policy that aims to accelerate the transition to sustainable energy supply. Thus, examining the factors which determine the demand for energy resources is one of the main areas of research.

Recently, much has been written on the rapid growth of renewable energy sources market as well as biofuels in the European Union (Anton & Nucu, 2020; Hoefnagels, Resch, Junginger, & Faaij, 2014). Besides, researchers study the so-called Cournot competition model on the natural gas market with three main suppliers namely Gazprom, Sonatrach, and Statoil (Jansen, Lier, Witteloostuijn, & Ochssee, 2012; Yang, Zhang, & Zhang, 2016).

There has also been much emphasis on the issue of providing energy supply security in all countries of the EU (Chalvatzis & Ioannidis, 2017; Matsumoto, Doumpos, & Andriosopoulos, 2018). Extensive research has been done on the role of the European Commission in creating an energy policy in the European Union that meets the requirements of sustainable development (Maltby, 2013).

However, previous studies have left several questions unanswered. One of them is whether natural gas will win in inter-fuel competition or whether other sources will supplant it in the foreseeable future.

Therefore, the purpose of this proposal is to identify the main trends of inter-fuel competition in the EU's energy sector in the 21st century and forecast competition between the main competitors. To this aim, this study will address the following research questions:

1) What factors influence the development of the EU's energy sector?

2) Is there is a positive correlation between prices on energy sources and carbon quotas and gas and coal consumption?

3) What are the long-term opportunities for inter-fuel competition and the future of coal and gas in the EU?

Moreover, we will attempt to divide the countries of the European Union into clusters based on similarities in energy activity. Different energy indicators will be used to present the current market situation more accurately.

This study may shed some light on the future of the EU's energy markets and appear to be valuable for future researchers who could take advantage of this proposal for their analysis.

Literature Review

Many researchers find their focus on considering drivers for the development of energy markets. Mitrova, Kulagin, Melnikova, Grushevenko, and Grushevenko (2015) investigate some patterns in the development of the EU's energy sector and events affecting current energy production. Researchers include such determinants as the global economic crisis of 2008 and the shale revolution in the United States that happened at the beginning of the 21st century. In particular, the first event affected the reduction in electricity consumption as a result of reduced production. In addition, the ability to pay high costs for renewable energy has decreased. Aruga (2016) defines the shale revolution as the introduction into commercial operation of effective technologies for the extraction of gas from shale and oil deposits. Due to the fact that shale gas displaced coal from the domestic energy market in the

United States, American coal producers reoriented to the international market. This led to a significant influx of cheap coal into the European energy market, and as a result, the displacement of natural gas.

Research also considers possible prospects for the application of new energy sources to optimize costs and conserve the environment. Blanco, Nijs, Ruf, and Faaij (2018) offer as possible solution hydrogen which is a multipurpose energy carrier that produces no end-use emissions. Besides, the study examines the so-called Power-to-Liquid (PtL), which is a potential combination of hydrogen and carbon dioxide, in terms of meeting the fuel transportation demand. The key finding is that hydrogen and this new chemical compound could ensure energy security due to the fact that they reduce the cost of energy-related imports.

Many studies address the issue of decarbonization of the economy, which is one of the crucial objectives of the EU in the long run. Sofia, Gioiella, Lotrecchiano, and Giuliano (2019) examine possible so-called mitigation strategies aimed at phasing out polluting industries by stimulating the use of renewable energy sources. Researchers in this work evaluate this process as bringing social benefits and increasing the welfare of society. Using an example of a specific country, namely Italy, they show how and what social benefits will arise in various sectors if the decarbonization scenario is implemented by 2030.

Scientists explore also another aspect of decarbonization, which is to assess the economic consequences of the policy to reduce greenhouse gas emissions. Jägemann, Fürsch, Hagspiel, and Nagl (2013) observe the fact that for its successful implementation, large volumes of investments are required for the construction of new, for example, nuclear plants or wind turbines, as well as for the further development of low carbon technologies. Carbon capture and storage (CCS) requires the creation of a specific infrastructure that can capture carbon dioxide waste and transport it to underground storage facilities for storage there. Even

though the use of renewable energy sources makes it possible to obtain cheap energy and minimize environmental damage, the total cost of decarbonization is relatively high.

The problem of high costs of implementing low-carbon policies has attracted much attention in the studies of Diaz-Rainey and Tzavara (2012). Therefore, as a possible way of stimulating investment, they propose introducing tariffs for green electricity, which will focus on the consumer. Based on statistics that reflect growing household concerns about the environment, researchers speculate willingness of consumers to help implement the concept of sustainable development.

The dynamic of consumption of natural gas by European countries has aroused considerable interest among scholars. Bastianin, Galeotti, and Polo (2019) demonstrate the fact that despite the close interconnection of countries and certain similarities, their national gas markets differ from each other. They describe factors, such as the existence of trading hubs that could lead to a common convergence in fuel price levels. Despite the presence of such determinants, the analysis in the article indicates the existence of this process only in the context of price increases.

Ample research has been done on the relationship between natural gas prices and various other economic indicators. Yorucu and Bahramian (2015) gauge the correlation between crude oil prices, blue fuel prices, and taxation among selected 12 countries of the European Union. The results of their work prove the existence of not only a significant but also a long-term relationship between the selected indicators. Acaravci, Ozturk, and Kandir (2012) estimate the relationship between natural gas prices and stock prices choosing 15 European Union countries as observations. For some countries, which include Austria, Denmark, Finland, Germany, and Luxembourg, empirical data show the interdependence between natural gas prices, industrial production, and stock prices. Nevertheless, researchers do not reveal such a correlation for other countries.

However, none of these studies evaluate the possible displacement of other energy sources by natural gas and the reasons that may contribute to this shift. Therefore, the aim of this work is to cover the existing research gap by identifying the key tendency in the EU's energy sector nowadays and predicting possible competition between the existing rivals.

Methods

The goal of this study is to analyze the key movements in the EU's energy segment today and to offer a forecast regarding fuel competition between the major rivals. With this aim in mind, we will conduct quantitative analysis and attempt to cluster European countries according to their type of electricity production.

The factors dividing the sample of countries into groups will be the shares of coal, gas and renewable energy sources in the energy mix and their consumption volumes. Variables will also include electricity prices and carbon emissions per capita. The necessary data will be collected by studying the reports for 2018 of various energy agencies, such as IEA, IRENA, EIA and companies operating in this area, for example, BP. We will use the official data provided by these specific organizations because of their credibility. Due to their reliability, we could be more confident that this information reflects the true picture of the European energy market.

The cluster analysis that we will perform will include several stages. First of all, we will need to check our data, and if necessary, remove outliers. We will build a «box plot», which will allow us to graphically display the presence of abnormal observations. After we analyze the diagram, we will obtain a symmetric distribution. In addition, we will calculate the correlation coefficient to ensure that there is no statistical relationship between the factors. Moreover, to ascertain reliable comparison, we will standardize our indicators. Due to the fact that we will analyze a relatively small sample, it will be reasonable to choose

Ward's method. After all, we will receive a dendrogram, that is, a graphical representation of our data divided into clusters.

A significant limitation of our analysis is that we will divide only the countries of the European Union into clusters. Therefore, it will not allow us to present a full picture of the European energy market. Due to the fact that we only use data at the time of 2018, this is also an obstacle to displaying changes in the energy mix of countries.

Expected Outcomes

The paper will advance existing research on the problem of the development of the EU's fuel and energy sector. Conducting cluster analysis will help identify similar groups of countries in the context of energy production and consumption, based on which we will determine the leading used energy source in the EU. Besides, on the basis of the obtained groups, we can presumably answer the question of whether it is possible in these countries to expand the use of not only natural gas but also other clean energy sources. So, the contribution to the academic community lies in evaluating potential development strategies for the energy sector of the European Union.

Moreover, the study can help to understand not only the previous trends in this sector and the reasons for the changes, but it will also provide us a possible forecast for the future development of the market. Additionally, it can be useful for different energy consumers, which are both households and firms because changes related to the energy mix also affect them as energy prices rise or fall.

Some findings from this study can be presented at the conference "Enlit 2020" to be held in Milan in October of this year. "Enlit 2020" is an event that brings together two exhibitions, namely European Utility Week and POWERGEN in a unique format and is devoted directly to the issue of energy production in Europe. Since the three-day program

includes various profiles related to the energy revolution, the digital trend in the energy sector and much more, this paper may be interesting for listeners there.

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