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The Role of Renewable Energy in Ensuring Energy Security of Supply and Reducing Energy-Related Import

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ABSTRACT

After the industrial revolution, energy and its raw materials became vital for the economic growth and national security. Energy, which is essential in the production process as intermediate asset, plays a role in all stages from transportation to the production of final goods. Energy, which determines the international competitive power of the countries, must be available in a long-term way in an affordable and accessible manner for the economic growth of countries in micro- and macro-scale. The aim of this study, which adopts analytical method in this way, is to emphasize that the inclination of energy poor countries to renewable energy sources within the context of energy security of supply will reduce the dependence on outer sources and thus the potential added value of this transformation to these countries should not be ignored. Importing energy, which is one of the biggest expenditure items of energy poor countries, often emerge as large budget expenditure or current account deficit for these countries. In this context, it was emphasized that in addition to the economic losses caused by energy imports in a country's budget, outer risks for energy security of supply have the potential to negatively affect the sustainability of economic activities. Furthermore, the study looks at renewable energy sources differently from the studies in the literature which mainly examine renewable energy within the context of climate change and its contributions to the climate change mitigation activities. Thus, it is argued that, with the renewable energy, countries will increase their energy diversity and prevent risks that threaten energy security of supply and income losses caused by energy imports and reduce their dependence on imported energy.

Keywords: Energy Security of Supply, Energy Import Reduction, Renewable Energy

JEL Classifications: F52, H60, Q42

1. INTRODUCTION

While renewable energy is an element that serves to ensure energy security and energy security of supply (Pode, 2010; Chalvatzis and Ioannidis, 2017; Nie and Yang, 2016), it is stated that the developments arising from climate change should be assessed within the framework of energy policies (Bang, 2010). In this regard, renewable energy sources play a central role in mitigating the serious adverse effects of fossil fuels, such as CO₂ emissions, on the climate and the environment. Thus, the importance of renewable energy sources comes to the forefront in reducing carbon emissions (Jewell et al., 2014).

While Bauen (2006) focused on the integration of renewable clean energy resources into energy systems, Bradshaw (2010) examined the relationship between global energy security and climate change policies. Hughes (2009) also demonstrated its role in ensuring energy security and Turton and Barreto (2006) emphasized the effect of renewable energy on securing long-term supply security. Additionally, Umbach (2010) discussed renewable energy within the framework of EU energy security, Chalvatzis and Hooper (2009) analysed the share of renewable energy in electricity generation in Germany, Greece, Poland and the United Kingdom, Pode (2010) evaluated renewable energy sources in terms of reducing India's energy dependence and Gnansounou and Dong (2010) dealt with renewable energy in

terms of securing China's energy security of supply. Therefore, the opportunities provided by renewable energy in tackling climate change, reducing carbon emission and ensuring security of energy supply have been accepted. However, the remarkable potential of renewable energy for energy importing countries in overcoming their dependence on foreign energy and cutting down on or even eliminating energy import expenses has not been emphasized.

To this end, the study focuses on the renewable energy sources in the context of energy security, energy security of supply and foreign trade expenses stemming from energy imports. Accordingly, in the first part of this study, the relationship between energy and security concepts and the elements of energy security of supply is examined. In the second part, the effects of imported fossil fuels on the national economy and their impacts on sustainable economic growth is discussed. In the last part, the benefits and advantages of replacing imported energy materials with renewable energy sources is reviewed.

2. ENERGY SECURITY OF SUPPLY

The concept of security is generally defined as non-existence of any threat factors. However, this definition has become influenced by many elements. Ultimately, the concept of security has come to a point containing a set of elements that seem to be independent from each other. One of these elements is energy.

The relationship between energy and security can be analysed in two different ways. The first approach considers energy as an object in the context of supply and demand security and sees energy as an element that must be protected against security threats. The second approach regards energy systems as a factor that causes to insecurity. Thus, as a result of the economic value it contains, energy is examined together with the armed conflicts and attacks against infrastructure networks (Johansson, 2013, p. 199). As it is seen, both approaches basically touch the supply security of energy.

In this context, energy security of supply is defined by the International Energy Agency as the uninterrupted availability of energy sources at an affordable price. At this point, the concept of supply security emphasizes access to adequate, affordable and reliable energy. Providing sufficient energy means supplying the energy needed by the economy. The affordable cost of energy (compared with fixed prices and income) will increase the security of energy supply to the extent that it facilitates access to energy (Bazilian et al., 2013, p. 18).

Considering the availability and pricing of fossil fuel flows, such as oil, gas and coal, which have a central role in the global energy system for consumers and users, energy security gains an economic dimension and so is examined in the context of energy supply. Once all the components that point to the physical dimension of energy security of supply are considered from an economic perspective, energy is important for industrial competitiveness and sustainability (Johansson, 2013, p. 199).

First, energy security of supply can be provided to the extent that primary energy resources are supplied in an amount sufficient

to meet the demand (Månsson et al., 2014, p. 3). At this point, reducing the demand for energy, increasing fuel efficiency, employing energy conservation practices, securing physical infrastructure networks, increasing storage capacity and properly managing geopolitical relations are among the methods that serve to ensure continuity of energy flow (Verrastro and Ladislav, 2007, p. 101; Hughes, 2009, p. 2-3; Secretariat, 2015, p. 22).

Secondly, energy security of supply can be ensured to the extent that energy is continuously available to energy-consuming countries. The fact that energy resources do not exist equally in all countries makes the energy-consuming countries uncomfortable. Possible political instability in energy producing countries and interruptions in the production and distribution chains increase the concerns of energy poor countries (Pode, 2010, p. 3015-3016; Keppler and D'haeseleer, 2010, p. 10). In this context, the availability of energy raw materials, which are critical for energy security of supply, can be achieved through the inclusion of different energy production materials in the energy production process, the ability to supply energy by expanding transport networks of energy sources, the establishment of energy production centres in different locations, and the diversification of supplier countries (Sovacool and Brown, 2010, p. 8; Chevalier, 2006, p. 2).

Despite all abovementioned measures, the shocks in the context of energy security of supply may not be prevented. Within this scope, the shocks are examined in three categories. The first one is about quantity. Quantity shocks are observed when physical barriers lead to decrease in raw material supply. Secondly, technological shocks are related to the development of new methods in energy production as a result of new concepts and ideas, failures or advances in technology. Finally, the most common shocks associated with energy are price shocks. (Helm, 2002, p. 178). These shocks in energy security of supply lead to power outage. These outages can be grouped under two headings as short and medium-long term. Short-term outage may result from political decisions, accidents, sabotage and attacks. However, these outages can be overcome by rapid repair work, military and police interventions, and the use of existing stocks or price adjustments (Chevalier, 2006, p. 3). Medium and long-term outages may be caused by prolonged political and social upheavals, depletion of available resources, or lack of investment needed to increase production and storage capacity. Moreover, this situation may cause great difficulties in reaching the required energy in the energy poor countries and it is inevitable that these countries will face an extra burden on their budgets in financial terms (Chevalier, 2006, p. 3).

Economic losses and rising energy prices cause macroeconomic reflections of energy security of supply (Bielecki, 2002, p. 237). As a matter of fact, the increase in energy prices may cause both unemployment and a decrease in the amount of investment in an energy importing country. (Labandeira and Manzano, 2012, p. 56).

At this point Yergin (2006, p. 70) distinguishes between the countries that import and export energy. Energy exporting countries seek to increase their revenues while providing security of demand. On the other hand, energy importing countries are concerned about the changes in the balance of payments as a result

of increases in energy prices. From this point of view, a dependence occurs which is disadvantageous to energy importing countries.

Johansson (2013. p. 201) suggest that the transportation, distribution and refinement of energy raw materials for energy importing countries may initiate a process that reveals energy dependence. In addition, Labandeira and Manzano (2012. p. 54) emphasizes that the increasing demand for energy, the large share of fossil fuels in the energy production process and the concentration of these resources in certain regions of the world in the geographic context raise concerns about energy dependence. Because, as explained by the concept of energy dependence, the produced energy by many countries in itself cannot meet their consumption needs and they import the required portion.

While energy importing countries do not want the energy prices to fluctuate, and hope the prices to remain low, the exporting countries want the prices to stay high without causing a decrease in demand (Johansson, 2013. p. 202). Still, the prices need to be relatively stable as well as affordable, which is an important element of energy security of supply (Sovacool and Brown, 2010. p. 10). As a matter of fact, the probable political instability in the producing countries, the lack of investment required for the exploration of energy resources and the scarcity of energy resources bring accessibility and affordability into the forefront in analysing the concept of security of supply (Månsson et al., 2014. p. 3-4).

However, the limited number of energy exporting countries creates an order far from the concept of free-market mechanism in terms of the price stability and energy availability (Labandeira and Manzano, 2012. p. 55-56). This failure in the market order makes it difficult to determine energy prices on the basis of cost-based and supply-demand balance. This leads to the advantage of one side of the balance and as a result, causes an increase of security concerns (Bielecki, 2002. p. 237).

Finally, deliberate interruption of the flow of energy, threats to cut off the flow and the use of energy as a weapon by the energy exporting or transit countries worries energy importing countries in the process of reaching energy materials. Thus, while the increase in prices as a result of interruptions in the supply of energy resources means deterioration of the balance of the importing country's economy, it also leads the economic losses, decrease in their production, and decline in their welfare level and setbacks in their balance of trade (Månsson et al., 2014. p. 3-8).

3. TRADE DEFICIT AND ENERGY

Following the liberalization of energy markets, the assessment of energy security of supply within the scope of national energy policies has become widespread. However, as a result of the emergence of energy dependency and the failure of the liberalized energy markets, the concept of energy security of supply has come up again with the concept of self-sufficiency (Chalvatzis and Hooper, 2009. p. 2704).

When it is approached from an economic perspective, energy security of supply focuses on the interrelationship between

energy markets, and the production and the use of energy, which are components of national energy security (Deutch, 2010. p. 1). However, energy security of supply is primarily related to the economic losses caused by increases in energy prices (Costantini et al., 2007. p. 222). In line with this, general table of the economic performance of a country can be understood from the macroeconomic indicators of that country.

While the goods and services of a country in international trade, international borrowing and lending amounts are shown together in the balance of payments account, the balance of payments account consists of current account and financial accounts tables. Therefore, in order to achieve the foreign economic balance, there should be a balance between the external inputs and outputs as well as it is necessary to achieve price stability in domestic markets to create employment and to achieve growth targets. The current account item is the most important indicator of whether the external economic balance is achieved or not.

Under the current account item, there is trade account, income account and transfer account. The trade account measures the value of goods and services exported and imported. The trade deficit arises when the imports are more than the exports. Thus, while the deficits in the current transactions make the economy vulnerable, it also increases the severity of the economic crisis and price instability. Thus, income or economic growth rates, budget deficits, foreign trade balance, exchange rates, interest rates, changes in total credit and deposit (saving) volumes, money supply or total money stock, inflation rates, internal□external debts and national/global crisis are among the factors that cause deficit in current transactions. Still, import-dependent export structure and production are the main structural problems in terms of current account deficit.

Therefore, as a result of high share of energy import in production process, the energy input is stated as expense in the current accounts table. Countries have to bear the cost of imported energy to the extent that they depend on foreign sources in energy, whether or not they have sufficient sources of income. Hence, the rise in imported energy prices or interruptions in energy supply will worsen this situation. Additionally, the share of energy imports in the Gross Domestic Product (GDP) will increase, expenditures for energy will be doubled over time and the export earnings will be used to close the imported energy expenditures, domestic and foreign investments will decrease (Mangla and Uppal, 2014. p. 260-266). Furthermore, it also causes a wealth flow from the energy importing countries to the exporting countries (Huntington, 2015. p. 71).

Following the increase in imported energy prices arising from outages in energy flow, countries may find it difficult to adapt themselves to the new conditions as they may not be able to rapidly decrease their energy use levels (Deutch, 2010. p. 2). When this situation is coupled with the ongoing dependency, it is inevitable that a large deficit in the current account balance of trade account will emerge. As a result of all this, the weakening of the competitiveness in international markets by the rising cost of export products in the said countries (Deutch, 2010. p. 2), increase

in inflation, job losses for companies, the emergence of insecurity in consumers, increasing of unemployment, deterioration of foreign trade balance and worsening of balance of payments are inevitable (Costantini et al., 2007. p. 222). In the short term, while energy demand is inelastic against energy price variations, increasing energy costs will make production more costly, and in the following quarters the economic growth will be limited and wealth losses will occur (Huntington, 2015. p. 72-78).

In front of all these problems caused by energy dependence, reducing consumption, increasing energy efficiency, and demand management exercises are among the measures that will provide long-term contribution to foreign-dependent economies in energy and mitigate the negative effects of upward volatile price increases. (Mangla and Uppal, 2014. p. 256). Similarly, diversification of supply and the creation of competitive energy markets are the methods to protect the economic order against supply interruptions (Deutch, 2010. p. 8). However, these measures cannot offer a long-term remedy to the scarcity of the energy raw materials. Therefore, the limited availability of fossil fuels and the inability to meet future energy demand inevitably necessitates energy importing countries to take action to end their dependence on foreign energy (Dependence, 2008. p. 35).

To ensure long-term security of energy supply and to reduce the dependence on external sources, renewable alternative energy sources need to be developed, supported, and energy types and supply sources need to be diversified. Thus, the negative consequences of energy systems based on imported fossil fuels can be mitigated.

In this context, countries' dependence on foreign sources in energy will decrease relatively to the extent that domestic renewable energy production replaces imported energy, and they will be immune to future crises as a result of depletion of fossil fuels. In addition, countries will gradually reduce their trade losses and current expenses or deficits resulting from energy imports. Therefore, they will become less vulnerable to energy shocks and price increases (Huntington, 2015. p. 70; Štreimikienė et al. p. 83). At the same time, countries will be able to utilize renewable energy in providing energy and energy security of supply, reducing dependence on foreign energy and to continue their economic growth without slowing the phase (Štreimikienė et al. p. 79-86).

4. ENERGY INDEPENDENCE AND RENEWABLE ENERGY PRODUCTION

Increases in the need for imported energy reinforce the view of independence in energy security of supply (Bahgat, 2007). The increase in the demand for energy resources on a global scale, the pressure on the supply due to this increase and rise in prices cause concerns about achieving the energy demand reliably and affordably. Thus, concerns about meeting the current consumption need and the need for energy to ensure the sustainability of sustainable growth further strengthen the idea of energy independence (Verrastro and Ladislav, 2007. p. 95-96).

While energy importing countries rely less on exporting countries, the importance of making their energy consumption independent from imports grows (Månsson et al., 2014. p. 3-8), because economic growth depends on ensuring an uninterrupted and reliable energy supply flow. (Secretariat, 2015. p. 27; Sovacool and Brown, 2010. p. 8). In this context, energy security of supply can be ensured by reducing the interruptions in the energy flow and the constraints in resources to the tolerable levels (Bazilian et al, 2013. p. 18).

Some countries aim to reduce their emission levels through the methods of transferring their energy intensive industries to other countries, i.e. deindustrialization and increasing the monetary contribution of the service sector (Moreau and Vuille, 2018. p. 54-55). However, production activities inside the country are transferred abroad with such methods. Therefore, the energy needed in the country will not be produced and the dependence on foreign energy will continue indirectly since the entry of externally produced products into the country will result in a re-import expense in the country's budget.

Energy saving and the implementation of more energy efficient conversion technologies can have positive effects on energy consumption (Mathiesen et al., 2011. p. 500). However, in order to reduce dependence on foreign energy, energy resources should be diversified and local energy resources should be preferred over imported energy resources (Helm, 2002. p. 178). In this respect, energy supply can be made more secure by enabling alternative energy sources to be an important part of energy consumption and by replacing imported energy sources (Hughes, 2009. p. 4). In addition, diversification of energy resources has a strategic importance to ensure energy security and to develop solutions for dependence on foreign energy (Yergin, 2006. p. 84). Thus, steps towards energy independence would enable to avoid from the risks caused by unstable and low-security energy supply lines and so a more stable structure will be established against the rise and fluctuations in imported energy prices (Verrastro and Ladislav, 2007. p. 95-97; Johansson, 2011. p. 4).

Renewable energy sources will make economies more resilient against the uncertainty in global fossil fuel markets and price fluctuations. At the same time, it will prevent the economies of the country from being affected by the future shortage of fossil fuels, as well as the geopolitical and military conflicts surrounding the countries rich in fossil resources (Cherp et al., 2012. p. 366; Asif and Muneer, 2007. p. 1408). The replacement of fossil fuels by renewable energy would ease the current geopolitical tension between energy producers and consumers (Hache, 2018) and prevent the use of energy as a weapon to some degree. As a matter of fact, the direct control of the renewable energy production process in the country will serve to ensure the security of energy supply (Valentine, 2011. p. 4575). Solar, wind, biomass and geothermal energy produced by domestic sources are in the category of renewable energy, and unlike fossil fuels, they are abundant, inexhaustible and generally accessible over a wide area without geographical constraints (Asif and Muneer, 2007. p. 1390).

In the face of possible outages in renewable energy sources such as fire, drought, lack of sufficient sunlight or windless period,

renewable energy networks can be installed geographically in various regions to compensate for the disruption in any region with production in another region (Congressional Budget Office, 2012. p. 13). Renewable energy sources will ensure continuity of the energy production process in case of possible interruptions and disruptions and contribute to the creation of more resilient energy security of supply (Cherp et al., 2012. p. 350). Additionally, with the help of renewable energy, external risks that may arise in the energy exporting (source) countries and the transportation process of energy to importing countries will no longer be the subject of energy supply security (Checchi et al., 2009. p. 32).

After all these abovementioned statements, the benefits and advantages of renewable energy can be expressed as follows:

- Renewable resources contribute to long-term energy supply security while providing diversity in energy supply, appearing as a more commercially preferred option, and lowering energy production costs (Asif and Muneer, 2007. p. 1390),
- Since the investments made for renewable energy are periodic and fixed cost, the return of these investments is obtained more safely (Francés et al., 2013. p. 553),
- Renewable resources stabilize energy prices (Paredes et al., 2017. p. 16),
- Renewable resources increase competitiveness in international markets (Checchi et al., 2009. p. 31),
- Renewable resources provide the emergence of large gains in exports (Mathiesen et al., 2011. p. 500),
- Dissemination of renewable energy production networks to rural and isolated regions enables expansion of production sites and opening of new business fields (Checchi et al., 2009. p. 32),
- Renewable resources reduce the impact of international energy price fluctuations on the national economies (Apergis et al., 2010. p. 2259),
- Renewable resources serve the sustainability of economic growth,
- Renewable resources do not lead to the transfer of wealth as in the distinction between importer-exporter country and prevents foreign exchange outflows,
- Renewable resources enable resources to be transferred to different areas in needed by reducing energy import costs.

Ultimately, there is a positive nurturing relationship between sustainable economic growth, ensuring energy security of supply and the use of renewable energy sources.

5. CONCLUSION

Energy security of supply means that energy is physically available, sufficient, reliable and acceptable for energy importing countries, while it indicates that it is economically competitive and sustainable.

Increasing demand in energy, on the one hand, makes energy-poor countries more dependent on energy exporting countries, and, on the other hand, instability and infrastructure problems in exporter or energy transit countries cause energy outages, damaging the reliability, availability and sufficient accessibility of energy.

The scarcity of fossil fuels and market failures in energy pricing cause price increases. This situation damages the accessibility of the energy security of supply (one of its major components). Furthermore, the competitiveness of energy importing countries weakens and the sustainability of their economic growth is affected adversely. Even if the price increase does not occur, the cost of energy imports, which currently leads to large foreign exchange losses for importing countries, will increase in the face of any developments threatening energy security of supply.

Ultimately, the benefits and advantages of renewable energy introduced in the study will minimize the dependence on foreign energy, serve to ensure energy security of supply and help countries to perform their long-term economic activities in a safer and more sustainable manner.

REFERENCES

- Apergis, N., Payne, J.E., Menyah, K., Wolde-Rufael, Y. (2010), On the causal dynamics between emissions, nuclear energy, renewable energy, and economic growth. *Ecological Economics*, 69(11), 2255-2260.
- Asif, M., Muneer, T. (2007), Energy supply, its demand and security issues for developed and emerging economies. *Renewable and Sustainable Energy Reviews*, 11(7), 1388-1413.
- Bahgat, G. (2007), Prospects for energy cooperation in the caspian sea. *Communist and Post-Communist Studies*, 40(2), 157-168.
- Bang, G. (2010), Energy security and climate change concerns: Triggers for energy policy change in the United States? *Energy Policy*, 38(4), 1645-1653.
- Bauen, A. (2006), Future energy sources and systems acting on climate change and energy security. *Journal of Power Sources*, 157(2), 893-901.
- Bazilian, M.I., Sovacool, B., Miller, M. (2013), *Linking Energy Independence to Energy Security*. USA: International Association for Energy Economics, IAAE.
- Bielecki, J. (2002), Energy security: Is the wolf at the door? *The Quarterly Review of Economics and Finance*, 42(2), 235-250.
- Bradshaw, M.J. (2010), Global energy dilemmas: A geographical perspective. *Geographical Journal*, 176(4), 275-290.
- Chalvatzis, K.J., Hooper, E. (2009), Energy security vs. Climate change: Theoretical framework development and experience in selected EU electricity markets. *Renewable and Sustainable Energy Reviews*, 13(9), 2703-2709.
- Chalvatzis, K.J., Ioannidis, A. (2017), Energy supply security in the EU: Benchmarking diversity and dependence of primary energy. *Applied Energy*, 207, 465-476.
- Checchi, A., Behrens, A., Egenhofer, C. (2009), Long-term Energy Security Risks for Europe: A Sector-Specific Approach. Vol. 309. CEPS Working Document.
- Cherp, A., Adenikinju, A., Goldthau, A., Hernandez, F., Hughes, L., Jansen, J., Jewell, J., Olshanskaya, M., de Oliveira, R.S., Sovacool, B., Vakulenko, S. (2012), Energy and security. In: *Global Energy Assessment: Toward a More Sustainable Future*. Ch. 5. Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg: Cambridge University Press. p325-384.
- Chevalier, J.M. (2006), Security of energy supply for the European union. *European Review of Energy Markets*, 1(3), 1-20.
- Congressional Budget Office. (2012), Energy Security in the US. Congress of the United States. Available from: <https://www.cbo.gov/publications/2012/05-23-energy-security>

- cbo.gov/sites/default/files/112th-congress-2011-2012/reports/05-311colenergysecurity.pdf. [Last accessed on 2019 Jun 29].
- Costantini, V., Gracceva, F., Markandya, A., Vicini, G. (2007), Security of energy supply: Comparing scenarios from a European perspective. *Energy Policy*, 35(1), 210-226.
- Dependence, E. (2008), Hard choices for oil-exporting states. In: Mitchell, J.V., Stevens, P., editors. A Chatham House Report by. UK, London: Royal Institute of International Affairs.
- Deutch, J. (2010), Oil and Gas Energy Security Issues. Institute Professor. Cambridge: Massachusetts Institute of Technology.
- Francés, G.E., Marín-Quemada, J.M., González, E.S.M. (2013), RES and risk: Renewable energy's contribution to energy security. A portfolio-based approach. *Renewable and Sustainable Energy Reviews*, 26, 549-559.
- Gnansounou, E., Dong, J. (2010), Vulnerability of the economy to the potential disturbances of energy supply: A logic-based model with application to the case of China. *Energy Policy*, 38(6), 2846-2857.
- Hache, E. (2018), Do renewable energies improve energy security in the long run? *International Economics*, 156, 127-135.
- Helm, D. (2002), Energy policy: Security of supply, sustainability and competition. *Energy Policy*, 30(3), 173-184.
- Hughes, L. (2009), The four 'R's of energy security. *Energy Policy*, 37(6), 2459-2461.
- Huntington, H.G. (2015), Crude oil trade and current account deficits. *Energy Economics*, 50, 70-79.
- International Energy Agency. (2014), Energy Security. Available from: <http://www.iea.org/topics/energysecurity>. [Last accessed on 2019 Jun 27].
- Jewell, J., Cherp, A., Riahi, K. (2014), Energy security under decarbonization scenarios: An assessment framework and evaluation under different technology and policy choices. *Energy Policy*, 65, 743-760.
- Johansson, B. (2011), Renewable Energy, Energy Security and Resilient Societies. In *Resilient Societies-Governing Risk and Vulnerability for Water, Energy and Climate Change*. Twente: Conference Paper.
- Johansson, B. (2013), A broadened typology on energy and security. *Energy*, 53, 199-205.
- Keppler, J.H., D'haeseleer, W. (2010), The Security of Energy Supply and the Contribution of Nuclear Energy: OECD Publishing.
- Labandeira, X., Manzano, B. (2012), Some economic aspects of energy security. *European Research Studies*, 15(4), 47.
- Mangla, I.U., Uppal, J.Y. (2014), Macro-economic policies and energy security implications for a chronic energy deficit country. *Pakistan Development Review*, 53(3), 255-274.
- Månsson, A., Johansson, B., Nilsson, L.J. (2014), Assessing energy security: An overview of commonly used methodologies. *Energy*, 73, 1-14.
- Mathiesen, B.V., Lund, H., Karlsson, K. (2011), 100% renewable energy systems, climate mitigation and economic growth. *Applied Energy*, 88(2), 488-501.
- Moreau, V., Vuille, F. (2018), Decoupling energy use and economic growth: Counter evidence from structural effects and embodied energy in trade. *Applied Energy*, 215, 54-62.
- Nie, P.Y., Yang, Y.C. (2016), Renewable energy strategies and energy security. *Journal of Renewable and Sustainable Energy*, 8(6), 065903.
- Paredes, J.R., Ramirez, C., John, J. (2017), Variable Renewable Energies and their Contribution to Energy Security: Complementarity in Colombia. Colombia: IDB Monograph.
- Pode, R. (2010), Addressing India's energy security and options for decreasing energy dependency. *Renewable and Sustainable Energy Reviews*, 14(9), 3014-3022.
- Secretariat, E.C. (2015), International Energy Security: Common Concept for Energy Producing, Consuming and Transit Countries. Brussels: Energy Charter Secretariat.
- Sovacool, B.K., Brown, M.A. (2010), Competing dimensions of energy security: An international perspective. *Annual Review of Environment and Resources*, 35, 77-108.
- Štreimikienė, D., Strielkowski, W., Bilan, Y., Mikalauskas, I. (2016), Energy dependency and sustainable regional development in the Baltic states: A review. *Geographica Pannonica*, 20(2), 79-87.
- Turton, H., Barreto, L. (2006), Long-term security of energy supply and climate change. *Energy Policy*, 34(15), 2232-2250.
- Umbach, F. (2010), Global energy security and the implications for the EU. *Energy Policy*, 38(3), 1229-1240.
- Valentine, S.V. (2011), Emerging symbiosis: Renewable energy and energy security. *Renewable and Sustainable Energy Reviews*, 15(9), 4572-4578.
- Verrastro, F., Ladislav, S. (2007), Providing energy security in an interdependent world. *Washington Quarterly*, 30(4), 95-104.
- Yergin, D. (2006), Ensuring energy security. *Foreign Affairs*, 85, 69-82.