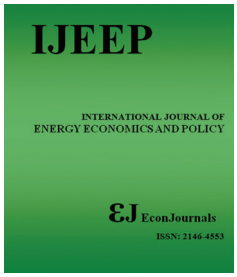


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(6), 588-593.

The Impact of Energy Production, Consumption and Import on the Budgetary Energy Requirement of Indonesia

Bambang Santoso Haryono[1]*, Abdul Hakim[1], Mardiono[1], Safri[1], Qomariyatus Sholihah[2]

[1]Faculty of Administration Science, Brawijaya University, Malang, East Java, Indonesia, [2]Department of Industrial, Engineering Faculty, Brawijaya University Jalan Veteran, 65145 Malang, East Java, Indonesia. *Email: bambangsfia@ub.ac.id

Received: 19 June 2020 **Accepted:** 10 September 2020 **DOI:** https://doi.org/10.32479/ijeep.10587

ABSTRACT

The aim of this article is to examine the influence of energy production along with energy consumption and import on the budgetary requirement of the energy in Indonesia. The time-series data has been extracted from the database of the World Bank along with trading economics database for budgetary energy requirement from 1990 to 2015. The ARDL, Augmented Dickey-Fuller and Phillips–Perron test have been executed for hypotheses testing. The findings revealed a positive association among energy production along with energy consumption and import and budgetary requirement of the energy in Indonesia. These findings provide the guidelines to the regulation-making authorities that they should enhance their focus and development policies that improve energy production and reduce the consumption and import of the energy that enhances the economic growth and make favorable the balance of payment. This study is also provided the recommendation to the future researchers that they should improve their scope of research by adding more countries in their analysis.

Keywords: Energy Consumption, Energy Production, Energy Import, The Budgetary Energy Requirement
JEL Classifications: K32, O13, H6

1. INTRODUCTION

Currently, the energy resources of any country get the intention of their regulatory along with budget-making authorities and researchers due to its importance in the economic growth of the country. The demand for energy resources has followed the increasing trend in every state, irrespective of developed and underdeveloped countries (Chen et al., 2019). In addition, these growing demands are alarming for the budget-making authorities and also enhance their attention to fulfill the energy demand of their country by strengthening the budgetary requirement of the energy in the country (Kerr et al., 2017). Moreover, this requirement could be fulfilled by improving the production of energy along with its imports and reduction of energy consumption in the country (Gillard and Lock, 2017). Thus, the current study's purpose is to investigate the influence of energy production along with energy consumption and import on the budgetary requirement of the energy in Indonesia. The energy requirement can also influence the price of the energy in the country, such as in Indonesia, the prices of energy production fluctuated with the fluctuation in the production of and requirement in the energy resources. The following figures show that the cost of energy generation was 4600 IRD/kWh in July 2019 while just in 10 months a lot of fluctuation has been observed in the cost of energy generation in Indonesia such as in August and September it reduced to 4500 IRD/kWh while in October, November and December it increase to the 4600 IRD/kWh. Moreover, in January 2020 it reached at peak that is 4700 IRD/kWh while it reduced to again 4600 IRD/kWh in February 2020. In addition, the cost of energy generation reduced at the lowest level and reached 4000 IRD/kWh in March 2020. However, the cost of energy production can get increase trend and reached 4200 IRD/kWh in April 2020, 4400 IRD/kWh in May 2020, and 4500 IRD/kWh in June 2020. These figures are mentioned in Figure 1.

Figure 1: Energy production cost in Indonesia

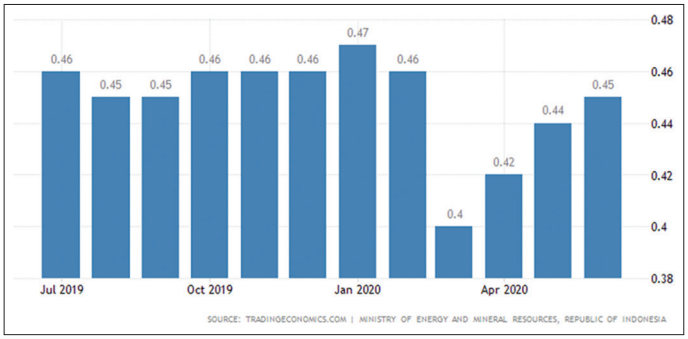
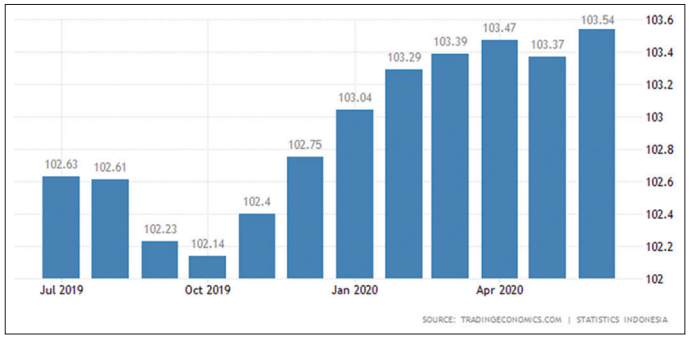


Figure 2: Producers' price index of Indonesia



Thus, the above figures show that the fluctuation in demand for the energy requirement could fluctuate the cost of energy production in the country. The increasing trend in demand for energy could also increase the cost of energy generation in the country (Sakah et al., 2017). Thus, the extensive focus of regulation and budgetary making authorities is required to reduce the unproductive consumption of energy resources in the country (Mariño et al., 2019). Therefore, the present study also executed to capture the focus of these authorities towards the energy consumption, energy, production, energy import, and budgetary energy requirement of the Indonesian economy.

The energy requirement and the cost of generation could also influence the prices of other products that are directly associated with energy production and consumption (Alsaleh and Abdul-Rahim, 2019; Sperling and Ramaswami, 2018). The following figures show that the fluctuation in the producers' prices in Indonesia. The statistics show that the producers' price index was 102.63 in July 2019 while reducing energy cost; the producers' price index was also reduced to 102.61 in August 2019. In addition, producers' price index was 102.23 in September 2019 while reducing energy cost; the producers' price index was also reduced to 102.14 in October 2019. Moreover, producers' price index was 102.40 in November 2019, while the increase in energy cost, the producers' price index also increased to 102.75 in December 2019. Similarly, producers' price index was 103.04 in January 2020, while the increase in energy cost, the producers' price index also increased to 103.29 in February 2020. Likewise, producers' price index was 103.39 in March 2020, while an increase in energy cost, the producers' price index also increased to 103.47 in April 2020. However, producers' price index was 103.37 in May 2020, while the increase in energy cost, the producers' price index also increased to 103.54 in June 2020. These figures are highlighted in Figure 2.

Hence, above both figures highlighted that if the energy requirement of the country increases, the cost of energy also increases that raises the price of the producers in the country, and the country can face the inflation situation. A study conducted by Del and Cerdá (2017) who also examined that the increase in the energy demand could also influence its cost and also enhance the prices of other products in the country. Thus, the budgetary energy requirement influences the cost of the energy that also influence the price of other product in the country (Greco et al., 2017). Therefore, high focus is required by the authorities regarding the budgetary requirement that can be reduced by eliminating the unproductive consumption of the energy resources in the country along with reducing the import of the energy resources and enhance the production level of the energy in the country (Hagenaars et al., 2017). The importance of energy production and its cost demands to investigate this area with several intervals, and to fulfill this gap, the current study focus on energy consumption and budgetary energy requirement. Hence, the foremost aim of the existing study is to examine the role of energy production, energy import and energy consumption on the budgetary energy requirement of Indonesia.

2. LITERATURE REVIEW

This section provided the past literature about energy consumption, energy import, energy production, and budgetary energy requirement and their relationships with them. The budgetary requirement of the energy in any country depends upon the consumption of the energy in the country (Chen et al., 2018). In addition, as far as the consumption of the energy increases in the country, the budgetary requirement of the energy also increases and vice versa (Afanas'ev et al., 2017). The focus on the budget about the energy requirement always depends upon the consumption of the energy in the country. A study conducted by Wiseman and Alexander (2017) who conducted the study on the consumption on energy and carbon budget target and indicated that high the use of energy in the country could lead the high budgetary energy and carbon requirement of the country. Moreover, a positive linkage has been exposed by the past studies among the budgetary energy requirement and consumption of energy resources in the country (Yu et al., 2018). In addition, high consumption of energy resources leads to high economic growth (Nawaz et al., 2019), but the unproductive use of energy sources could lead to the high production cost in the country and could face the inflation situation by the state.

Energy consumption has played an essential role in the economic growth of the country, but too much usage of the energy resources could enhance the product prices along with inflation and environmental degradation situation in the country (Sinha et al., 2017). The cost of energy production depends upon its consumption as much as the consumption of the energy increases the cost and budgetary energy requirement also increases and vice versa. Similarly, a study executed by Nguyen and Kakinaka (2019) on renewable energy consumption and exposed that the use of

energy resources enhances its next year's budgetary requirement that may also increase the cost of production that ultimately affected the prices of the commodities along with inflation situation in the country. Likewise, the growth in the consumption of renewable energy in the country, the requirement of the energy in the budget will also increase that may lead the economy towards high inflation (De Lauretis et al., 2017). Thus, the foremost aim of the existing study is to examine the role of energy consumption on the budgetary energy requirement of Indonesia.

Energy production has played a vital role in the growth of the economy of the country, but the too much production of the energy resources could enhance the commodity prices along with environmental degradation in the country (Das et al., 2019). In addition, the high production of energy resources leads the country towards the high growth of the economy, but the unproductive production of energy sources could lead towards the high commodity cost and could face the inflation by the country. The emphasis on the budget regarding the energy requirement depends upon the production ability of the energy in the country. Moreover, a positive nexus has been observed among the budgetary energy requirement and production of energy resources in the country (Jamshidi et al., 2017). A study conducted by Akkarawatkhoosith et al. (2019) on the production of energy and indicated that high the production of energy in the country could lead towards the high budgetary energy requirement of the country.

The budgetary requirement of the energy depends upon the production of the energy in the country. In addition, as far as the energy production increases in the country, the budgetary requirement of the energy could also increases and vice versa. Similarly, a study executed by Yang et al. (2020) on energy requirement and found that the production of energy resources enhance its budgetary requirement that may also increase the production cost and also affected the commodities prices along with high inflation in the country. The quantity of energy production depends upon its consumption as much as the consumption of the energy increases the cost and production along with budgetary energy requirement also increases and vice versa. Likewise, the growth in the production of renewable energy, the requirement of the energy in the budget, will also increase that may lead the economy towards high inflation. Thus, the prime aim of the current study is to investigate the role of energy production on the budgetary energy requirement of Indonesia.

The import of energy resources has an essential role in the economic growth of the country, but the too much import of the energy resources could enhance the product prices along with inflation in the country (Anwar, 2016). Similarly, the growth in the import of energy in the country, the requirement of the energy in the budget will also increase that may lead the economy towards high inflation (Shao et al., 2019). Thus, the foremost aim of the existing study is to examine the role of energy consumption on the budgetary energy requirement of Indonesia.

The budgetary energy requirement depends upon the energy import in the country. The focus on the budgetary energy requirement always relies on the import of energy in the country (Bulut and Muratoglu, 2018). A study conducted by Wang et al. (2018) found that high the import of energy could lead to the high budgetary energy of the country. Moreover, a positive, along with significant association, has been found among the budgetary energy requirement and import of energy resources in the country (Glynn et al., 2017). In addition, as far as the import of the energy increases in the country, the budgetary requirement of the energy also increases, and vice versa. In addition, the high import of energy resources leads to the high economic growth, but the unproductive use and import of energy sources could lead to the high production cost and also could face the inflation by the country. There is positive association has been found by the past literature among the energy requirement and the energy import of the country. Therefore, the present study aims to explore the role of energy import on the budgetary energy requirement of Indonesia.

3. RESEARCH METHODOLOGY

The aim connected with the current article is to investigate the role of energy production, energy consumption, and energy import on the budgetary requirement of the energy in Indonesia. The time-series data has been extracted from the database of the World Bank along with trading economics database for budgetary energy requirement from 1990 to 2015. The data includes the budgetary energy requirement that is measured as the requirement of energy in the annual budget in kWh and extracted from the trading economics database. In addition, energy production is measured as energy production in a year in kWh, while energy consumption is measured as energy usage (percentage of goods produce), and energy import is measured as the import of energy as a percentage of energy usage. Finally, a control variable has been used named as inflation and measured as the consumer price (annual percentage). The variables, along with their measurements, are as follow in Table 1.

The ARDL approach has been executed for hypotheses testing. ARDL model has some advantages, such as its works efficiently, even in small sample sizes (Meo et al., 2018). "The ARDL model is equally efficient for the variables that are stationary at the level I (0) or first difference I (1) or even fractionally integrated" (Fareed et al., 2018). Thus, the present study employed the ARDL approach due to its ability to investigate the short-run along with long-run relationships among variables. The current research has developed the equation as follow:

Table 1: Variables with measurements

S#	Variables	Measurement	Sources
01	Budgetary Requirement of Energy	The requirement of energy in the annual budget in kWh	Trading Economics Database
02	Energy Production	Energy produce in a year in kWh	World Bank Database
03	Energy Usage	Energy usage in a year (percentage of goods produce)	World Bank Database
04	Energy Import	Import of energy (percentage of energy usage)	World Bank Database
05	Inflation	Consumer price (annual percentage)	World Bank Database

$$LNBER_t = \alpha_0 + \beta_1 LNEP_t + \beta_2 EC_t + \beta_3 EI_t + \beta_4 INF_t + e_t \quad (1)$$

Where
t = time period
BER = Budgetary Energy Requirement
EP = Energy Production
EC = Energy Consumption
EI = Energy Import
INF = Inflation

In addition, the ARDL cointegrating model is as follows:

$$\Delta LNBER_t = \alpha_0 + \sum \delta_1 \Delta LNBER_{t-1} + \sum \delta_2 \Delta LNEP_{t-1} + \sum \delta_3 \Delta EC_{t-1} + \sum \delta_4 \Delta EI_{t-1} + \sum \delta_5 \Delta INF_{t-1} + \varphi_1 LNBER_{t-1} + \varphi_2 LNEP_{t-1} + \varphi_3 EC_{t-1} + \varphi_4 EI_{t-1} + \varphi_5 INF_{t-1} + \varepsilon_1 \quad (2)$$

In Equation (2) δ_1, δ_2, δ_3, δ_4, and δ_5 are show coefficients related to the short-term relationships with the summation signs, however ϕ_1, $_2$, ϕ_3, ϕ_4, ϕ_5, and ε_1 are the coefficients about the long-term relationships and Gaussian white noise term, respectively. While in the next step, the current study estimated the error correction model:

$$\Delta LNBER_t = \alpha_0 + \sum \delta_1 \Delta LNBER_{t-1} + \sum \varphi_2 \Delta LNEP_{t-1} + \sum \omega_3 \Delta EC_{t-1} + \sum \theta_4 \Delta EI_{t-1} + \sum \Upsilon_5 \Delta INF_{t-1} + \delta ECM_t + \upsilon_t \quad (3)$$

4. FINDINGS

The present study has tested the stationarity of understudy variables before investigating the dynamic association between energy production, energy consumption, energy import, inflation, and budgetary energy requirement. Moreover, the ARDL model is considered as a flexible co-integrating approach because it only can be executed when all understudy variables are stationary at 1(0) or 1(1) or the mixture of 1(0) and 1(1). Nevertheless, the ARDL cannot be executed in the case of 1(2), which is the limitation of the ARDL approach (Ibrahim, 2015). Therefore, to check the stationarity of the variables, PP and ADF unit root test has been executed by the study. The results related to the unit root tests are mentioned in Table 2. The findings indicated that none of the understudy variables is I (2). Hence, the current study can proceed to the ARDL approach.

The second estimation that is conducted by the current study is the ARDL bound testing, the results of F-test are presented in Table 3. The figures highlighted that the calculated F-test exceeds the upper bounds' critical value at 5% and 10% level of significant. Thus, co-integration between the variables is confirmed. These figures are mentioned in Table 3.

The third estimation that is conducted by the current study is the ARDL, and the results show the short-run linkage among the variables. The estimation shows that the short-run, positive, along with significant association among the energy production, energy consumption, inflation, and budgetary requirement of energy because the beta has a positive sign. At the same time, the t-statistics are larger than 1.64, and probability values are <0.05. However, insignificant and negative linkage among the energy import and budgetary requirement of energy because the beta has a positive sign while the t-statistics are smaller than 1.64 and probability values are larger than 0.05. These links are shown in Table 4.

The results also show the long-run linkage among the variables. The estimation shows that long-run, positive, along with significant association among the energy consumption, inflation, and budgetary requirement of energy because the beta has positive sign while the t-statistics are larger than 1.64 and probability values are <0.05. However, insignificant and positive linkage among the energy production and budgetary requirement of energy, while insignificant and negative linkage with energy import, and budgetary requirement of energy because the beta has negative sign while the t-statistics are smaller than 1.64 and probability values are larger than 0.05. These links are shown in Table 5.

Table 2: Unit root test

Test	LNBER	LNEP	EC	EI	INF
Augmented Dickey-Fuller Test (ADF)					
1(0)	−2.152	−0.486	−1.494	−1.254	−1.625
1(1)	−3.995	−7.621	−4.124	−4.123	−5.954
Phillips–Perron Test (PP)					
1(0)	−2.412	−0.413	−2.321	−1.154	−1.725
1(1)	−4.912	−8.145	−4.569	−4.458	−5.145

5. DISCUSSIONS AND IMPLICATIONS

The findings revealed a positive association among energy production along with energy consumption and import and

Table 3: ARDL bound test

Model	F-statistics	Lag	Level of Significance	Bound test critical values	
				I(0)	I(1)
LNBER/(LNEP, EC, EI, INF)	5.120	4	1%	4.4	5.72
			5%	3.47	4.57
			10%	3.03	4.06

Table 4: Short-run coefficients

Variables	Beta	S.D.	t-statistics	P-values
D(LNEP)	0.555895	0.273246	2.034413	0.0646
D(EC)	3.664565	1.025358	3.573936	0.0038
D(EI)	−126.257830	77.385978	−1.631534	0.1287
D(INF)	0.733537	0.206316	3.555411	0.0040
ECM(−1)	−0.581288	0.217867	−2.668091	0.0205

Table 5: Long-run coefficients

Variables	Beta	S.D.	t-statistics	P-values
D(LNEP)	0.956315	0.664893	1.438299	0.1759
D(EC)	6.304212	2.305644	2.734252	0.0181
D(EI)	−217.203453	190.717768	−1.138874	0.2770
D(INF)	1.261915	0.370850	3.402762	0.0052
C	396.388392	355.923351	1.113690	0.2872
@TREND	0.502763	0.351509	1.430300	0.1781

budgetary requirement of the energy in Indonesia. These results are matched with the findings of Mohammadi and Omid (2010), who also found a positive association among the energy production and budgetary requirement of the energy. In addition, a study by Barbosa et al. (2015) conducted a study on the energy requirement and exposed that energy requirement depends upon the energy consumption of the country. These outputs are the same as the findings of the current study. Moreover, the ongoing study findings are similar to Heinonen and Junnila (2014), who also examined that the energy consumption of any country could increase the budgetary energy requirement of that country. Similarly, a study by Wiedenhofer et al. (2013) conducted on energy consumption and requirement and found a positive association between energy requirement and energy consumption. These outcomes are the same as the output of the present study. In addition, the high production of energy resources leads the country towards the high growth of the economy, but the unproductive production of energy sources could lead towards the high commodity cost and could face the inflation by the country. The emphasis on the budget regarding the energy requirement depends upon the production ability of the energy in the country. Moreover, a positive nexus has been observed among the budgetary energy requirement and production of energy resources in the country.

6. CONCLUSION

Thus, the ongoing study concluded that Indonesia has a high budgetary requirement due to its high consumption and production on energy in the country that is the reason for high economic growth in the country. They have paid less intention to the import of the energy due to the high production of energy levels in the country that fulfills the high budgetary requirement. These findings provide the guidelines to the regulation-making authorities that they should enhance their focus and development policies that improve energy production and reduce the consumption and import of the energy that enhances the economic growth and make favorable the balance of payment. This study is also provided the recommendation to the future researchers that they should improve their scope of the study by adding more countries in their analysis. In addition, this study has taken the data from 1990 to 2015 and suggested that future studies should also expand their scope by adding more time frames in the studies.

REFERENCES

Afanas'ev, V., Kovalev, V., Tarasova, V., Tarasov, V. (2017), The use of statistical methods to analyze electric-energy consumption by budget institutions. Russian Electrical Engineering, 88(7), 443-447.

Akkarawatkhoosith, N., Srichai, A., Kaewchada, A., Ngamcharussrivichai, C., Jaree, A. (2019), Evaluation on safety and energy requirement of biodiesel production: Conventional system and microreactors. Process Safety and Environmental Protection, 132, 294-302.

Alsaleh, M., Abdul-Rahim, A. (2019), Estimating the economic determinants of technical efficiency of bioenergy in EU-28: An application of tobit analysis. Journal of Social Economics Research, 6(2), 97-105.

Anwar, J. (2016), Analysis of energy security, environmental emission and fuel import costs under energy import reduction targets: A case of Pakistan. Renewable and Sustainable Energy Reviews, 65, 1065-1078.

Barbosa, G.L., Gadelha, F.D.A., Kublik, N., Proctor, A., Reichelm, L., Weissinger, E., Halden, R.U. (2015), Comparison of land, water, and energy requirements of lettuce grown using hydroponic vs. Conventional agricultural methods. International Journal of Environmental Research and Public Health, 12(6), 6879-6891.

Bulut, U., Muratoglu, G. (2018), Renewable energy in Turkey: Great potential, low but increasing utilization, and an empirical analysis on renewable energy-growth nexus. Energy Policy, 123, 240-250.

Chen, J., Liu, R., Niu, Y., Zhu, J. (2019), Impact of product heterogeneity and soft budget constraint on excess capacity in Chinese energy industry based on the duopoly model. Chinese Journal of Population Resources and Environment, 17(2), 123-134.

Chen, Y., Xie, G., Li, R. (2018), Reducing energy consumption with cost budget using available budget preassignment in heterogeneous cloud computing systems. IEEE Access, 6, 20572-20583.

Das, P., Khan, S., Thaher, M., AbdulQuadir, M., Hoekman, S.K., Al-Jabri, H. (2019), Effect of harvesting methods on the energy requirement of *Tetraselmis* sp. Biomass production and biocrude yield and quality. Bioresource Technology, 284, 9-15.

De Lauretis, S., Ghersi, F., Cayla, J.M. (2017), Energy consumption and activity patterns: An analysis extended to total time and energy use for French households. Applied Energy, 206, 634-648.

Del, R.P., Cerdá, E. (2017), The missing link: The influence of instruments and design features on the interactions between climate and renewable electricity policies. Energy Research and Social Science, 33, 49-58.

Fareed, Z., Meo, M.S., Zulfiqar, B., Shahzad, F., Wang, N. (2018), Nexus of tourism, terrorism, and economic growth in Thailand: New evidence from asymmetric ARDL cointegration approach. Asia Pacific Journal of Tourism Research, 23(12), 1129-1141.

Gillard, R., Lock, K. (2017), Blowing policy bubbles: Rethinking emissions targets and low-carbon energy policies in the UK. Journal of Environmental Policy and Planning, 19(6), 638-653.

Glynn, J., Chiodi, A., Gallachóir, B.Ó. (2017), Energy security assessment methods: Quantifying the security co-benefits of decarbonising the Irish energy system. Energy Strategy Reviews, 15, 72-88.

Greco, M., Locatelli, G., Lisi, S. (2017), Open innovation in the power and energy sector: Bringing together government policies, companies' interests, and academic essence. Energy Policy, 104, 316-324.

Hagenaars, L.L., Jeurissen, P.P.T., Klazinga, N.S. (2017), The taxation of unhealthy energy-dense foods (EDFs) and sugar-sweetened beverages (SSBs): An overview of patterns observed in the policy content and policy context of 13 case studies. Health Policy, 121(8), 887-894.

Heinonen, J., Junnila, S. (2014), Residential energy consumption patterns and the overall housing energy requirements of urban and rural households in Finland. Energy and Buildings, 76, 295-303.

Ibrahim, M.H. (2015), Oil and food prices in Malaysia: A nonlinear ARDL analysis. Agricultural and Food Economics, 3(1), 1-14.

Jamshidi, A., Kurumisawa, K., Nawa, T., Samali, B., Igarashi, T. (2017), Evaluation of energy requirement and greenhouse gas emission of concrete heavy-duty pavements incorporating high volume of industrial by-products. Journal of Cleaner Production, 166, 1507-1520.

Kerr, N., Gouldson, A., Barrett, J. (2017), The rationale for energy efficiency policy: Assessing the recognition of the multiple benefits of energy efficiency retrofit policy. Energy Policy, 106, 212-221.

Mariño, J., Augustine, S., Dufour, S.C., Hurford, A. (2019), Dynamic energy budget theory predicts smaller energy reserves in thyasirid bivalves

that harbour symbionts. Journal of Sea Research, 143, 119-127.
Meo, M.S., Khan, V.J., Ibrahim, T.O., Khan, S., Ali, S., Noor, K. (2018), Asymmetric impact of inflation and unemployment on poverty in Pakistan: New evidence from asymmetric ARDL cointegration. Asia Pacific Journal of Social Work and Development, 28(4), 295-310.
Mohammadi, A., Omid, M. (2010), Economical analysis and relation between energy inputs and yield of greenhouse cucumber production in Iran. Applied Energy, 87(1), 191-196.
Nawaz, M.A., Azam, M.A., Bhatti, M.A. (2019), Are natural resources, mineral and energy depletions damaging economic growth? Evidence from ASEAN countries. Pakistan Journal of Economic Studies, 2(2), 145-153.
Nguyen, K.H., Kakinaka, M. (2019), Renewable energy consumption, carbon emissions, and development stages: Some evidence from panel cointegration analysis. Renewable Energy, 132, 1049-1057.
Sakah, M., Diawuo, F.A., Katzenbach, R., Gyamfi, S. (2017), Towards a sustainable electrification in Ghana: A review of renewable energy deployment policies. Renewable and Sustainable Energy Reviews, 79, 544-557.
Shao, S., Guo, L., Yu, M., Yang, L., Guan, D. (2019), Does the rebound effect matter in energy import-dependent mega-cities? Evidence from Shanghai (China). Applied Energy, 241, 212-228.
Sinha, A., Shahbaz, M., Balsalobre, D. (2017), Exploring the relationship between energy usage segregation and environmental degradation in N-11 countries. Journal of Cleaner Production, 168, 1217-1229.
Sperling, J.B., Ramaswami, A. (2018), Cities and budget-based management of the energy-water-climate nexus: Case studies in transportation policy, infrastructure systems, and urban utility risk management. Environmental Progress and Sustainable Energy, 37(1), 91-107.
Wang, B., Wang, Q., Wei, Y.M., Li, Z.P. (2018), Role of renewable energy in China's energy security and climate change mitigation: An index decomposition analysis. Renewable and Sustainable Energy Reviews, 90, 187-194.
Wiedenhofer, D., Lenzen, M., Steinberger, J.K. (2013), Energy requirements of consumption: Urban form, climatic and socio-economic factors, rebounds and their policy implications. Energy Policy, 63, 696-707.
Wiseman, J., Alexander, S. (2017), The Degrowth Imperative: Reducing Energy and Resource Consumption as an Essential Component in Achieving Carbon Budget Targets Transitioning to a Post-carbon Society. Berlin, Germany: Springer. p87-108.
Yang, C., Wang, C., Zhao, Y., Chen, T., Aubry, A., Gordon, A., Yan, T. (2020), Updating maintenance energy requirement for the current sheep flocks and the associated effect of nutritional and animal factors. Animal, 14(2), 295-302.
Yu, Y., Herman, P., Rothman, D.L., Agarwal, D., Hyder, F. (2018), Evaluating the gray and white matter energy budgets of human brain function. Journal of Cerebral Blood Flow and Metabolism, 38(8), 1339-1353.