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Analysis of countries' policy change to energy crisis

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Abstract

Energy efficiency improvement in global energy network and its high consumption determinants have been affecting countries' economies and energy policies' development status for some decades. The consequences of those determinants have been leading economies to energy crisis and shocks and in its turn that was fostering and encouraging countries' energy policy-makers to develop better or proactive energy policies as a response to energy crisis. A few empirical studies have examined the relationship between countries' energy diversification, oil dependency and energy polices development. This paper firstly analyzes the status of effectiveness of energy diversification and the subsequently applied policies on consumption, energy related technological innovation development, pricing regulation and conservation, and import/export sources of crude oil within 21 energy import/export countries' sample data from 1990 to 2010 respectively. The obtained outcomes of analyses show an energy policy implication for countries requiring the preparation of a credential for the consumption and supply of energy and import sources in an age of increasing energy prices.

Keywords: Energy policy; energy diversification; environmental technological innovation; pricing regulation; Manufacturing Weight (MW); Oil Dependency Index (ODI)

1. Introduction

As a matter of fact, these days our standards of living and life styles have started to depend on energy and its development in a dynamic way. Also being concord to this movement, modern technologies have developed to such an extent that everything we use nowadays needs energy. As both manufacturing and industrial activities increase, the demand for energy similarly increases. In fact, one of the successful amongst existed spheres of economic developments industrial, service or manufacturing, manufacturing industry has been succeeding in economies growth due to high consumption or dependency on energy, mainly on oil [5], [11]. It is obvious, especially with a look at the recent past decades, that energy was a crucial ingredient for economic development and nowadays drives economies towards its usage in a huge amount, and sometimes encourages countries to improper ways of consumption, which causes either instability or leads to an energy crisis [4],[7]. Now then, due to the rapid development and structural changes of societies towards improvement, more than several decades ago the world entered into an era of higher energy costs and meeting the growing demand for energy in a safe and environmentally responsible manner was a key challenge. Hence, the need to determine the relationship between energy and economic growth derives from the increasing realization of the importance of energy to the economic development of nations [1],[3]. Unfortunately, the importance of energy dominance and a high dependency upon it makes many economies vulnerable and unstable these days. Ideally speaking, too much usage of everything or being highly dependent on something often causes inconvenience or vulnerability. Thus, facing problems like an energy crisis, price shocks, climate change, and demand-

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supply imbalances, requires energy to be diversified and sustainable; it needs to be used more efficiently and properly. Taking the above mentioned into consideration and being motivated by green and sustainable energy growth and oil-free economies slogans [2],[6] we attempted in this paper to generally discuss the importance of energy diversification and energy-related policies' implications for countries as a response to an energy crisis and price changes for oil import and export countries. The paper also sheds a light to an extensive literature and data analysis on the influential factors for energy policy implications as a response to energy crisis.

The paper's content is organized as follows. Section 2 reviews theoretical background of the energy policy and its influence on energy import/export countries policies and its changes. Sections 3,4 and 5 demonstrates and categorizes countries with offer of graphs and table of measurements of countries' energy policy development by taking into account variables like energy diversification by sources and import/export origins, energy related technological innovation development, and energy pricing policy movements as well as analyze ODI and MW indexes.. Finally, section 6 discusses the implications of the empirical analysis, and section 7 concludes this study.

2. Influential Components of Energy Policy

2.1 Energy diversification

Energy policy and energy efficiency development have come to the agenda in tandem with stable economic development as a guarantor a few decades ago, and currently recognized as a flagship of sustainable and green growth, a new trend for securing and consolidating the development of economies as well as clean mean to coping with energy crisis. Previous studies clearly underlined the importance of energy diversification by sources not only for oil-importing countries but also for oil-exporting ones, and namely, addressing this policy in achieving transparent and stable development of economies, as well as securing the intelligent formulation of societies [12], [16], [18]. However, there are a few studies that analyze and underline of importance of energy policy with considered patterns implementations for import/export countries like energy diversification by sources and import/export origins, environmentally technological innovation development and energy pricing/tax policy implementation in separately. In support to the aforementioned, Kenneth (2012) expresses that energy diversification as a strategy implemented to endorse both economic and physical securities, thereby lessening the risk of manipulation from foreign entities that may have a monopoly on specific non-renewable energy sources, such as oil. The unexpected and strong growth in the energy demand and supply imbalance, the global demand for energy increased during the mid-2000s, alongside political unrests and instabilities, and the improper usage of energy by both oil-producing and consuming countries, bringing the energy crisis to the limelight more effectively [8], [13].

Showing this prevalence of energy source, Fig.1 refers to the clear explanation of the imbalanced consumption of energy sources.

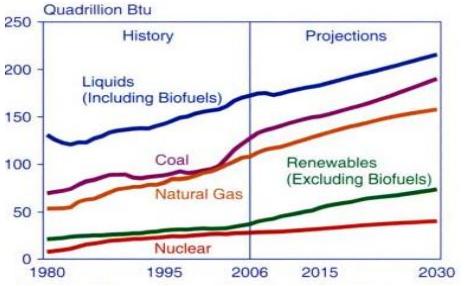

Fig. 1. World Marketed Energy Use by Renewable; Source (EIA, 2009)

Renewables are becoming the fastest-growing sources of the world energy. As documented in the IMF report (2012), many countries have increased the number of sources from which they import/export oil, making them less vulnerable to disruptions from any one source. They understand that in order to cope

with energy crises and oil price shocks, governments should rely on slogans stating that the key step is diversification either in sources or in import/export origin [9], [10]. Thus, diversification of energy sources helps to ensure the economy remains productive and viable in the event of unpleasant circumstance or conflicts with other nations, including conveyors of renewable energy sources [3], [14], [17].

2.2 Energy import/export diversification

Oil-independent countries care about import diversification in order to achieve a higher level of economic development and thus, policy makers covet it as a source of economic growth, and in doing so forget that exports are vulnerable to external shocks. Thus, policy-makers in commodity-exporting countries and energy-exporting countries are confronted with the question of how much to invest, save, and consume out of revenues from exports. Intuitively, oil exporters should save a great deal because they are often hit by adverse income shocks. Along with low investments and development in other fields of industry, there is also a lack of environmentally related technological innovation development as well as weak scope on the consideration of energy related policies such as energy diversification and energy-related price taxation [5], [9]. Moreover, severe usage of crude oil leaves behind liquid fuels and other petroleum types of usage as much slower growing sources of energy globally. Obviously, relying on a single source for oil imports, in general, is far riskier than importing oil from multiple sources and the dominance of a single-energy system inevitably leads to an excessive burden, which causes environmental fatigue and failure [6], [7]. Nevertheless, it becomes clear that diversification of oil import sources is only one of numerous supply securities and demand management measures that can enhance security and one should not over emphasize its importance [3], [5]. We proceed to develop a solid empirical background for this pattern selection and consider it as one of the efficient and effective measurements for energy policy development for import/export countries.

2.3. Technological innovation

Technological innovation combined with scientific research has always constituted a driving force for transformation in our societies. Environmental technological innovation development technologies are mainly encouraged at present as technologies that lower processing costs and can improve the economic competitiveness of unconventional oil resources and help to bring more domestic oil to market. Renewable sectors included in tough policy decisions need to balance the often conflicting priorities of energy security, universal access to affordable energy, and environmental protection [4], [6]. Reinforcements of environmentally related technologies and patent development are also given insights into how finance and innovation are shaping our energy future. Thus, new energy-related technologies developments play a critical role not only in achieving the objective of the UN Convention on Climate Change, the Kyoto Protocol, in reducing greenhouse gas emissions growth, 20/20/20 or 2050 goals of CO_2 emissions but also became guarantors for a safe and stable green future. Hence, the strong scope of consideration and accountability of public-private institutes and bodies for technological innovation development for energy should be in the agenda. In order to promote technologies that require a long lead time before commercialization and great investments in research and development, it is essential that the government and private sectors speedy up the direction or roadmap. Therefore, governments can and do use a wide number of instruments to promote development and dissemination of new technologies, from subsidizing R&D to voluntary agreements, standards, taxes and cap-and-trade systems. Policy mixes may be more efficient than isolated measures, which suits the methods detailed in our paper, i.e. the consideration of innovation in technological development patterns as one of components of mixed energy policy.

2.4. Energy pricing policy: Conservation and price taxation

Recent years have witnessed the emergence of many pollution abatement strategies with reasonable levels of success. In most countries, mainly OECD and the EU, to these issues are given special interest

and high priority. Also, as signatories to the Kyoto Protocol deal, they must seek the best ways to begin the process of reducing greenhouse gas emission, and contribute and encourage countries to move towards the Kyoto target 2012 [2], [3]. For example, countries like Sweden, Denmark, Finland, UK, Germany, the Netherlands, and the four Nordic countries firmly provided energy-taxation policies more than a decade ago and yet continue to implement energy emission reduction related projects today [9], [11]. The greatest decreases in the energy intensity of economies occurred in Germany, the USA and Norway in 1990s. These days energy pricing or conservation policies are high in the scope of countries' energy concerns and considered as the novelty in energy policy implementation [4]. Thus, with an extent to literature review and solid empirical background of energy pricing, taxing or conservation policies and its related studies, we attempted to apply further for this pattern for our analyses of the given study.

3. Oil Import Countries VS. Oil Export Countries

3.1. Method and data

Unlike the antecedent studies and the lack of data source availability, our study considers only 21 energy import/export countries data samples from 1990-2010 within a grouping and categorization of energy policy development patterns, which have not been highlighted or focused in previous studies as an ensemble. The novelty and contribution to the previous studies is that we consider four patterns of energy policy movement for all related countries as a whole time series dataset. We proceed to develop a consistent time series dataset of considered countries for energy diversification (TPES), import/export diversification, environmentally related technological innovation and energy pricing policy trends development patterns. In order to develop an appropriate dataset for our research, we referred to the International Energy Agency (IEA), U.S. Energy Information Administration (EIA), and Organization for Economic Co-operation and Development (OECD) data banks for data collections and utilized them as reliable sources for our analyses. Respective countries are considered as energy import/export countries and chosen on a neutral base. The difference of our method from others is that we adhered to a logical and symbol-based measurement on the basis of statistics, and considered all separate patterns as an ensemble. The method applied is based on a descriptive approach; every symbol has its own interpretation and its own measure behind. They are shown as follows: A=ascending, LF=low fluctuation, F=fluctuation, D=descending, HD=high descending, L=low and N/A=not available. The above mentioned patterns' symbols of energy diversification by sources and import/export data are based on the annual data calculation of the Herfindahl–Hirschman Index (HHI) which is one of the most reliable and widely used methods of measurement for diversification.

Tab. 1 and Tab. 2 depict a grouping of energy import/export countries within four patterns of energy policy trends formulation from 1990-2010. The above-mentioned method that we assigned to those symbols is made according to each pattern data trend and movement within 20 years

Table 1. Policy patterns of oil import countries Sources (EIA, 2009, 2013; IEA, 2012; OECD, 2012)

	Oil Import Countries (OECD)										
Patterns	**Australia**	**Austria**	**Belgium**	**Canada**	**Denmark**	**Finland**	**Germany**	**Greece**	**Japan**	**Korea**	**USA**
Energy diver	F	F	LF	A	HF	F	A	L	A	A	LF
Import diver	F	D	A	D	LF	F	A	F	LF	LF	LF
Technlogical Innova	F	A	A	LF	A	A	A	L	A	A	F
EnerPrP	A	A	L	A	A	D	F	L	A	A	L

Another scenario and evolution of energy policy development can be seen from oil-export country cases (see Tab. 2), which are composed mainly of non-OECD countries, except Norway and the U.K. We considered mainly two groups of countries as import/export countries rather than belonging to unions, groups or memberships.

Table 2. Policy patterns of oil export countries Sources: (EIA, 2009, 2013; IEA, 2012; OECD, 2012)

	Oil Export Countries (non-OECD and OECD)									
Patterns	Algeria	Qatar	Indonesia	Iran	Malaysia	Norway	Oman	Saudi Arabia	UK	Venezuela
Energy diver	F	HD	HD	D	D	F	HD	HD	LF	D
Export diver	D	D	LF	F	D	LF	D	D	LF	LF
Technlogical Innova	LF	N/A	LF	LF	A	F	N/A	LF	F	LF
EnerPrP	L	N/A	L	L	L	A	L	L	A	L

With regard to the availability and consistency of datasets for all countries and energy pricing policy startup year development, we took 1990 as a base year [3], [15]. The symbols reflect and describe countries' energy policy movements by patterns' developments.

3.2. Results

Oil dependent countries along with oil independent ones, severely grapple with oil price shock and to the best of our knowledge, oil importers have taken a number of actions to increase their resilience to economic shocks caused by the abrupt rise and fall in the oil prices. Thus, shocks to price volatility may also have different macroeconomic impacts than shocks on prices themselves [10]. Our study goes beyond the political and social concerns of societies and countries, so, we aim to lay out analytical and empirical studies of countries' policies and their response to energy crises and their level of readiness for energy policy development.

In continuation, in order to make the symbolic description more obvious, we attempted to develop graphs for each group with four separate pattern development trends (see Fig. 2). For all graphs contained in the paper analysis we assigned arithmetical-based values on a scale from 5-20 with 3 steps difference in order to develop visible patterns movements.

Fig. 2. Energy diverstification trend (TPES) of oil import/export countries (1990-2010); Source (IEA, 2008, 2012)

Fig. 2 depicts energy diversification development of two group countries and their trends' movements from 1990 to 2010. The outcome from study and assertion is that only a few countries have benefited from the rapid increase in trade, while others have been marginalized, looks credible at first glance.

The next pattern is import/export diversification is considered below (Fig. 3). It depicts the annual trend of energy import/export movements by origin and by destination.

Fig. 3. Import/export diversification trend for oil import/export countries (1990-2010); Sources (EIA, 2009, 2013;

IEA, 2012)

According to the IEA, Norway exported an estimated 1.45 million bbl/d of crude oil in 2010, of which 90 percent went to OECD European countries (EIA, 2009). Nearly 80 percent of U.K. crude oil is exported to E.U. countries (EIA, 2009). Meanwhile, Malaysia and Indonesia are the main net oil exporters in the Asian region, and also lead in crude oil export on specific terms. For example, Malaysian and Indonesian crude oil is of high quality and low sulfur content, and consequently are in high demand in the Asian region (EIA, 2009, 2013). Those explanations underline and match to our method and approach of energy import/export countries movements and trends of status. The scenario in import countries looks different and quite challenging compared to export countries' energy diversification policy. Almost all import countries are on a level that shows promising and a willingness to move towards an import diversification policy, except Greece, Canada, Austria and Finland, which are yet on the level and stage of fluctuation and dependency on foreign oil. Taking into consideration innovation technologies development, the next stage of energy policy formulation of our study analysis is environmental technological innovation development for import/export countries (Fig. 4).

Fig. 4. Technological innovation trend for oil import/export countries (1990-2010); Source (OECD, 2012)

The whole scenario and shape of this pattern trend offers to us to see a positive implications and expectations for future energy policy development for those countries, except for Greece, which is still behind in innovation technology patterns energy policy development. South Korea is a leading country after Japan in energy policy enhancement and pays deep attention to energy diversification and efficiency, by means of innovation and R&D development, which is significant in the GDP contribution of country. The remaining European countries, except Greece, are involved in joint R&D programs and projects organized by the EU and EU energy development initiatives in green growth and oil-free economies developments.

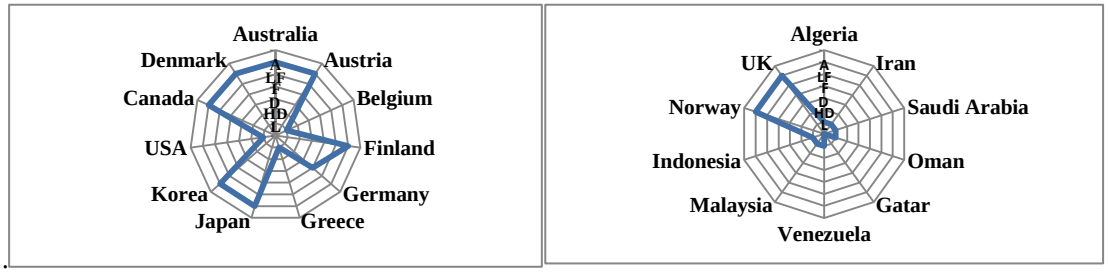

Fig. 5. Energy pricing and conservation policy trend for oil import/export countries (1990-2010); Sources (EIA, 2009, 2013)

Different models of energy policy are applied for different stages of energy consumption in countries according to their political, social and economic circumstances. Although the pricing model is straightforward and easy to understand by household, it is still underdeveloped in Europe despite having been already used by more than 90 countries around the world. Asian countries like Japan and Korea have not improved as much as other countries, because South Korea's energy consumption per capita was

more than twice as high as the world average and has been higher since 2007[1]. Since 1982, Japan has shifted from a high energy-intensive industry to a highly energy-efficient economy [7], [9]. However, these days, those countries are considered as active contributors amongst OECD countries in energy conservation and tax-emission reduction of energy policies (see Fig.5). As the next step of our analysis, we aim to manifest an average data comparison between two groups of countries in order to see how they affect each other in a group and how the scenario of their four patterns of energy policy development looks like (Fig. 6). The idea is to compare oil import and export countries movements, stages, and the different ways of interaction and collaboration. Our intension is also to affirm and claim that there is a significant relationship between countries in oil import/export policies. The average structure of oil import countries' four patterns in energy policy development is shaped significantly and almost perfectly. Among the four patterns of energy development policy, import/export diversification is one of the most successful ones, and this says that oil import as well as oil export countries' policies might claim similar export and import diversification.

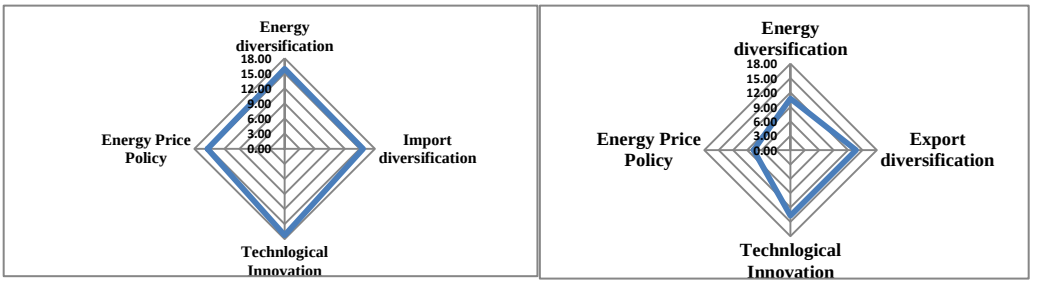

Fig. 6. Average patterns of energy policy for oil import/export countries

The assertion is that import countries innovation technological development pattern is ahead of the remaining three patterns. However, it does not mean that the three others patterns are not significant enough. The average of export diversification and innovation technological developments are similar and behind other patterns. Thus, as a conclusion, it turns logical that oil export diversifies as much as oil import.

4. Oil Dependent Counties VS. Oil Independent Countries

4.1. Method and data

In the following chapter of our study's non-political framework, we refer to the 2008 oil price bubble as one of the non-political but economic crisis cases. The increase in oil prices up to 2008 led to inflationary pressures in many developing economies. As one of the conventional factors, the cause of the 2008 oil bubble was strong growth in the oil demand from China, India, the Middle East, and other newly industrialized nations [11], [13], [15]. Tokic (2012) argues that, since we still do not have enough information to understand how the 2008 oil bubble inflated, any regulation based on incomplete information may be ineffective. Thus, we have an appropriate case for our study comparison of how countries behaved and responded to the energy crisis of 2008 that does not consider neither political instability nor exogenous conditions This analysis implies findings of countries index and weight of oil dependency that gives foreseen thoughts and recommendation of energy policy development stages and manifest readiness for response to energy crises in future.

In order to imply our study's findings and treat our analysis as appropriate, we succeed in finding an average value of two indicators Oil Dependent Index (ODI) and Manufacturing Weight (MW), and by means of comparison, to put our thoughts and arguments as follows: as seen in Table 3, an average of

[1] South Korea Energy efficiency report, 2011

ODI is 0.254576 and in case of comparison of each country's ODI, we grouped them as high and low level ODI countries, regardless of import/export origin or grouping.

$$\boldsymbol{Oil\ Dependency\ Index(ODI)} = \frac{\boldsymbol{\%\ of\ oil\ demand}}{all\ energy\ demand, energy\ diverstiy, economic\ dependency\ on\ oil\ (oil\ demand\ out\ of\ GDP), and\ share\ of\ net\ imports\ to\ oil\ consumption} \quad (1)$$

Our aim is to identify clearly which countries are high-dependent on oil, and which are low- dependent on oil.

Table 3. Average comparisons of low ODI countries with high ODI; Source (GeoCommon, 2009)

Average	Low ODI	ODI	High ODI	ODI
0.25476	**Algeria**	0.111724936	**Belgium**	0.521610516
	Australia	0.207097552	**Finland**	0.446761895
	Austria	0.191067249	**Germany**	0.37714397
	Canada	0.043763938	**Japan**	0.443773939
	Denmark	0.014132788	**Korea**	0.608064768
	Indonesia	0.210112981	**Saudia Arabia**	0.406210816
	Malaysia	0.148718672	**USA**	0.354465729
	Norway	0		
	UK	0.02138035		
	Venezuela	0.22482957		

The general scenario implies that even in 2008, a year of economic crisis, while countries were still dependent on oil, amongst 17 countries the number of low ODI countries is high, which looks promising and provides positive implications for the significance of energy policy formulation in oil import/export countries. However, Norway's ODI is 0, which says that, being a net oil exporter, Norway[2] prepares its energy policy successfully without heavy dependency on oil, and could be considered an example for oil export countries-partners in future. In case of countries with high ODI, this says that as of 2008, those countries were highly dependent on oil, especially Korea, Belgium, Finland and Japan. This implies clearly that those countries' energy policy development was not set up well at that time. However, at present, those countries are counted as one of the fastest dynamically moving countries towards energy policy development within considered patterns of energy policy. Their energy policy determination, success and willingness to diversify energy consumption with speedy development have become an example for some countries cases so far.

4.2. Results

By moving forward in this study, we attempted to develop and compare the average ODI with other pattern averages in order to inspect their influence with each other and the scenario of ODI for import/export countries. Firstly, by calculating the average of all countries' ODI, we divided them into two groups with high and low ODIs.

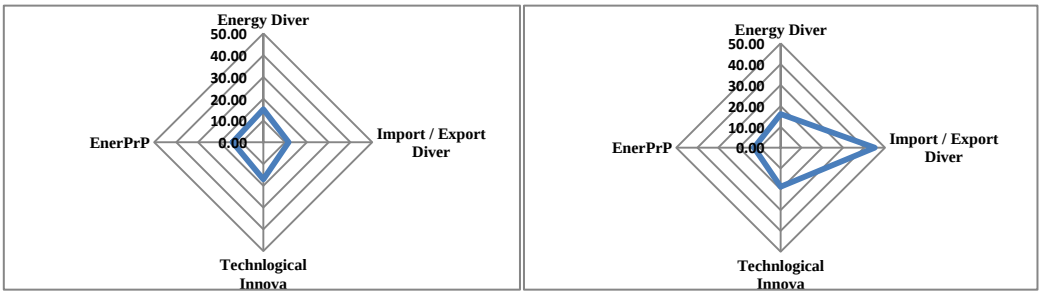

Fig. 7. Average patterns of energy policies for oil dependent/independent countries

Thus, Fig. 7 shows how the oil dependency index of all countries as an average, substituting the

import/export diversification pattern, has almost the same scenario compared to previous graphs. The motivation is not to compare patterns with each group of countries but to compare two group countries with each pattern. For example, the energy diversification pattern formulation of low oil dependent countries is almost at the same scale as energy diversification of highly oil dependent countries, which implies that those countries' dependency on oil is high and movement to energy diversification policy is lacking by being dependent on oil. Thus, regardless on import/export country origin, dependency on oil still plays a crucial role in the formulation of energy policies, in its encouragement and determination towards a green and stable economy development.

5. High Manufacturing Countries VS. Low Manufacturing Countries

5.1. Method and data

The evolution of the manufacturing industry has experienced increased regulatory scrutiny, increases and fluctuations in the price of raw materials (including oil), more complex projects, and rapid development of new environmental technologies. To keep pace, the industry is pushed to build new facilities in growing markets, revamp existing plants in mature markets, and get them operational as quickly as possible. Companies in this industry manufacture machinery and equipment used in oil and gas exploration and production, as well as water well drilling machinery. As mentioned earlier, amongst the three major industries we considered in our study, manufacturing as the industry is requiring the most oil, making our analysis concise and supporting our arguments [18].
The purpose of this variable selection is to see how the development of the manufacturing industry for oil import/export countries affects the overall energy policy development and how dependent on oil they are once again. The equation (2) shows the percentage of total each country's manufacturing output for 2008 with regards to the GDP of the respective country taken for 2008.

$$\boldsymbol{Manufacturing\ Weight\ (MW)} = \frac{\%\ of\ total\ \ manufacturing\ output\ 2008}{GDP\ of\ 2008} \qquad (2)$$

Thus, Table 4 depicts two groups' countries high and low MWs values respectively. The average value of 17 countries' MW is 16.3694.

Table 4. Average comparison between high and low MW countries; Source (WB, 2012)

Average	Low MW	MW	High MW	MW
16.3694	**Algeria**	4.63	**Austria**	20.39
	Belgium	15.3	**Finland**	22.23
	Australia	10.08	**Germany**	22.74
	Canada	11.96	**Indonesia**	27.81
	Denmark	14.17	**Japan**	19.79
	Norway	8.98	**Korea**	27.86
	Saudi Arabia	8.28	**Malaysia**	24.56
	UK	11.64		
	USA	12.93		
	Venezuela	14.93		

Amongst low MW countries, the USA, the UK, Denmark, Belgium, Canada, Australia, and Venezuela are leading ones with their original MW values performance implying that those countries are yet active in oil consumption and dependency. Meanwhile, if we look at all Asian (Japan, Korea, Malaysia, and Indonesia) countries amongst import/export countries, we can see how active they were in oil import/export balance and MW performance. In the case of data from Norway[2], the country is considered

[2] In case of Norway the ODI was at the zero level. It might be treated like Norway is considered as one of the less d ependent oil export country.

as of 2008, yet it looks successful enough to say that presently it keeps its leadership position amongst oil export countries as one of the fastest in moving to energy diversification and energy policy implication. Japan and Korea, with high MW value showcased as of 2008, currently remain the leaders in the Asian region with their energy diversification and energy conservation policies development.

5.2. *Results*

Traditionally, we developed graphs by calculating the average MW for 17 countries, and then divided them into two groups: low and high MW countries. For our method, we considered the previous four patterns average values in concord with the MW average value of import/export countries. Figure 8 depicts the two group countries' layouts not as import/export countries but as low and high manufacturing weighted countries.

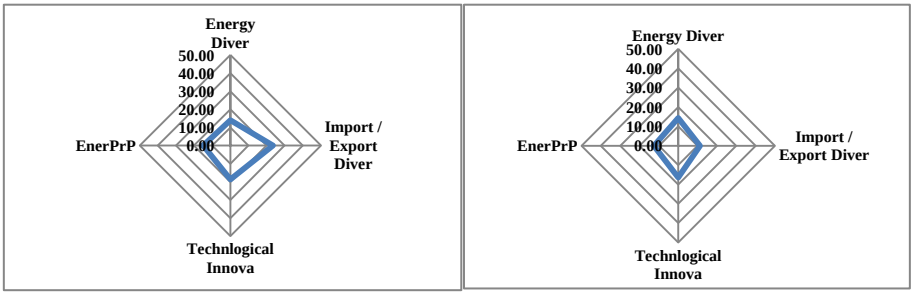

Fig. 8 Average patterns of energy policies for high/low manufacturing countries; high MW (left) and low MW (right)

We can see that there is a connection between countries with high ODI pattern and high MW and vice versa, which implies that those countries are highly dependent on oil and consume it more for their manufacturing industry than low MW and ODI countries. Logically and empirically, it supports our study's motivation and research findings as proposed.

As a conclusion, it might be said that in the year of 2008, the year of an economic crisis and oil bubble in oil import and export countries, they have been dependent on oil in their own ways. The scenario of ODI and MW values of import/export countries implies that countries still continued to develop their economies through a high consumption of energy even during the 2008 oil crisis; however, currently their aims are less consumption of oil and a deeper focus on energy policy development as a response to energy crises.

6. Discussions

As a conclusion, it might be said the scenario of ODI and MW values of import/export countries implies that countries still continued to develop their economies through a high consumption of energy even during the 2008 oil crisis; however, currently their aims are less consumption of oil and a deeper focus on energy policy development as a response to energy crises.

The main result of our analysis underlines the significant outcomes that were in the scope of our paper. Unlike other studies, we succeed in an analytical approach not only in one or few countries but with a larger group of countries' energy policy development. This study has demanded deep empirical consideration and inexhaustible efforts in managing all countries' data sets accordingly and respectively to the study's objectives. Also it showed us how different and how similar countries' demands and goals are towards energy policy development as well as how tirelessly and responsibly their movements towards social and economic stability achievements have been. Meanwhile, it is surprising and interesting to understand why those countries rich in oil and natural resource are not successful in PEST performance. Why is despite having rich natural resources, most export countries' GDP and social welfare is not high and stable? The one commonality to come out from this study is that in order to be successful in policies and developments, having natural resources is not a primary criterion at all. The willingness to share

knowledge and learn, the capability for cooperation, and paying forward experiences are suitable and appropriate factors that can make laggard countries leaders. The same concept applies for countries that are on their way towards energy policy developments. We have utilized the logical approach model as a measurement method and considered analyses of countries, as opposed to conventional research in measurement structured primarily around a few or single case study or on one country's or on a small number of countries data samples. The logical approach is based on statistics and data collected from verified sources as well as from individual country's energy reports.

This paper has its limits in that it lacks consideration of the peculiarities of political subject areas and the strategies of individual countries and their results. Despite on such limitations, this paper has gone beyond common energy related research analysis and proposed its own method of analysis as well as an appropriate assortment of data.

As a new approach to research and with regards to the implications and findings of the study, we would recommend to energy import/export countries a chain likewise *high ODI→high MW→active energy policies structure*. Countries with high oil dependency and heavy manufacturing industry development should consider or reconsider their energy policies development including patters we proposed above as a future green growth guarantor of stable economic development and as a response to energy crises

7. Conclusion

This paper demonstrates that our study findings show a positive relationship between energy and source concentration and energy policy development as a response to energy crises, driving policy suggestions that some countries need to employ diversification efforts in energy sources and in import origins, innovation technology developments and energy pricing policy formulation in this age of increasing energy prices. One country may have the potential to manage a transnational shock of the energy price by adopting national diversification of the energy supply and demand based on the patterns we suggested above. Because of that our study considers oil import/export countries' energy policy development patterns consistently, and we can propose recommendations to oil export developing countries to push incentives and encouragement and learn from import countries, including the willingness to share experiences, policies and implications in order to make the world more balanced and economies greener. However, non-government agencies and the public have to take a more proactive step to coordinate, promote and use energy generated from renewable resources. Apart from that, close collaboration with countries from other regions and spheres can also further promote the use of renewable energy which can be a milestone for sustainable energy policy, oil-free economy and green growth development.

Therefore, further study requires more consideration of other import and export countries' data and a comparison of the results between import and export countries in order to draw a general conclusion regarding the overall diversification effects and their energy policy development as a response to energy crises.

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Appendix A

Table A .1. List of countries in the sample data and analyses

21 countries of oil import and export countries
Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Greece, Japan, Norway, UK, USA
Algeria, Iran, Saudi Arabia, Oman, Qatar, Venezuela, Malaysia, Indonesia
Note 2: In comparison analysis of countries MW and ODI data, we excluded such countries like Greece, Oman, Qatar, and Iran from common data sample because of unavailability those data.
Note 3: Scale of measurement of patterns assigned between (0-21) with the step 3 for each symbol. N/A symbol is considered as 0 because of absence of the patterns or being less than L.

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