

A comparative study on the role of energy efficiency in urban planning system of Iran and Germany

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Abstract

Special attention on controlling energy consumption in different scales become increasingly important nowadays and a more comprehensive review on urban planning can be effective to achieve energy efficiency targets in this level. Germany has found its place as one of successful countries in improving energy efficiency in architecture and urban planning on a worldwide scale. Recognizing organizational system and its application in urban planning can be helpful for similar activities in Iran. In order to achieve the right result, assessment of defects and difficulties in optimizing energy consumption is essential. The approach used in this research is a comparative case study. The library sources and collected information from online credible sources is used in research process. After collecting the data and a review on similar examples, urban planning system of both countries, Germany and Iran, will be introduced. In a comparative case study, the causes of failure in Iran are described and research hypotheses are developed. The results obtained in this study indicate that the main differences in urban planning of Iran and Germany, on one hand can be in urban planning system and participation of non-governmental organizations, and on the other hand can be the lack of related topics of energy efficiency in urban planning documents. In a comprehensive and large scale overview, the ineffectiveness of activities in energy planning can be related to the lack of a national master plan to coordinate all organizational bodies of power in Iran. In surveying aforesaid, attempts are taken to eliminate defects in order to improve decision-making and organizing urban planning system properly, while introducing a framework to strengthen optimizing energy consumption program in Iran. In this regard, a framework has been provided to continue the researches in urban planning and energy consumption by emphasizing on Germany's experiences which can be utilized as a sample of leading countries experiences in achievement of energy efficiency goals.

Keywords

Urban planning, Germany, Energy efficiency, Organizations.

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Introduction

Reviewing the conditions and efficiency indicators in energy consumption of both Germany and Iran reveals noticeable distinct between these two countries. Obviously, differences in geographic situation, economic, technical, and social conditions, and also management and planning patterns have significant effects on two countries approach to achieve their objectives. Iran has various climatic and micro- climatic zones, each with particular climatic situation and with their specific method, culture, and consumption pattern of energy sources. More importantly, its economy is based on exporting fossil fuels which its low price has a direct impact on energy consumption and its population life style. Its centralized planning and management system and limited public participation also are factors with strong impression on the success of governmental plans and programs. In this regard, the lack of access to state of art technology in producing and consuming renewable energies can be another barrier in this country. Otherwise, Germany with a homogeneous climate and culture all around its territory imports fossil fuels and due to its experiences of two world wars, hard work and wise consumption has been established within its people as an attitude. Other advantages in this country are namely: industry and export based economy, state of art technologies in generating renewable energy and decentralized management and planning system with maximum public participation which affected its production and energy consumption patterns.

According to current researches, urban planning can play an important role in controlling and optimizing energy consumption. Thus, the configuration of a city and its physical characteristics have an impact on energy consumption through some elements such as building density, land-use mixture, geometry of access networks and public transportation system (Van Wee, 2002; Pan, et al, 2009; Ferguson & Woods, 2009; Kitamura, et al, 1997; Owens, 1986). Simultaneously, allocating the highest energy consumption rate in urban areas to the buildings, can

reveal the role of cities and their importance in energy consumption (Kari & Fayaz, 2006). On the other hand, in Iran some recent studies was carried out regarding to the position of urban planning and its impacts on energy consumption, however only a few studies has been done so far in this field namely: relationship between urban form and energy consumption (Baratie & Sardareh, 2013, Abbasie, et al, 2012), relationship between form of residential building blocks and energy consumption (Rafieian, et al, 2011), relationship between land use, transportaion system and energy consumption (Shahabian, et al, 2012), definitions and characteristics of eco-city (Sharifian Barforoush, & Mofidie Shemiranie, 2014), and comparing England and Iran with the focus on policies of energy consumption in land-use planning (Barakpour & Mosananzadeh, 2011). The last one is the closest study in terms of topic and context to the present paper. This study, which surveys land-use planning as an influential key in energy consumption on urban scale, reveals that the lack of consideration to urban palnning polisies which can reduce energy consuming in Iran; and comparing to England, the lack of integrated urban governance; are the factors leading to failur in this field. One of the key recommendations of the study is to formulate the national regulations in order to reduce energy consumption on urban scale. Limited studies in this field and its impotant role on both local and global scale shows the nessesity of complimentary studies and considering the issue on national scale as an important axes in urban planning of country; meanwhile, due to the increasing environmental crises and energy consumption in Iran accompaning with rapid urban development and the lack of considerations to energy consumption, a more comprehensive study in this field is required (Mirmoghtadaee, 2011). Due to the increasing price of energy and the its domestic producing defficiency which ncessitate efficient consumption, this case study explores urban planning system and the situation of energy in Germany as a successful country but in a different perspective. Thus, this

approach can reveals weaknesses of Iranian structure and leads to achievement of essential strategies in optimizing energy consumption.

Methodology

A comparative method has been utilized in this research. In accordance to the concept, a comparative method mainly has a qualitative approach which compares both similarities and differences of two comparable data gained from at least two communities. Case-based comparative method is one of comparative methods in which cases are compared as a whole but not as a set of variables (Rigin, 2009). On the other hand, the logic of research is in compliance with studys based on Grounded Theory¹ as the research is not focused on proving preset theories, however research outcome leads to formulate a theory (Strauss and Corbin, 2011). Otherwise, developing a theory is the result of studying similarities and differences between two countries in a specific subjective area and after recognizing the different dimensions of analysis (urban planning and energy), a general theory or perspective will be achieved. The process of identification in this study is the result of long term works conducted in cooperation with German researchers in the field of energy efficient urban planning, during which different approaches and perspectives of the German team in correspondence with similar cases in Iran have been identified and analyzed. The main question this study sought to answer is to identify similarities and differences between urban planning system with emphasizing on the role of energy issues in two countries; and the reason of choosing Germany is its relative success in the field of energy efficiency, compared with Iran. And in this regard, that country shall be considered as the main sample and the situation in Iran will be analyzed in comparison with that country.

First, both Islamic Republic of Iran and the Federal Republic of Germany will be surveyed in the areas of macro-energy organizations and policymakers. In the second stage, the outlines of urban planning

in two countries will be compared emphasizing on energy issues. Then, the missing parts of performance of organizations and institutions in the country comparing with Germany will be highlighted. To collect information, research tools such as library studies and reputable online sources are used. Additional information is gained by interviewing urban planning experts from Germany.

A comparative study on the role of energy in planning system of Iran and Germany - Influential organizations on energy issue

In this section, the role of influential organizations in regulating of energy consumption in Iran and Germany will be explored and compared. On the right side of table 1, influential organizations in the field of energy in Germany are shown in which four of seven organizations are directly active in this field. All these organizations operate based on a general program entitled “Energy Transition (Energiewende)”². This program lead to the preparation of “energy planning documents”, which have been developed in 2010 to define the policies and goals achieving by 2050 in Germany, and is one of the most important and comprehensive documents in optimizing energy consumption in the country. The program was reviewed in 2011 and its title changed to “Energy Shift” program (BMWi & BMU, 2010; Morris & Pehnt, 2015). The role of German Energy Agency, which half of its shares belong to four main ministries, is noteworthy as a public-private organization in coordinating and connecting. It should be noted that exploring ministries tasks in Germany shows that the environmental considerations and sustainable development are at the head of affairs, and in fact they are integral parts of planning in all areas even in some organizations which are involved indirectly in energy issues. The role of municipalities as independent organizations in local management is very important which will be discussed in the following sections of article. The Iranian energy-related organizations are illustrated on the left side of table 1 in which the five organizations directly and three organizations

indirectly are associated in energy issues. It should be noticed that there is no national energy master plan (such as a comprehensive energy document) to link these organizations activities (Mobinie Dehkordi and Hourii Jafari, 2008). There is also no national coordinator of the energy issues, and energy supply is the most important subject in Iranian policies. There seems that the existence of an integrated program in Germany and the unity in relation to optimization of energy consumption in this country has led to more consistency on organization scale (Table1).

The role of energy in urban planning system

• Federal Republic of Germany

-Urban planning system

The basic legislative system and democracy has been defined at three levels namely federal, state and local governments in Germany. At the federal level, the Federal Diet³ is in executive power. State Diet⁴, county council⁵, city council⁶, and municipal council⁷ are in executive power but limited to states, cities, towns and urban area respectively and undertake the responsibilities in these areas. Federal structure of the state with the three levels of federal, state and local governments is decisive for the system of planning in Germany. Spatial planning of Germany is accordingly decentralized in its agenda. The distribution of competence and functions between three levels of government produces a system with legally, organizationally, and substantively differentiated planning levels (Schayan & Giehle, 2010).

State spatial planning gains its concrete structure and form from federal principles of spatial planning, while at the local area, objectives are developed in compliance with both state and federal planning specifications. At the local level, it is the responsibility of local authorities to regulate the use of land for buildings and other purposes with upstream projects (Diagram 1).

Planning is therefore decentralized in Germany and the most important documents are provided on states and municipalities scale. Generally, planning is performed at three level including federal, governing mayor, and municipalities. The most important

instrument of urban planning is land-use plan which is provided as a legal document by governing municipality and will be updated every five years periodically. Local development plans (detailed plans) are prepared by the municipalities and include three-dimensional information. These plans will be updated in case of any changes or requirements.

-The role of energy in urban planning system

As mentioned above, "Energy Transition" is the most important pace in energy management on the largest scale in all dimensions. It should be noted that this has not happen suddenly and without background. Existing infrastructure in the country has provided the proper foundation for this program. Obviously, the urban planning system is one of the main issues which are considered in this program. It is noteworthy that the general principles of Germany's energy policy are based on three principles: sustainability, economic continuity, and environmentally sound energy supply. The Energy Transition program is based on five-axes namely reducing greenhouse gas emission, efficiency, construction, transportation and renewable energy (Morris & Peht, 2015).

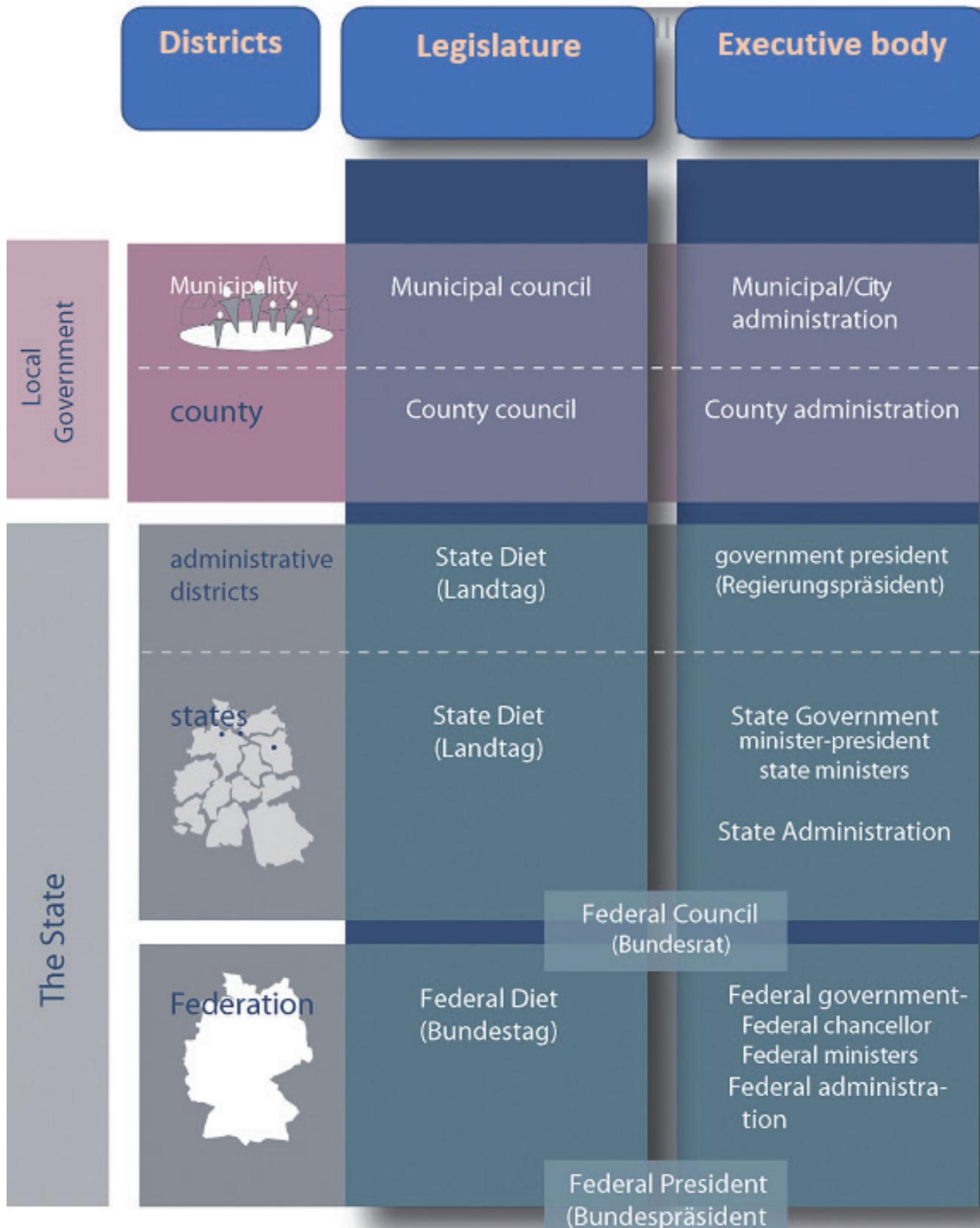
Generally, planning system of Germany consists of formal and informal instruments. National Building code⁸ is used as a source of providing legal documents such as land-use plan and local development plan (detailed plan). In this regard, informal instruments such as integrated development plans are prepared on various scales such as districts⁹ and urban quarters¹⁰. Likewise, other documents such as "Climate Action Plan" are gathered as informal instruments in accordance with Energy Transition program and these instruments are used in the planning process. Accordingly, the strategies on the urban scale are provided as "Climate zoning plan" in which all actions related to sustainable development aimed at improving the viability and resilience against climate changes are considered. Thus, providing these documents decreases vulnerability of cities to the limited energy resources and rising energy prices, and also improves the traffic condition and climatic situation (Bialk & Kurth, 2013).

It is also essential to notify the importance of

Table 1. Comparison of Iranian and German organizations with the focus on energy issue. Source: Official website of the mentioned organizations.

Germany			Iran			
Main organizations	Affiliated organizations		Main organizations	Affiliated organizations		
Federal Ministry of Economic Affairs and Energy (BMWE)	The Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (BNetzA)	German Energy Agency (DENA)	Oil Ministry	National Gas Company National oil company National Petrochemical Company fuel efficiency Company Oil Industry Institute (RIPI)		
	Federal Office of Identical Industries			Ministry of Power	Assistant department of Power and Energy Power Research Institute New Energy Organization of Iran (SUNA) Energy Efficiency Organization (Saba) power Company	
	Federal Office of Economics and Export Control (BAFA)				Assistant Department of Human Environment -Climate Change Office National Committee for Sustainable Development Institute of Environment and Sustainable Development	
	Federal Institute for Materials Research and Testing (BAM)				Ministry of Roads and City Planning	The Research Center for Housing and Urban Development Meteorology Research Institute
	German Renewable Energy Agency					Transportation and Fuel Management Headquarters
	Federal Institute for Geosciences and Natural Resources (BGR)				Federal Ministry of Food and Agriculture (BMI)	
Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB)	Federal Environmental Agency (UBA)	Indirect relation with energy	Ministry of Science, Research and Technology	Iranian Research Organization for Science and Technology Materials and Energy Research Institute Energy research institute (SUT)		
Federal Ministry of Transport and digital infrastructure (BMVBS)	Federal Agency for Nature Conservation (BfN)		Management and Planning Organization	National Iranian Productivity Organization		
	The German Weather Service (DWD)		Municipalities	Assistant Department of Architecture and Urban Planning Assistant Department of Environment Assistant Department of Transportation and Traffic		
Federal Ministry of Education and Research (BMBF)	Supporting research planning and projects related to the environment and energy					
Federal Ministry of Economics (BMF)	KfW Bank granting loans for all kinds of improvement and modernization and development in close cooperation with municipalities (one of the shareholders of the German Energy Agency)					
Municipalities-Department of Urban Development and Environment	Housing office Buildings Office City Planning Office Traffic office Environment Office					

Diagram. 1. Legal and administrative organization in Germany. Source: Pahl-Weber & Henckel, 2008.



municipalities in providing and implementing urban plans and documents to achieve the goals of energy efficiency. Municipalities show a great tendency to support “Energy Transition” program (Schönberger, 2013).

Depending on their legal authority, municipalities can provide instructions including rules for construction, guidelines for energy efficiency, heaters and hot water systems. They can also support programs to inform and advise people at sector level. In addition, they have the right of decision-making on issues related to land-use. It should be noted that this authority is established provided that it does not show any contrast with district development programs. Municipalities affect the areas such as energy efficiency, transportation and public housing significantly by their management and decision-making in the field of urban infrastructure (Buchan, 2012).

Finally, municipalities attempt to improve their situation and popularity in politics as an environmentally friendly organization by creating district alliances or joining a national network to promote areas with 100% renewable energy. To achieve the objectives, municipalities act within the framework of public participation and cooperation and also monitoring non-governmental organizations. Due to the local planning and decentralized system in Germany, documentation and energy efficiency programs varies in different states; and municipalities in some cities such as Munich are pioneers in this issue. In this city, for example, energy planning documents are prepared in three scales of city, neighborhood and buildings. Supplying energy program to reduce energy consumption and CO₂ emission is planned on a city scale while providing urban development and land-use documents. In two other smaller levels related documents have been formulated to meet the climate specifications (Eicker & Detlef, 2013).

• Iran

-Urban planning system

Iranian urban planning system has a centralized

structure in which decision-making and planning is based on a hierarchical process which limits downstream bodies and local authorities in decision-making independently. General policies of the system are commonly based on programs and national plans such as Vision 20 document and five-year plans for economic-social development (which is prepared and proclaimed by Management and Planning Organization). Ministry of Road and Urban Development is the main body in policy-making for urban planning. High Council of urban development and Architecture, which works under supervision of the ministry, acts as the head office in approving policies and regulations and proclaims general approvals of Planning and Architecture to relevant organizations and also undertakes final approval of its component (Bonakdar, et al, 2012). In fact, the Ministry and its affiliated agencies including national organizations and companies play the role of policy-making, development planning, determining the budget and monitoring planning system; and district and sector scale organizations are in charge of implementing the policies and directives from the top to the lowest point of planning system. In the field of urban and regional planning, national spatial plans and urban development plans are pre dominate documents. In the next levels, comprehensive regional plans for metropolitan areas and urban agglomerations are provided by the Ministry of Road & Urban development, and provincial plans are provided by the Management and Planning Organization. Also, comprehensive and detailed plans provided in a larger scale for cities -in which the land-uses are determined and the condition of access networks and population density in different districts are specified-can be counted as most important plans on city scale (Rasoolimanesh, et al, 2013).

Locally, Islamic councils and municipals undertake the prime responsibility for urban planning in Iran, however some organization can legally impact on this planning sector. In Iran, municipalities are dependent on financial aids from the City

Council and the Interior Ministry, and are monitored by this bodies that indicates the limited role of municipalities as a sector planning body and performer of comprehensive plans and city management which are not able to take any role in further planning (Pahl-Weber, et al, 2013).

- The role of energy in urban planning system

Comparative study on Iran and Germany indicates that the main differences in the role of energy efficiency in urban planning system can be examined in several bases: the rate of centralization and distribution pattern of the power, the authority level on local scale and integrating energy issues in planning documents and instruments. Centralized organization structure has led to approve acts regardless of local characteristics and variation of cities in Iran. In addition, a review on the specification of urban planning documents indicates that energy issues are not considered seriously and has no specific position in urban planning (Barak pour and Mosannan Zadeh, 2011).

Municipalities are mainly in charge of implementing

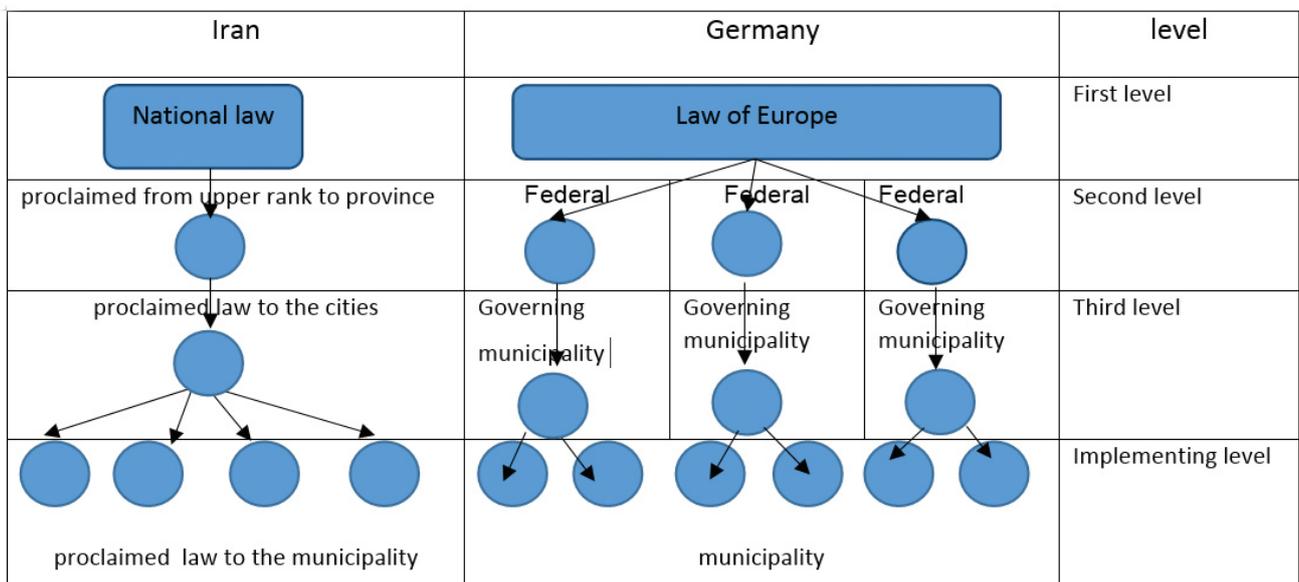
land-use plans, allocating density and development of urban access networks. Although, a limited consideration to environment can be found in their actions, planning and implementing issues related to energy and environment does not exist in their agenda. In the other hand, considering the multiplicity of organizations responsible in providing urban infrastructure, decision-making in most issues related to energy consumption is not in their authority scope.

Another lost issue to consider in decision-making about energy in urban planning is the lack of public participants in various sectors, which is the consequence of centralized political system in the country. NGOs and private organizations can play an important role in such decision-makings. In this trend, since people are the main decision makers, they are more concern about making the best implementation too (Diagram 2)

Conclusion

Cities as the main energy consumers have important role in optimizing energy consumption. Iran is

Diagram 2. schematic diagram of decision taking and approval of legal documents in Iran and Germany. Reference: authors.



realized as a foremost energy producer in the region and at the international level; to pave the way of its progressing, it is necessary to search for solutions in optimizing energy consumption. Therefore, in this research the attempts are taken to distinguish differences and implementing defects of Iran comparing with Germany and to find ways to resolve its weaknesses. The results on large-scale of energy consumption indicates that the absence of a national energy master plan to create consistency within organizations associated with energy topic, is the main reason of inefficiency of Energy Planning in Iran comparing with Germany. Also, the lack of urban regulations and documents related to energy and the lack of public participation in the form of private organizations and NGOs in the specialized scope and the urban planning level can be the most important factors in the failure of planning in this field. Diagram 2 which represent the structural differences in urban management and decision-making in Iran and Germany, implicitly reflects differences in the structure of energy planning as well. The study shows that in addition to a master plan for making changes in energy consumption pattern in Germany, the local states independency in which public bodies determine the degree of local authority's power, is the main reason of Germany's success in optimizing energy consumption in comparison with Iran. Considering the general knowledge gained during the research process related to the both countries, the following two viewpoints or theories can be presented as the result of research (Table 2).

-On the macro scale, the lack of quantitative targets and lack of coordination in the field of policy-making for the energy are main reasons of Iran's failure in the area of energy policy-making in comparison with Germany.

-Among the most important reasons for Iran's failure in urban development based on optimizing energy consumption, the factors such as predomination of centralized political system, low attentions to local conditions and differences, and also the lack of specific positions for public participation and private and governmental organizations, and the lack of documentation and regulation related to energy consumption on city scale can be counted in specialized field of urban planning.

While approving the results of similar research conducted by Barak pour and Mosannan Zadeh (2011), this study also shows that successful planning in the field of energy should consist of linked hierarchy and coordinated system of plans and programs which are in consistency from country to local level. The results of other studies done in the field of urban planning and energy consumption indicates the important role of local governments in planning for energy efficiency and at the same time, the need for coordination with national programs (Morlet & Keirstead, 2013; Hammer, 2008). Likewise, it must be considered that energy planning on urban scale requires availability of basic energy production and supply data and also the information about the role of local authorities along with public bodies in regulating and controlling consumption. Therefore, besides political tendency and proper distribution of power in the planning system, the need for technical information and data associated with large-scale energy requirements for planning and complementary documentation are required.

Further studies have been conducted to investigate the causes of the relative success of energy projects in Germany, in addition to the aforementioned, there are other issues pointed as strong financial incentives and support of state-owned banks as well as energy performance certification and support pilot projects (Power & Zulauf, 2011). In current situation in Iran, the most important area of energy planning includes building and insulating its facade (Section 19, National Building Regulations), which are very valuable in their own right, but since there is no connection with planning processes in other related measures, unlikely expected results would be achieved. It is therefore imperative for organizations, especially the Ministry of Roads and Urban Development, to develop a comprehensive and coherent plan in energy field, and municipalities must establish and implement some programs within the framework of their knowledge about local conditions and opportunities. In this regard as the main achievement of this study - which is counted as the initial step in the

field of energy and urban planning comparative studies – a framework for developing research in this area is recommended. Table 3 provides a program for comprehensive comparative study in the field of energy planning at the urban scale, with emphasizing on the experiences of Germany. Obviously, similar programs can be developed to study other successful countries in this area and the results of such studies can be useful to complete the planning system and reform the country.

Table 2. Comparison on the major differences of energy planning, in Iran and Germany. Source: authors.

Organizations in charge of energy supply		Urban planning	
		Local government role	Urban planning documents
Iran	<ul style="list-style-type: none"> -Overlapping tasks -The absence of a national master plan as a coordinator or organization in charge of coordinating 	<ul style="list-style-type: none"> - Centralized planning system - Lack of independency of local government - The limited role of NGOs 	<ul style="list-style-type: none"> - Shortage / lack of attention to issues related to energy and environment in urban planning documents
Germany	<ul style="list-style-type: none"> - A focus on energy and environmental issues in the activities of all organizations (even those that are not directly involved with energy sector). - The national program as a coordinator of energy (energy transition) and the German Energy Agency, in coordinating organizational activities 	<ul style="list-style-type: none"> - Decentralized planning system - Independency of local government within the framework of the public institutions supervision 	<ul style="list-style-type: none"> - Issues related to energy and environment pivotal role in urban planning documents - Developing additional documents related to municipal energy

Table 3. Suggested research plan on energy planning experiences of Germany. Source: authors.

target	plan
national energy master plan to create coordination between institutions in charge of the country’s energy planning	Studying hierarchy of Management and Laws for developing and achieving the goals of energy transition program in Germany
Strengthening and supporting public institutions active in the field of energy efficiency and their interaction with the urban management	The study of urban management system in Germany and its connection with public institutions activities in the field of energy and environment
Providing documents and complementary guides for projects and urban plans with the aim of considering the topic of energy	German municipalities experiences in various states in developing manuals and documents of urban development in accordance with the objectives of the energy transition program

Endnote

1. Grounded Theory

“Energy Transition (Energiewende)” this term was initiated by Institute of Applied Ecology in Germany for the first time, which means elevating energy regime efficiency and shifting to the use of renewable regime.

3. Bundestag

4. Landtag

5. Kreistag

6. Stadtrat

7. Gemeinderat

8. (Baugeetzbuch- BauGB)

9. Stadtteil

10. Quartier

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