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Energy Efficiency Policies in Urban Planning System, The Case of Iran

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ABSTRACT: Urban areas are the main consumers of energy resources with a considerable amount of waste in building and transport sectors. This comes about due to inefficient development patterns as well as consumption habits. Towards steering an energy efficiency transformation in cities, it is thus crucial to develop policies, strategies and measures to improve efficiency in these sectors. Hence, not only physical but also climatic as well as socio-economic characteristics should be taken into account in development of energy efficient urban areas. The respective urban development factors- besides technological applications and organizational readiness- can support better energy performance of cities. Against this background, the present research emphasizes on identifying energy efficiency planning measures together with their integration in local urban development practices. In terms of methodology, the research investigates relevant theoretical knowledge in urban sustainability and energy efficiency and develops a comprehensive set of spatial planning measures to be analysed in the Iranian context. Furthermore, Iranian urban energy facts and figures are surveyed in line with current practical procedures and bottlenecks in the local planning context. The methods used to examine the local context are diverse and include: via desk research, field observations and interviews with local experts. Besides, GAP analysis is utilized aiming at identifying the existing gaps from technical, regulatory as well as organizational perspective. This is followed by a comprehensive set of strategies and recommendations for the integration of the missing spatial energy measures in the local planning practice.

Keywords: Urban Sustainability, Energy Efficiency, Urban Planning System, Integrated Planning.

INTRODUCTION

With cities accounting for half of the world's population today, and two-thirds of global energy demand, urbanization is exacting a serious toll on the environment (GEA, 2012). As rapid urban growth continues, energy use in cities and associated levels of greenhouse gas (GHG) emissions are projected to continue unabated. Current projections indicate that approximately 70 percent of the world's population will live in cities by 2050, producing some 80 percent of the world's GHG emissions. The development and mainstreaming of energy-efficient and low-carbon urban pathways that curtail climate impacts without hampering the urban development agenda thus are essential to meeting such challenges (Ranjan, 2010). Within this complex system knowing, analyzing and integrating the energy drivers and efficiency measures will take a significance role in controlling, mitigating and optimization of the energy performance in urban context (GEA, 2012).

Urban planning and design can improve the energy performance of the built environment to a considerable extent. It does that by configuring the form and functional features of cities. This include measures, to reduce demand for energy both in building and transport sectors - as the largest energy end-consuming sectors in cities. Towards this end, the present research investigates relevant theoretical knowledge in urban sustainability and

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energy efficiency. Here, it is critical to seek out solutions targeting the minimization of energy consumption in cities by urban planning measures. The Iranian urban energy related facts and figures are surveyed in line with current practical procedures and bottlenecks in the local planning context. A GAP analysis is put in place aiming at generating recommendations for integration of the energy-efficient spatial planning criteria in the statuary process of urban development plans. The main target of the research is to introduce an integrated set of measures and recommendations to achieve energy efficiency through modified urban planning in the iranian context.

URBAN PLANNING AND ENERGY EFFICIENCY DEBATE IN THE IRANIAN CONTEXT

A Review on Urban Planning System in Iran

During the 20th century Iran gradually changed from a country dominated by a rural-nomad population to a largely urbanized one. A 1962 reform of agricultural land began Iran's gradual transition from an agriculture-based to an oil-based economy, as well as the acceleration of rural to urban migration (UNDP & DoE, 2010). Urbanization continued to increase at a rapid pace even after the Islamic revolution. Today more than 71 % of the population is urban and urbanization continues to grow. From 2006 to 2011, the average annual population growth rate in urban areas was 2.14 %, while rural populations shrank by an average rate of -0.63 % (Statistical Center of Iran, 2011). As of 2011, there are 1,143 cities ("Shahr") and approximately 96,549 villages ("Deh" or "Roosta") in Iran (Statistical Center or Iran, 2011). Three main factors underlie urban expansion in Iran are the natural growth of population, the rural-urban migration motivated by the superior socio-economic circumstances of cities, and changes to the official definition of rural areas which led to some former villages becoming cities due to their population growth (Statistical Center of Iran, 2006).

Iran has faced a massive alteration during the previous decades regarding its urbanization process, and respectively, it's planning system. Looking at the current urban planning system of Iran, a sectoral-centralized model is observable, where organizations and agencies in different planning levels are vertically linked[1]. The responsive institutions at local level are considered as the representative of the equivalent ministry or organization at national level (Hejazi, 2003 & Saeednia, 2013). These authorities are structured in three spatial levels: national, regional (province – "Ostan" and county-"Shahrestan") and local (city-"Shahr"). In the local scale, municipalities and Islamic city councils are the main responsible planning authorities; however, both organizations have not enough legal power to influence the current binding urban development and planning process of cities solely (Tehran is an exception). Municipality is a public body and mostly financially independent (municipalities of small cities still receive financial support from the province governor), overseen by the Ministry of Interior, and recently by Islamic city council. Therefore, the municipality is more of an explicative rather than legislative authority and its responsibilities are limited to the implementation of master plans, detailed plans and other urban management activities (i.e., sanitation) (Zamani & Arefi, 2013).

Similar to the planning structure and bodies, there is a hierarchical classification of development plans in Iran. All development plans are categorized in 3 main levels (National, Regional and sub-regional and local level). Each plan should be produced based on the defined framework of the affiliated higher-level plan. Therefore, a top-down system is again observable (Zamani & Arefi, 2013). Among different types of plans, the most influential on local level are comprehensive and detailed plans which are utilized to shape the future physical structure of cities. The detailed plan is a local-level development plan, in which urban services and spaces are proposed within a detailed structure of form and content. Such a plan provides specific guidelines for different urban sectors, which, based on their priorities, will be reflected as implementation plans in the execution process for municipalities (as the local implementation body in Iran). The "detailed plan" is a plan, in the frame of a comprehensive plan with regulations and development measures, which provides the exact land-use for exact areas in urban districts at local level. The detailed access network, population and building densities in local urban units, the regeneration, renovation priorities and last but not least the land ownership analysis are the most important functional items outlined in a detailed plan (MRUD, 2012).

In fact the comprehensive and detailed plan contains all necessary details and definitions on the level of urban quarters (Shieh, 1996, p. 96) and therefore, are assumed as the main urban planning instrument, having the potential for integrating energy measures. Although new strategic approaches have been tried in several planning practices in recent years, the dominant planning system is still oriented on physical and quantitative elements with a comprehensive planning approach. Any change in the general planning approach/system in Iran, will likely face tough resistance. This is so mostly due to the complexities in the steering modalities, accompanied with a lack of knowledge in new planning approaches and their benefits among local authorities (Khodabakhsh, 2017).

Energy and Environmental Conditions in Iran

Iran has some of the largest oil and natural gas resources in the world. Not surprisingly, oil, petroleum products, and natural gas are the main energy sources in Iran (MoE, 2009). Although the country also has great potential for renewable energies, e. g. solar photovoltaics, the current primary renewable energy supply is negligible. This leaves ample room for improvement in related technologies and policy instruments. Looking at different energy sectors, the residential sector has the highest energy consumption in Iran, followed by transportation and industry. Iranian households use natural gas and oil mainly for heating, cooking, and hot water. Lighting and appliances (including cooling systems) are the major components of household electricity use (IEA-WI, 2009). There is a considerable amount of energy waste in the residential sector due to inefficient construction patterns and energy intensive household appliances (Farahmandpour et al., 2008). As the sector with the greatest share of energy consumption, it is crucial to develop policies, strategies and measures for increasing the efficiency of Iranian building energy use.

Table 1. Share of Energy Use by Sectors

Sectors	Energy sources (Share)		
	Petrolium Products	Natural Qas	Electricity
Residential, Public and Commercial	12%	49%	47%
Transport	62%	6%	0%
Industry	8%	34%	35%
Agriculture	5%	1%	16%
Non-energy Use	13%	10%	2%

(Mo, 2013)

On the other hand, emissions increased rapidly in the 1960s, slowed slightly during the eight-year war period with Iraq, and have climbed steadily since the 1990s (Carbon Dioxide Information Analysis Center, 2012). The use of natural gas for primary energy supply increased from around 20% in 1990 to over 50% in 2009. While the decrease in use of oil and petroleum creates comparatively lower amounts of CO_2 emissions, use of natural gas still accounts for a considerable amount of Co2 emission (MoE, 2006). From the CO_2 emmissions perspective, the Iranian energy industries as well as the building sector (households, commercial and public) are responsible fro 27% and 28% of Iran's CO_2 emmissions, follwed by the transportation sector with 24%. (UNDP and DoE, 2010). The transport sector's large, and increasing, share of CO_2 emissions is primarily due to the dominant and growing role of private cars in combination with inadequate public transport.

Table 2. Total Emissions and Sectorial Share (2010-2030)

Sector	2010				2030			
	CO_2	CO	NO_X	SO_2	CO_2	CO	NOX	SO_2
Household, Commercial, Public (%)	28	0.8	6	4	24	1	5	4
Manufacturing Industry (%)	19	3	9	13	29	5	10	19
Agriculture (%)	2	0.2	3	4	1.4	0.1	2	3
Transportation (%)	24	94	47	29	21	91.9	61	48
Power Generation Plants (%)	27	2	34	50	24.6	2	22	26
Total Emission (Million Tons)	737	8.25	1.84	1.43	1032	14.5	4.61	2.68

(Moshiri & Lechtenböhmer, 2015)

According to the Köppen climatic classification there are three prevailing climate zones in Iran. The dominant climate type is arid and semi-arid climate, covering 81% of the country. 17% of the country is of temperate or mesothermal climate and 2% of the country is of continental-microclimate. In most Iranian cities the coldest month is January (with a monthly average temperature between -6˚C and 21˚C) and the warmest is July with a monthly average temperature between 19˚C and 39˚C. In most regions the highest precipitation occurs in winter and there is almost no rain in summer. However, it is very important to note that there are considerable regional differences in precipitation, with the average annual total ranging from 2,000 mm along the Caspian Sea to some areas in the central desert with almost no rainfall (UNDP and DoE 2010). In the coming decades Iran will feel severe effects of climate change. The following changes are projected for the period between now and 2039.The increasing number of hot days will raise the demand for cooling, resulting in increased energy use and, thus, higher CO_2 emissions (UNDP and DoE, 2010).

URBAN ENERGY EFFICIENCY MEASURES – THE TRIAS ENERGETICA APPROACH

A suitable comprehensive approach that is not focused on specific sectors or disciplines, but considers several energy related effects on the cities comes from energy-related building research. I opt for the so-called Trias Energetica. This approach takes a more complex view of the built environment formulated under the headings "Prevention - Renewables - Efficiency" a target range for the sustainable use of energy (ENTROP and BROUERS 2010, p. 296). In the sustainability/energy efficiency debate very similar strategies are classified under the headings of efficiency, consistency and sufficiency, which - as the triad Energetica shows - also can be applied on the energy efficiency in the built environment (including Behrendt et al., 1998; Sachs, 2005; Hegger, 2007, p. 59). The Trias Energetica centres around three criteria:

- **Efficiency:** efficiency targets by a rational use of energy to minimize the use and conversion of materials and energy, thus increasing the energy and resource productivity (Behrendt et al., 1998, pp. 261-262). Efficiency is a strategy with a high initial potential and lasting effect; these strategies can, however, find their limits when they can no longer neutralize an increasing demand (Sachs, 2005, p. 165; Entrop & Brouers, 2010, p. 296).

- **Consistency (Renewables):** Consistency refers to the provision of energy and raw materials consumption in closed energy systems, as indicated by the use of renewable energies i.e. solar, wind, hydrogen (Behrendt et al., 1998, pp. 261-262; Entrop & Brouers, 2010, p. 296). In the wider context, the consistency strategy is aimed at closed material and energy flows within a spatial unit.

- **Sufficiency (Prevention):** Sufficiency targets consumption patterns of individual users, with the aim of limiting the consumption of energy (Sachs, 2005, p. 167; Hegger, 2007, p. 50, Entrop & Brouers, 2010, p. 296).

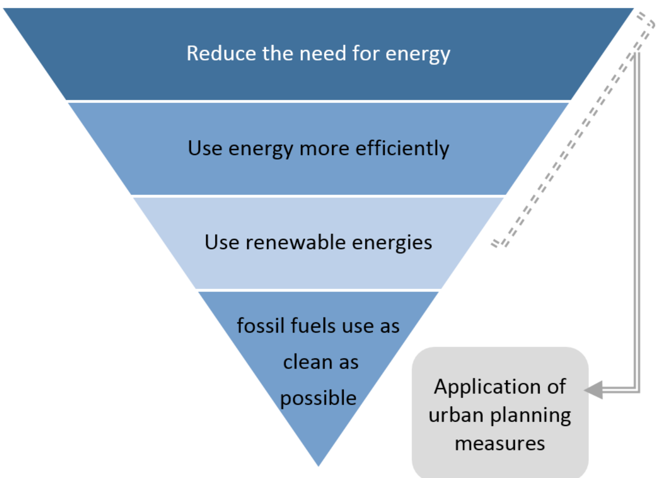

Fig. 1. Urban Energy Efficiency Targets and the Focus of this Research (Entrop and Brouwers, 2010)

Based on the elaborations above, it is possible to derive a hierarchy of targets (see Fig. 1). In line with the focus of the study at hand, the priorities in urban planning measures are rather focused on reducing the need for energy as well as to provide opportunities in maximizing the use of renewable as well as passive energy use[2].

A Review on Energy-efficient Planning Measures

The dynamic interaction between energy systems and the spatial organization of society has been a subject of considerable interest since the energy crises of the 1970s (for example, see Ashworth, 1974; Beaumont and Keys, 1982; Burchell and Listokin, 1982; Hall, 1979; Odell, 1977; Owens, 1984a; 1984b; 1986). It is believed that approaches to energy consumption reduction can be achieved through planning principles, such as the mixture of functions, the acceptable density or the "city of short distances". Furthermore, urban development should not be viewed in isolation from the traffic planning and energy supply, but rather are in exchange with these sectors. By reducing the volume of traffic and the shift to public passenger transport itself energy consumption minimization approaches arise. But also by an increased efficiency of energy supply and use of energy produced from renewable energy sources, paving the way for an energy efficient city planning are provided (GEA, 2012). Many environmental problems can be traced back to inefficient land-use practices and policies that encourage urban sprawl, which increases the need for transport, demand for energy (for heating and cooling purposes), and has higher infrastructure costs (UN-HABITAT, 2012).

The factors that determine urban energy use can be classified into a few major groups (GEA, 2012). These factors do not work in isolation, but rather are linked with exhibit feedback behavior, which prohibits simple linear relations with aggregated energy use (Grubler et al., 2012). An important factor in planning for urban energy efficient settlement is the compactness of the structures and balanced configuration and distribution of urban services and facilities. This improves facilities performance in relation to demand for urban mobility and movements (Odell, 1975). Creation of balanced distribution of facilities in relation to urban structure compactness and building configuration is proved in many urban energy assessment models (Hemmens, 1967). Worth mentioning is that the compact urban form is not equal to high rises development, rather balanced development of different types of buildings in accordance to citizens needs and local conditions and the balanced allocation of urban services and facilities accordingly (Pahl-Weber et al., 2014). Consideration of development patterns to optimize the accessibility conditions (all modes, especially walking, cycling and access to public transport) is highly recommended in energy literature. This impact drastically on the energy consumed in the transport sectors. Therefore, planning urban areas by focusing on balanced allocation of urban services and integration of the services with the public transport system, creation of walking and cycling possibilities and creation of walkable distances are important elements to reduce energy demand for transport. Here, concepts such as mixed use (vertical and horizontal) are influential solutions (Pahl-weber et al., 2013).

In urban energy literature, density has perhaps received more attention than any other single variable in the energy – urban form debate. The emphasis may well be responsible for the notion that energy efficiency requires futuristic 'compact cities' – a notion which can be easily dispelled. Optimizing building volumes can, among other policies, stabilize a building's thermal behavior through compactness and surface to volume ratios. This efficiently regulates the interior climate against reduces thermal loss through building surfaces and extreme outside temperatures and seasonal or daily temperature peaks. Depending on surface- design and material, the influence of outside climate on interior spaces can be greatly reduced. This strategy must be developed in tandem with architectural design (Pahl-Weber et al., 2013; Peseke and Roscheck, 2010). Respectively important is the height of the neighboring building and in general the interrelation of the buildings in an urban structure considering the local climate conditions (i.e. sun light, wind exposure etc.). Another important factor is the consideration of the domestic cultural background and values. Here, factors such as the average residential area per capita impacts on general energy consumption of households. This can be in some extensions steered through policies in comprehensive and detailed planning concepts for building developments especially in new development and urban growth areas together with awareness raising programmes. Furthermore, consideration of the religious believes and cultural values can impact highly on development patterns and should be directly considered in planning and design of high density and compact structures (issues such as visibility from the neighboring buildings are important factors to be integrate in plans) (Pahl-Weber et al., 2013). In addition to climatic variables (heating degree days and cooling degree days) energy price and more specifically electricity price and the floor area of the unit influence on increasing energy consumption (Hamidi & Erwing, 2012).

Theoretical considerations show clearly that if other variables are held constant, built form exerts a systematic influence on energy requirements for space heating. Since the heating requirements of a building may be calculated quite simply from basic information about its size, shape, and structure, internal and external temperatures, and the ventilation rate, the relationship can be explored. In a much quoted study, the British Building Research Establishment compared the heating requirements of Hypothetical dwellings of similar volume and insulation standards, but of different form (BRE, 1975). The results, confirmed by others show that a detached house could have energy requirements for space heating three times greater than those of an intermediate flat of equivalent size. This difference is of similar magnitude to that between poorly insulated dwellings and those with medium insulation standards, implying that any widespread trend in the built form of new housing could have an important influence on the consumption of energy, in extreme cases of the order of magnitude envisaged from a general improvement in the thermal insulation of new constructions' (BRE, 1975).

Sitting, layout, and orientation of buildings determine the extent to which they can be warmed by or shaded from the sun, and ventilated by or protected from the wind. Landscaping, for example, the use of trees to provide shade in summer, is also significant at this scale. Traditional built form and micro location in different climatic regions show clearly that the benefits to be obtained from sitting in relation to microclimate have long been realized in practice. Now that energy conservation has become a significant issue, interest in sitting in relation to microclimate has been reawakened (Keplinger, 1987). Appropriate buildings and block orientation directly impact on passive energy absorbance (sun light) as well as passive ventilation possibilities. Therefore, providing possibilities for cooling and heating as well as ventilation of the buildings (Wehage et al., 2013). Insulation of building envelopes, both opaque and transparent, is one of the most important strategies for building energy conservation. Insulation of walls, roof, attic, basement walls and even foundations are one of the most essential features of energy-efficient buildings. In addition, as glass is a poor insulator, insulating transparent envelopes, windows and skylights, significantly reduces heat loss and gain during the winter and summer (Kim & Moon, 2009). Last but not least are social norms and behavioural factors. A number of studies (Becker et al., 1981; Brandon and Lewis, 1999) indicate that environmental beliefs and/or socially responsible attitudes do not significantly influence energy consumption; monetary savings, for instance, seem to be better motivators. Elizabeth Shove (2003) argues that there is evidence that routine consumption is controlled to a large extent by social norms and is profoundly shaped by cultural and economic factors. She argues that current consumption patterns reflect that we generally remain unaware of routines and habits, particularly when it comes to energy and water consumption.

Against the above mentioned background and in accordance to the comprehensive set of energy efficiency planning measures addressed, a diagram for energy efficient planning measures is demonstrated. The figure provides an insight of the main urban planning measures in relation to energy consumption and comprises of three influential dimensions:

- **External elements:** to be considered as preconditions.
- **Planning measures:** to be integrated in planning process.
- **Impacts on energy consumption:** demonstrating the impact of each measure on energy sectors.

In terms of planning measures, the figure classifies measures in to three main dimensions namely:

- A. Measures to minimize the energy demand and loss of energy.
- B. Measures to maximize the passive energy utilization.
- C. Measures to reduce the need for movement and to maximize the use of efficient transport modes.

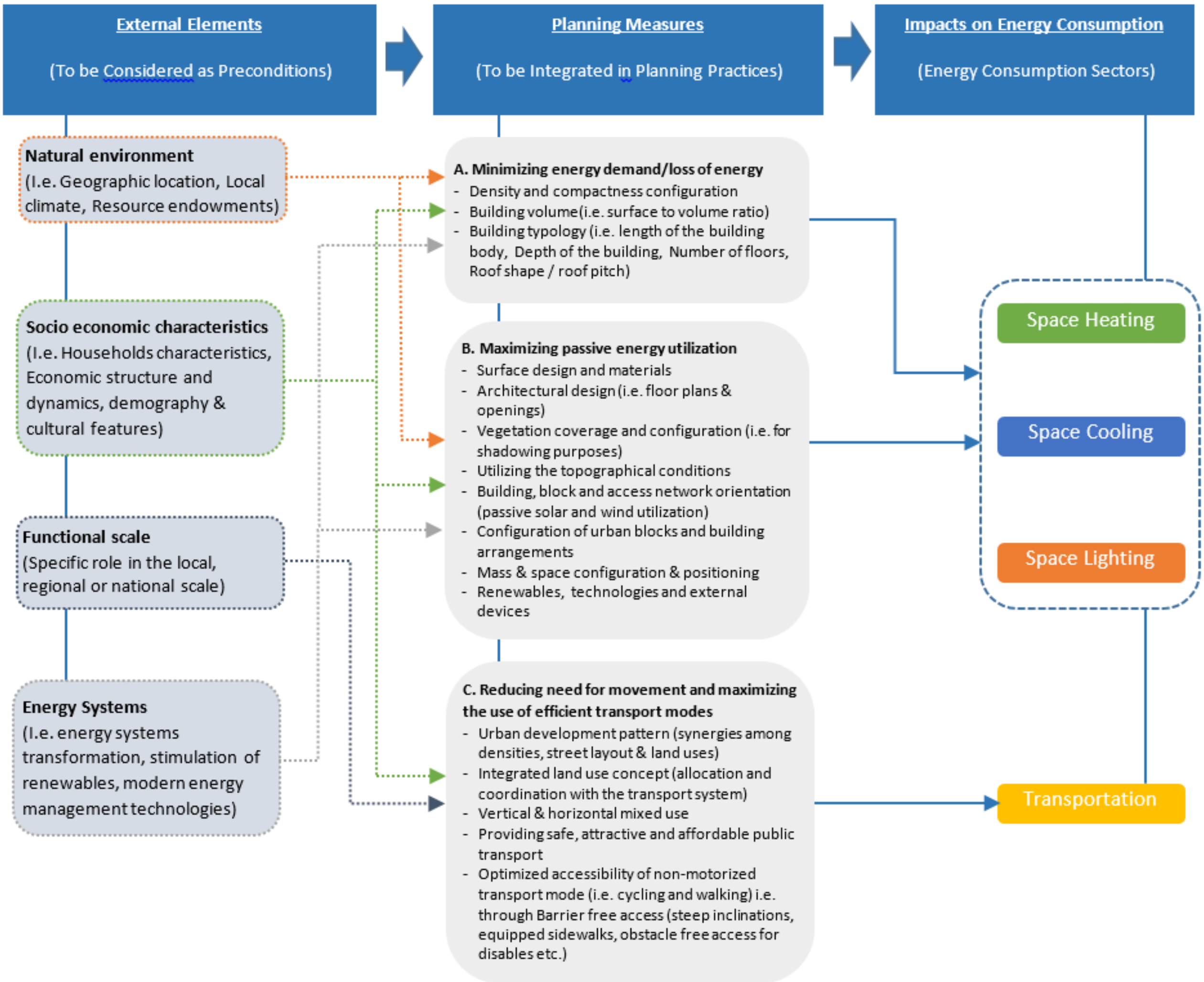

Fig. 2. Influential Planning Measures on Building and Transport Energy Use (Khodabakhsh, 2017)

Zooming in on the direct and indirect integration of identified energy efficiency measures in existing urban development plans yields yet another informative picture. Table below shows the current status on how and to which extent functional energy efficiency planning measures are considered within the current spatial development planning process in Iran. Reviewing the table indicates that a only a few energy efficiency measures are considered partially in some types of development plans accompanied by few dedicated enforcement instruments and responsible authorities.

Table 3. Status Quo of Energy Efficiency Planning Measures in the Local Planning Process

Criteria in Relation to Energy		Existing Obligatory Planning Measures		
		Type of Development Plan	**Type of Enforcement Instruments**	**Controlling Body/ Ies**
A	Density and compactness configurations	CP/DP	M/R/S	MU
	Building volume (i.e. surface to volume ratio)	-	-	-
	Building typology (Length of the building body, Depth of the building, Number of floors, Roof shape / roof pitch)	-	-	-
B	Surface design and materials	-	-	-
	Architectural design (i.e. floor plans & openings)	-	-	-
	Vegetation coverage and configuration (i.e. for shadowing purposes)		G	CEO
	Utilizing the topographical conditions (i.e. south facing slopes)	-	-	-
	Building and block orientation to regulate passive wind utilization	-	-	-
	Building and block orientation to regulate passive solar utilization	-	G	CEO/MU
	Street network orientation and dimension to regulate passive solar and wind utilization	-	-	-
	Configuration of urban blocks and building arrangements	-	-	-
	Mass & space configuration & positioning	CP/DP	R	MU
	Renewables, technologies and external devices	-	-	-
C	Urban development pattern (synergies among densities, street layout & land uses)	CP/DP	M/R/G/S	MU
	Integrated land use concept (allocation and coordination with the transport system)	-	-	-
	Vertical & horizontal mixed use concepts	CP/DP	M/R	MU
	Providing safe, attractive and affordable public transport	CP/DP	S	-
	Optimized accessibility of non-motorized transport mode (i.e. cycling and walking) i.e. through Barrier free access (steep inclinations, equipped sidewalks, obstacle free access for disables etc.)	CP/DP	S	-
CP (Comprehensive Plan), DP (Detailed Plan), M (Maps), R (Regulations), S (Strategies), DC (Design Code), AP (Architecture Plan), G (Guidelines), MU (Municipality), CEO (Construction Engineering Organization)				

(Khodabakhsh, 2017)

GAP ANALYSIS - INTEGRATION OF ENERGY EFFICIENCY MEASURES IN THE SPATIAL PLANNING PROCESS

In general, gap analysis has been extensively drawn upon in domains such as business process management (Jeston & Nelis, 2006; Palmer & Mooney, 2007) and supply chain management (Bolstorff & Rosenbaum, 2007). Several approaches have emerged which aim to help organizations obtain a better understanding of improving their business and procedures. The same procedure is being applied in this research, aiming at analyzing the main shortcomings in current planning practices in Iran. Results from field observations and interviews with local experts[3], in combination with information obtained through desk research (i.e. analysis of development plans and planning regulation) are utilized for identifying existing gaps in local planning practice and serve as a basis for strategic recommendations. Secondary data is inter alia derived from the pertinent literature. Validity is assessed by triangulating (i.e. Delphi Model) the data so derived with other sources in the local planning practice. The GAP analysis shows that shortcomings in the current Iranian planning practices, appear in terms of limited know-how on energy efficiency measures in the spatial planning process. With the exception of a building code dedicated to energy and environmental issues (Code no.19), no other planning and design measures exists in the planning system to cover the issue. It appears that most actors and stakeholders involved in urban development activities in Iran neglect energy efficiency and environmental designs principles. Nor is there any special large scale incentives, which focuses on energy efficient planning and design activities. In addition, there are no particular monitoring and enforcement mechanisms in place. Lack of incentives to motivate the developers and planners in integrating new environmental qualities is another shortcoming. On a more general level energy efficiency items are not among the compulsory spatial planning codes yet. The following gives a more detailed overview on the main gaps in the current planning system.

Table 4. Gap Analysis for Integration of Energy Efficiency in the Local Spatial Planning Process

Dimensions	Expectations	Gaps
Planning Measures	Identification, Definition & Importance of Energy Efficiency Criteria in the Spatial Planning	- Lack of clear definition and the impact of planning criteria/measure on environment and energy savings - Lack of an EE[4] checklist/guideline for local actors
	Integration of the EE Criteria and Measures in the Local Planning System. Contribution Scale and Phase (Where the Planning Measures should be Integrated?)	- Lack of EE measures and criteria in the current planning practices - Lack of clarity where each criteria should be integrated in the local planning system (which phase of planning?) - Complexities concerning the scale of contribution (i.e. building, urban district)
Organizational Dimension (Actors and Stakeholders)	Enhanced Sensitivity and Awareness of the Actors Concerning the Importance of EE	- Lack of know-how among local actors about the potential energy gains in the physical development of cities - Lack of know-how about energy efficiency planning measures (no training and capacity building programme)
	Extent and Type of Contribution and Participation of Involved Local Actors i.e. Planner, Developer, Administration	- Lack of common political will to put energy efficiency on top of the agenda - Lack of multilevel (horizontal and vertical) communication and cooperation among involved authorities (i.e. municipalities, ministerial organizations and NGOs involved in energy efficiency topics). - Rigid top down modalities with limited participatory approaches - Overlapping responsibilities with inefficient workflows

Regulation Dimension (Planning Instruments and Enforcement)	Existence of Special Department/Organization for Steering the Process, Promote, Control and Monitor the Process in the Local Urban Planning Practices	- Lack of competent department/organization responsible for promoting, monitoring and authorizing energy efficiency considerations in the spatial development of cities - Lack of an integrated workflow, dedicated tasks and responsibilities for actors (especially at the local level)
	Dedicated Obligatory & Promotional Instruments and Measures	- Lack of energy efficiency guideline, regulation or checklist available for spatial development in cities (with an exception of Code 19 on buildings) - Lack of energy efficiency incentives and promotional measures (i.e. energy efficiency certificates, tax deductions) for planners and developers - Lack of financial instrument/support dedicated on this topic - Lack of an enforcement/monitoring mechanism in place
	Enhanced & Integrated Willingness Among Actors on all Levels (National, Regional and Local)	- Lack of a clear link between policy/strategy measures and the local regulatory measures and actions in the field (divergence of priorities & policies within and among different decision making levels)

(Khodabakhsh, 2017)

CONCLUSION

Energy strategies are needed at a city level and consequently, adequate planning tools are required to support urban energy planners as well as other stakeholders in assessing their decisions (Ouhajjou et al., 2016). Here, in a developing urban context (such as the Iranian one), where bottom up initiatives are rather seldom, external incentives are essential. In other words, there should be some guidelines in places, demonstrating the procedures for integration of EE measues in the local planning practices. Recalling the GAP analysis, one of the main barrier is the lack of correlation and interconnection among plans and contents in different scales. In other words, there is no horizontal interconnection among actors and planning instruments in place. The vertical interconnections among planning measures in different scale are not fully considered in practices, and in most cases the general policies and strategy measure do not end up with influential operational measures in local plans. One key missing factor is an integrated approach which brings together the energy-efficient measures, actors, instruments in each scale. Here, the following table is an example of an integrated approach towards energy efficiency measures in urban development practices in Iran. The result of the abovementioned GAP analysis is followed-up by devising strategies in the following categories (Table 5):

Table 5. Strategies to Facilitate the Integration and Implementation of Energy Efficient Planning Measures

Categories	Strategies	
Improving Technical Knowledge and Integration of New Planning Measures	Developing Common Planning Measures and their Integration in the Spatial Planning System	- Establishing a classified set of planning measures, frameworks and guidelines with potentials for integration in the statuary spatial planning process. - Developing a comprehensive checklist of energy efficient urban planning measures (in accordance to the respective local socio-cultural and specific historical contexts) and their contribution in the existing planning system.
	Effective Integration of EE Planning Measures During Different Stages of the Planning Process	- Designation of the measures, their contribution scale and respective planning instrument (i.e. relevant measures at the level of comprehenisive planning, detailed planning, urban design and architectural design)
	Boosting further Development of Current Energy Related Initiatives	- Empowering the urban energy and environemntal commissions/departments together with mainstreaming its activities and success throughout other district municipalities - Promotion of the current pilot practices/ projects

Improving Organizational Readiness and Effective Interaction of Actors and Stakeholders	Enhancing the Importance of Energy Considerations in Planning	- Enhancing the political will on different levels by streamlining the benefits of energy efficiency measures to higher level authorities, based on tangible results of local experiences - Identification of the influential actors on different levels, clear tasks and responsibilities and interaction/communication structure among them - Establishing multilevel mechanisms among different actors in all levels of planning process
	Creating a Participatory Environment for all Involved Actors	- Identifying different target groups and their needs - Choosing appropriate communication message and communication channels: ”awareness raising matters!”
	Enhancing Capacities for the Local Authorities and Experts for Integration of New Planning Criteria and Measures	- Initiatives to improve the awareness and know-how among experts and local authorities (i.e. training and local workshops) in regard to new planning qualities such as environmental considerations and energy efficiency.
Enhancing the Regulator	Integrating the New EE Planning Measures and Criteria in Statutory Development Plans	- Developing obligatory measures for integrating energy efficiency measures during different development phases in accordance to the existing regulatory environment - Introducing promotional measures and incentives (i.e. energy efficient building certificates, tax deductions etc.) - Designation of the monitoring mechanisms and enforcement measures such as energy efficiency planning codes and standards.
	Improving the Current Planning Procedures	- Determination of the roles and responsibilities of the actors, together with an integrated mechanism for their multilayer and multiscale coordination. - Setting up a clear structure, regulatory and statuary framework with clear responsibilities and transparent decision-making processes. The starting point can be a guideline/checklist to determine the contribution of each energy efficiency measure in the process of spatial planning.
	Setting up Regular Reviews, Feedbacks and Constant Improvements	- Necessity to review objectives, structures and processes regularly. In long term projects, fluctuating external circumstances, technical and organizational innovations, and changes in the attitude of individual partners are to be expected. Therefore, regular assurance mechanisms are required.

(Khodabakhsh, 2017)

ENDNOTE

1. In some recent practices in larger urban areas, the typical Iranian comprehensive planning model is replaced by a strategic planning procedure.

2. The last aspect, use fossil fuels as clean as possible is not identified as a priority area of this research.

3. In the course of interviews, several meetings were organized and interviews (30 Interviews) carried out with local government officials, experts from consulting agencies, municipality organizations and governmental bodies. These include a wide range of actors from local authorities (several departments in District 22 municipality i.e. department of ICT, urban design and environment commission, deputy department of the mayor, urban planning and development department and geo-spatial information department, Tehran Municipality Research and Planning Canter (TMRPC), Tehran Municipality Information and Communication Technology Organization (TMICTO), Tehran City Technology Company (on behalf of Tehran Municipality), Tehran Municipality Urban Planing and Architecture Department), local consulting companies (i.e. Armanshahr Consulting Engineers responsible for preparation of several urban development plans of District 22, Omran-Zaveh Consulting Engineers, Academia (i.e. Shahid Beheshti University- Department of Urban and Regional Planning, Iran University of Science and Technology – Department of urban and Regional Planning) as well as local experts active in different urban development planning in the Iranian context. The interviews were designed and carried out to acquire a common qualitative understanding on the energy efficiency issue in the local planning practice (no statistical outputs). Names can not be published due to personal information protection.

4. Energy Efficiency

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