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SUBSIDIZE-REFORM PLAN AND ENERGY EFFICIENCY IN BUILDING ENERGY CONSUMPTION IN CASE OF IRAN

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ABSTRACT

Each year, IRAN spends high cost on energy subsidy and total index of energy consumption does not show a good rating in compared to other countries. In this regard, preservation of energy resources and environment has faced to serious restrictions and most countries make provision the national regulations in energy consumption.Nowadays, the importance of saving-energy in buildings exposed more than ever. In recent decades, everybody (professionals, managers, communities and many experts) pose as a key issue in the future sustainable development in construction industry.

Keywords: Subsidize-reform, energy consumption, construction industry, energy efficiency

INTRODUCTION

Energy is one of the most important factors of development and production in most countries. Supply of energy Security is strategic subject that all governments are facing to it. With regard to domestic energy prices, government subsidy payments, Limited fossil resources, the types of energy consumed annually in Iran, economic and technical efficiency of energy consumption, Exports of oil products for saving and environment-related problems caused by irrational and inefficient fuel consumption, and it is necessary to become optimize the energy consumption in the country.

The growing trend in building energy consumption will continue during the coming years due to the expansion of built area and associated energy needs, as long as resource and environmental exhaustion or economic recession allows it. Private initiative together with government intervention through the promotion of energy efficiency, new technologies for energy production, limiting energy consumption and raising social awareness on the rational use of energy will be essential to make possible a sustainable energy future (Lombard et al., 2008). In this regard, the proliferation of energy consumption and CO2 emissions in the built environment has made energy efficiency and savings strategies a priority objective for energy policies in most countries (Directive 2002/91/CE of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, 2002).

A 1995 study of the macro-economic impact of phasing out producer subsidies in oil exporting developing countries by Birol et al. used an econometric partial equilibrium model to estimate price and non-price induced energy savings. The domestic oil savings were estimated at 13% in Algeria, 20% in Iran and 19% in Nigeria for the year 2005. The study assumed that oil saved would be sold on the world market, resulting in substantially increased export revenues. Including the increased domestic revenues, the total increase in revenues was estimated to be $9.5 billion in Algeria, $4.5 billion in Iran and $14.9 billion in Nigeria (UNEP, 2003).

ENERGY CONSUMPTION AND BUILDING CONSTRUCTION

Energy Consumption in Buildings

Energy consumption analysis of buildings is a difficult task because it requires considering detailed interactions among the building, HVAC system, and surroundings (weather) as well as obtaining mathematical/physical models that are effective in characterizing each of those items (Fumo et al., 2010). Especially important has been the intensification of energy consumption in HVAC systems, which has now become almost essential in parallel to the spread in the demand for thermal comfort,

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considered a luxury not long ago. It is the largest energy end use both in the residential and non-residential sector, comprising heating, ventilation and air conditioning (Lombard et al., 2008). Its predominance is obvious when it is compared with other end uses. For dwellings it represents about half the energy consumption more than doubling that for domestic hot water (DHW) (Ministry of Economy, 2003).

In the residential sector, size and location are key factors for energy consumption. Small flats need less energy as there is less conditioned and transfer area, and also less occupation. The amount and type of energy used in dwellings are mainly related to weather, architectural design, energy systems and economic level of the occupants. By and large, dwellings in developed countries use more energy than those in emerging economies and it is expected to continue growing due to the installation of new appliances (air conditioners, computers, etc.) (Lombard et al., 2008).

Residential Primary Energy End-Use Splits

Most of the energy used in a home goes towards conditioning the space, which is often more affected by the size of the house than the number of occupants. Despite increased energy efficiency of this equipment, Heating, cooling, and lighting are still the largest single energy end-uses in a home (U.S. Department of Energy, 2008) (Figure 1).

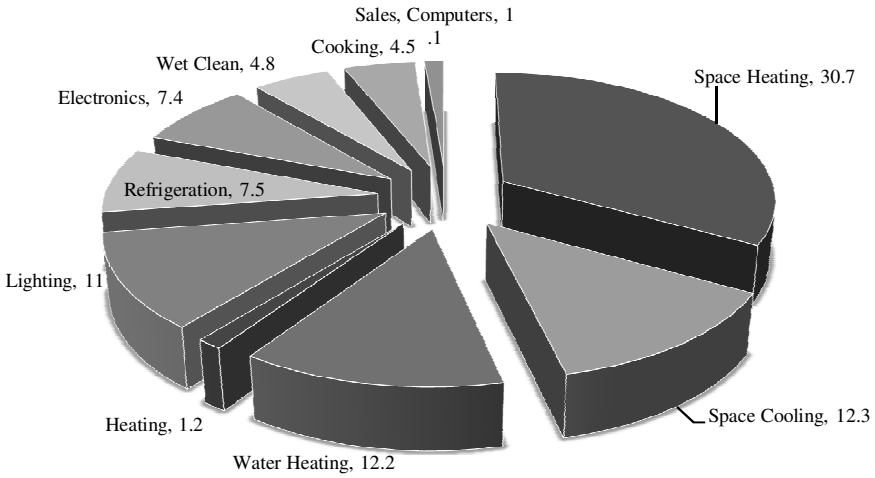

Figure 1. Energy consumption by end uses in the residential sector.

Reference year 2008. Source: U.S. Department of Energy

Energy Consumption in Iran

Final energy consumption is usually shown split into three main sectors: industry, transport and 'other', including in the last-named, agriculture, service sector and residential. This makes it considerably difficult to gather information about building energy consumption. For example, energy consumption in buildings other than dwellings constitutes a fraction of the services shared within the 'other' key sector. Considering its overall significance in developed countries (buildings account for a 20–40% of the total final energy consumption), we believe it should be accounted for independently and become the third main sector, broken down, at least, for domestic and nondomestic buildings (Lombard et al., 2008). In Iran total primary energy consumption in 2008 was roughly 1493.1 million barrels of oil equivalent or 20.57 boe per capita. Primary energy use has increased on average by 7.02% annually since 2001(Figure 2). Total final energy consumption in 2008 was about 995.7 million boe, or 13.72 boe per capita, having increased at an average annual rate of 4.94% over the previous ten years (Figure 3). Over the last decade, the share of oil in final energy demand has fallen from 57% to 48% while the natural gas has increased from 33% to 43%. The residential/commercial sector remains the largest consuming sector, accounting for more than a third of total final consumption. Transport's

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share of final demand has risen more than a quarter. Energy intensity is measured by primary energy use per unit of GDP and has increased progressively over the last few decades, mainly due to low energy prices and rapid and urbanization (Table 1).

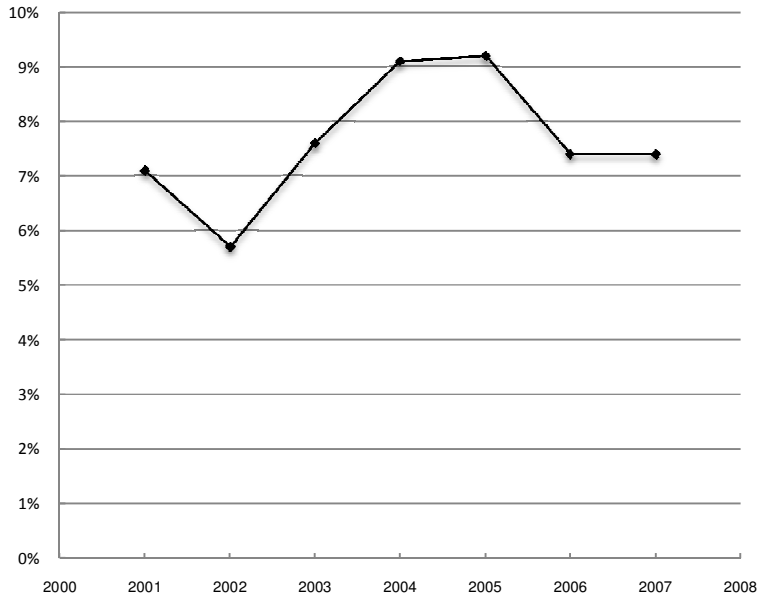

Figure 2. Primary energy use

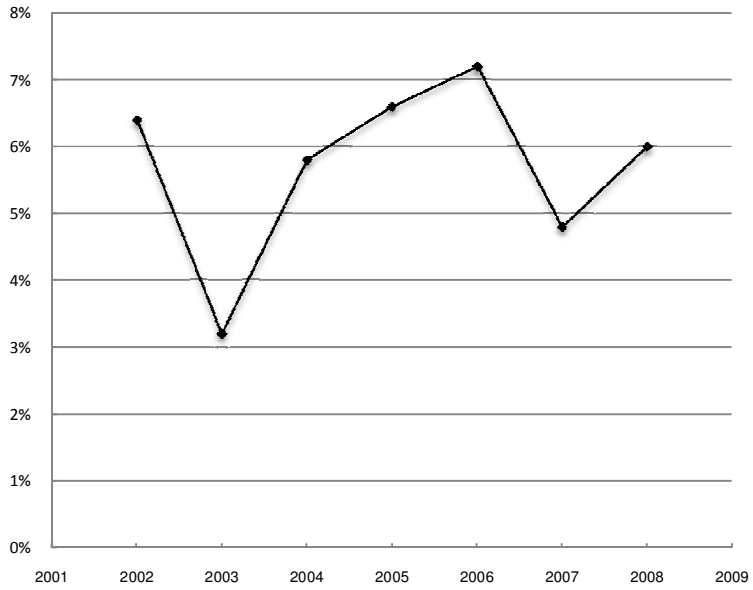

Figure 3. Total final energy consumption

Both residential and commercial building accounts for 41.92 percent of all energy use in the Iran. This sector consumes more energy than either transportation or agriculture, surpassing industrial as the number one consuming sector in 2008. Both residential and commercial building energy use are growing, and represent an ever-increasing share of Iran energy consumption (Figure 4).

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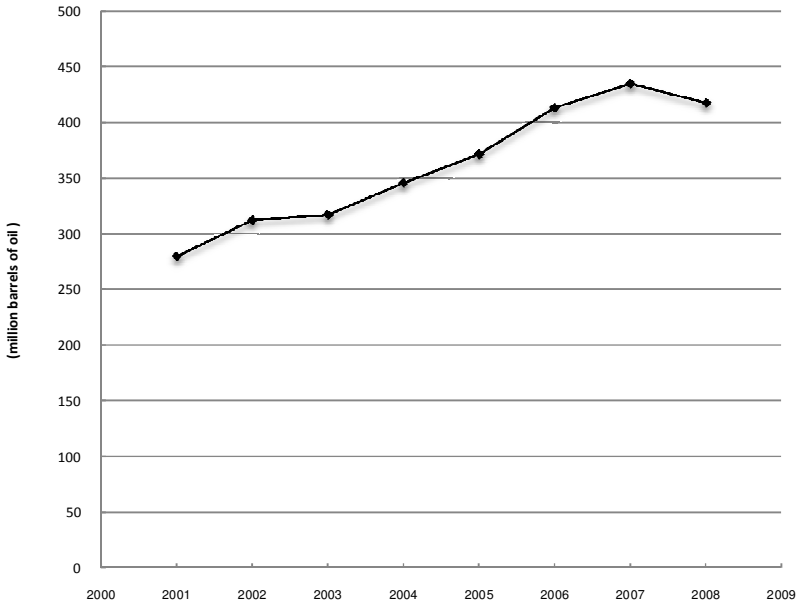

Figure 4.Growing of energy consumption in IRAN

Table 1.Final Energy Consumption in Iran

		2001		2002		2003		2004		2005		2006		2007		2008		
		Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Annual growth rate
sector	Industry	135.3	21.2%	141.3	20.4%	155.3	21.4%	167.0	21.4%	183.1	21.7%	196.5	21.4%	238.3	24.4%	254.8	25.6%	9.6%
	Residential &	279.6	43.7%	312.1	45.1%	316.9	43.7%	345.5	44.4%	371.3	44.1%	413.2	45.1%	434.7	44.5%	417.4	41.9%	6.0%
	Transportation	194.4	30.4%	209.0	30.2%	220.8	30.5%	234.0	30.1%	254.3	30.2%	270.4	29.5%	265.2	27.2%	281.6	28.3%	5.5%
	Agriculture	30.4	4.8%	29.3	4.2%	31.6	4.4%	32.2	4.1%	33.4	4.0%	36.8	4.0%	37.6	3.9%	41.9	4.2%	4.8%
	total	639.7		691.6		724.6		778.7		842.1		916.9		975.8		995.7		6.5%

Improvements in technologies and practices over the past three decades in building fixtures, windows, insulation, building controls, and appliances, as well as whole-building design and construction have made it possible to deliver many building services with lower energy intensity. Natural gas consumption in the eight-year period studied from 2001 to 2008, in the domestic and commercial sector has doubled. The fuel consumption overall trend, residential / commercial shows that fuel consumption growth in this sector in 2002 of 6.4 percent than 2001 to about 6.0 percent in 2008 compared to the previous year is decreased. The starting point for reducing energy consumption in this sector is managed.

While households have grown, so has the amount of commercial floor space. Overall economic activity, as measured by GDP, is a key determinant of commercial sector growth, and, in turn, commercial floor space growth. From 1980 to 2005, GDP doubled in real terms from $5.8 trillion to $12.4 trillion as measured in constant year 2005 dollars. Consequently, though not perfectly correlated, the absolute amount of commercial floor-space (as measured in square feet) grew by roughly 50 percent over this same period (Iranian Ministry of Energy, 2008).

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Table 2. Energy indexes in Iran

TPES/GDP(PPP) (toe/thousand 2000 US$)	*TPES/GDP (toe/thousand 2000 US$)*	*TPES/ Population (toe/capital)*	*Population (million)*	*TPES(Mtoe)*	*GDP(PPP) (billion 2000 US$)*	*GDP(billion 2000 US$)*
0.31	1.15	2.18	67.01	145.84	463.4	126.32

RESEARCH QUESTIONS AND INFERENCE MECHANISM

According to the article introduction, this study has the following basic questions:

Energy consumption in different parts of the building before and after the subsidy is how?

Does reform of energy subsidies on improving the construction industry has been effective?

To answer these questions, two-way documents and field studies and the combined strategies is used.

Due to Table 3 shows the general information of two groups (Group A and Group B). The buildings in group A were all built in the year of 2005 while those in group B are all new buildings built in the year of 2011. 50 households in group A and 50 households in group B were selected to trace their monthly energy consumption data of electricity and city gas. In addition, one residence in each household was selected from all the investigated households to do questionnaires in summer and winter. The contents of the questionnaire surveys covered the architecture characteristics, household information, the usage of space heating and cooling equipment, and energy-saving actions, etc.

Table 3.General information of two groups (Group A and Group B)

	Investigated Buildings	*Construction year*	*Total floors of the building*	*Energy sources*	*Number of family members*
Group A	50	2005	5 floors	Electricity, city gas	3-4 persons
Group B	50	2011	5 floors	Electricity, city gas	3-4 persons
	Materials of window frames	Energy-saving actions		Floor area	Construction structure
Group A	Iron	Use illumination as little as possible, Use energy-efficiency Appliances, Use space heaters and air-conditioning appliances as little as possible		~60m2	Brick-concrete
Group B	PVC	Use illumination as little as possible, Use energy-efficiency Appliances, Use space heaters and air-conditioning appliances as little as possible		~60m2	earthenware-concrete

Space Heating and Cooling Appliances

Electrical fan is only the space coolers in two groups and central space heating and chimney are the two main space heating appliances, where all the buildings in both groups have electrical fans and 75% of the buildings in Group A and 84.3% in Group B have central space heating. Figure 5 shows the monthly usage of central space heating, chimney and electrical fans respectively. More than 81% of the households in both groups use central space heating and chimney from December to February. The peak time of space heating in both groups is from January to February. 88% of the households in both groups use Electrical fan from July to August (Figure 6). As for the space heating area in all the heated buildings with chimney, 34% of the households in Group A have space heating only in living rooms, while in groups with central space heating 92% have space heating in all the rooms and living rooms.

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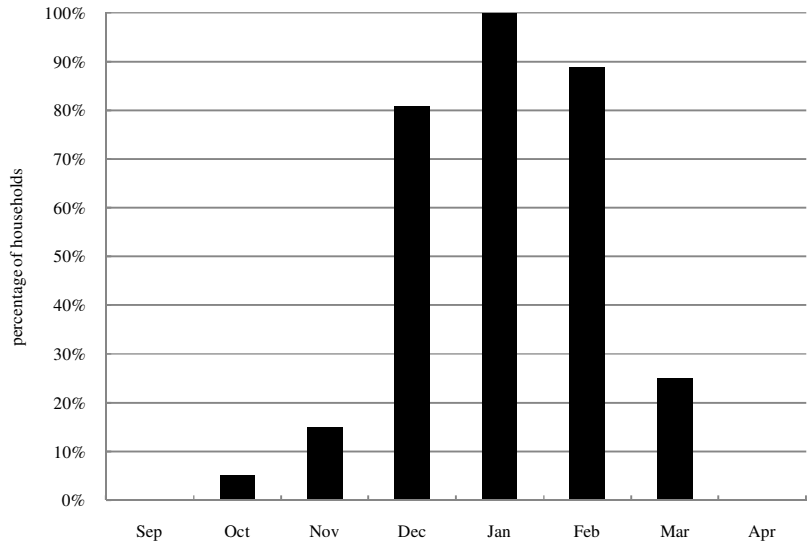

Figure 5. Monthly usage of space heating equipment

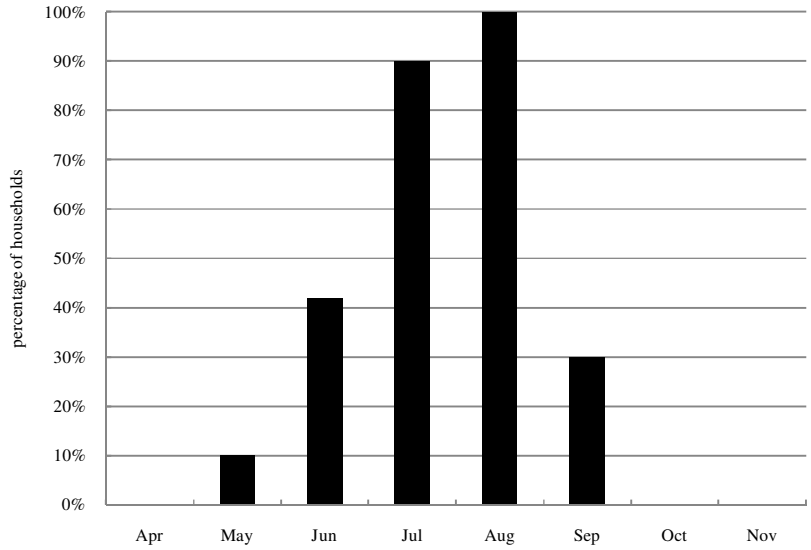

Figure 6. Monthly usage of space cooling equipment

All of the end use energy consumption can be divided into non-weather related energy use, namely lighting, electrical equipment, and weather related energy use. In such an instance, typical examples are space heating and cooling use. Other than space heating and cooling use, the monthly use of all other appliances is suppose to be stable. The space heating and cooling periods of each family are also recorded in investigations. Therefore, the monthly space heating and cooling amount can determined by subtracting the average monthly use in non-space heating and cooling periods from the monthly total use in space heating and cooling periods. Then the annual energy consumption amount of space heating and cooling can be gotten by adding the monthly space heating and cooling amounts in space heating and cooling periods (Francis and Wan, 2004; Joseph and Li Danny, 2003).

TEST AND DATA ANALYSIS

The complexity of economic decisions, the development and application of sophisticated and efficient analysis techniques in order to support decision making became necessary. Building design and construction are directly connected with decision making at the economic level, since buildings

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constitute investments of capital intensity. However, as in any modern problem, decisions should be examined taking into consideration all the parameters and the consequences of various alternative choices. Thus, in the case of building design, it is essential, beyond the initial cost of investment, that other factors should also be included, such as operation and maintenance cost, energy consumption, indoor air quality, thermal comfort, environmental impacts, etc. These goals have been refuted and each alternative solution differs from the other in many features. Hence, there is no unique criterion that adequately describes the consequences of every alternative solution and there is no solution that simultaneously optimizes all the criteria (Sean and Honkey, 1999).

Monthly Energy Consumption Of Electricity

Figure 7 shows the monthly electricity energy consumption of two groups. In group A, the monthly average electricity amount ranges from 123 to 267 KWH /household, while that in Group B is from 108 to 248 KWH /household. Figure 8 shows monthly electricity energy consumption of space cooling in each groups based on the above method. The household electricity energy consumption in Group A is larger than those in Group B and energy consumption of space cooling in Group A is 9% larger than that in Group B.

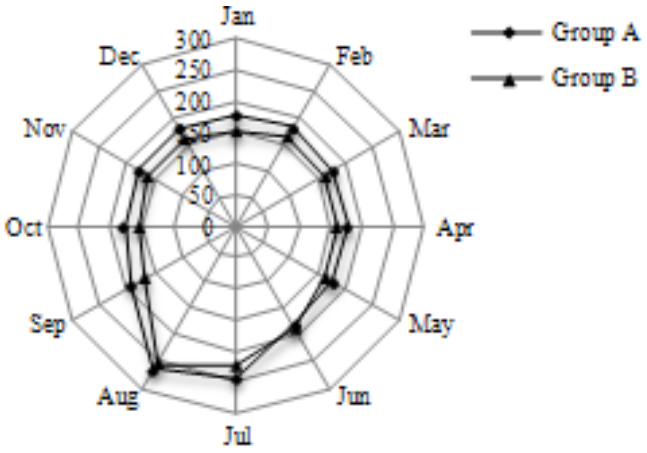

Figure 7. Evolution of monthly electricity energy consumption (kWh/household)over a eleven month period of 50 household in two groups (group A and group B)

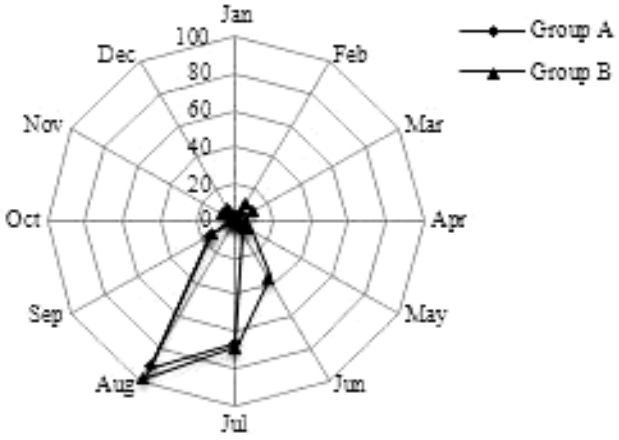

Figure 8. Monthly space cooling amounts in each group

Monthly Energy Consumption of Gas

The energy consumption of 50 households in Group A and 50 households in Group B are analysed . Figure 9 shows that the monthly average of gas consumption in Group A ranges from 176 to 391

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M^3/household, while that in Group B is from 131 to 348 M^3 /household. The value of household gas consumption is largest in winter and smallest in summer, and it reaches its culmination in January and its minimum in August. The standard deviations of energy consumption in summer and winter are larger than those in spring and autumn, which suggests that the difference of energy consumption quantities of all the households is larger in summer and winter than that in spring and autumn.

The monthly energy consumption of central space heating and chimney is analyzed in the above way. Figure 10 shows the subtracting of end users. It is seen that space heating plays the largest part in total consumption, with the percentage of 40%. Space heating and cooling accounts for 26% of total energy consumption. The reason why energy-saving of space heating is larger than that of space cooling is because the energy loss of chimney is larger than central space heating.

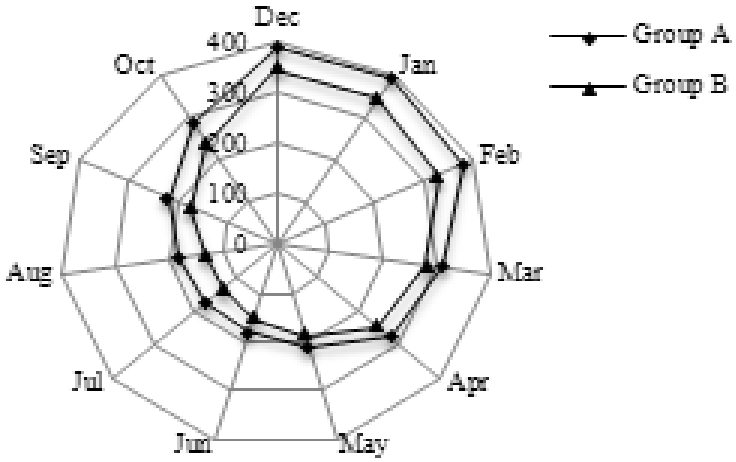

Figure 9. Evolution of Monthly energy consumption (M^3 /household) over a eleven month period of 50 households in two groups(group A and group B)

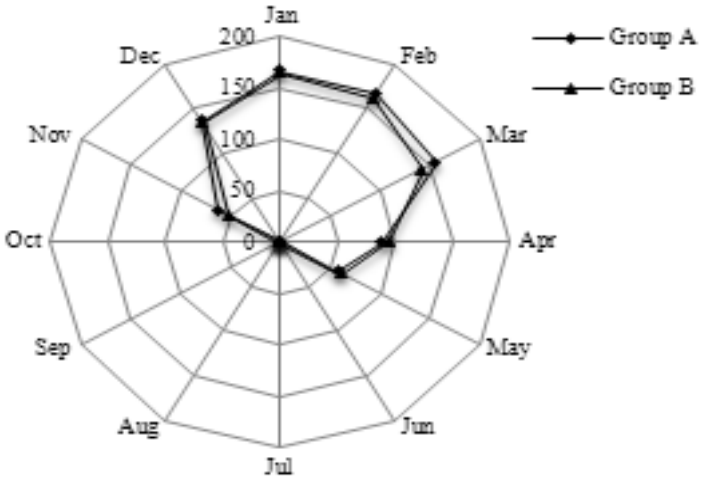

Figure 10. Monthly space heating amounts in each group

CONCLUSION

The trend of energy-saving provisions has continued for decades in the world. The prescribed and general systems are started and gradually moved to the building performance system control. In

practice can be justified as a stronger economy but more and higher level of technical expertise and facilities needs.

The complexity of the design with the new methods is the rules in most countries that relating to residence, the tendency to apply the simple rules which are prescribed. Iran rules for saving energy with this approach are recommended for residence. Due to the use of sustainable energy and in residential areas, according to the renewable global experience in this field should consider this issue be specific and in coming years. In a upper level, Planning of the required energy product scale in regional or local should be on the agenda and the use of indigenous materials for optimizing the outer shell thermal performance of the building is seriously and isn't paid attention to it.

Monthly city gas and electricity consumption can be controlled with subsidies for home insulation in Iran, such as the double doors and windows and use of solar heating.

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