Review of the existing energy policies and challenges of energy consumption to achieve a sustainable behavioural change among Iranian households

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Abstract: *The growing number of household subscribers have resulted in high energy demands leading to wrong energy consumption patterns in Iran. As a result, power supply has failed to fully meet energy demands in housing sector, causing unplanned recurring blackouts. Although government has endeavoured to propose supply-side initiatives for energy conservation, achieving energy efficiency required further investigations in terms of demand-side to include households' energy consumption behaviour. Various interventions and energy use models were proposed to analyse demand-side approaches to change households' energy related behaviour, however, the incidental nature of behaviour has caused unsustainable change over a longer period of time. This issue necessitates more value-based strategies aiming to reduce peak load time's electricity consumption to achieve a more sustainable behaviour change. This entails new perspective in intervention strategies rather than punishments or monetary or environment-related motivations. The notion of changing lifestyles may impact wrong energy consumption patterns, which can be related to daily habitual life routines. Therefore, consumption may not solely address households' basic needs, but includes perceived values. This research will emphasise the need to develop strategies based on households' values and beliefs in terms of their well-being to be nudged towards more energy saving activities. It aims to focus on the important role of households' values on choosing their daily life activities to be used as an effective reward for a more energy efficient consumption pattern. This research suggests well-being related activities to sustain the change in households' energy consumption habits as well as achieving energy efficiency as a reward.*

Keywords: *Consumption Pattern, Energy Efficiency, Health and Well-being, Lifestyle, Self-care Activities.*

1 Introduction

The intensive growth of urbanisation worldwide, especially in developing countries has significantly affected environment in a local and global scales (Riazi and Hosseyni 189). The increase of energy demand is one of the drivers of such effects, which has been exacerbated by the lack of energy efficiency in existing buildings. This has led to an increase in all sectors of energy consumption in Iran, particularly housing as a major factor of energy use increment (Kazemi and Hosseinzadeh 231; Raeiszadeh and Monjazeb 92). As a result, the energy intensity in Iran has become one of the highest in the world, representing a high level of inefficiency in energy consumption (Moshiri et al. 122). Many researchers have attributed the ever increasing energy demand to the allocation of energy subsidies in oil-rich countries including Iran (Solaymani "Energy Subsidy Reform Evaluation Research – Reviews in Iran" 520; Groot and Oostveen 1926; Araghi and Barkhordari 399). This policy, which was deemed to be a solution for accessibility of electricity and other energy sources for low-income households, brought about serious problems. It has not only imposed significant burden on government budgets (Moshiri "Consumer Responses to Gasoline Price and Non-Price Policies" 10), but has caused overconsumption, energy inefficiency and eventually, climate change (Li, Shi and Su 51; Groot and Oostveen 1927; Araghi and Barkhordari 400; Moshiri "Consumer Responses to Gasoline Price and Non-Price Policies" 111078). Along with the inevitable increase of demand, the use of fossil fuel as a major energy resource in Iran has also resulted in additional pressure on the environment and public health due to greenhouse gas (GHG) emissions (Wang et al. 284; Vafa-Arani et al. 24; Torbatian et al. 434).

The issues of energy subsidy are not limited to the above-mentioned problems. These heavily subsidized prices have also caused difficulties for country's power supply network in terms of managing and planning for the electricity supply and demand (Bazzazan, Ghashami and Mousavi 16). In a study conducted by (Veloza and Santamaria 45), the review of the main causes of major blackouts showed that high load level was the main cause of the most occurred blackouts in Iran. In this regard, (Dehghan, Amin-Naseri and Nahavandi 12) demonstrated that with the current trend of energy consumption in Iran, power supply will fail to fully meet energy demands. Due to this failure, Iran is recently experiencing recurring blackouts in healthcare, domestic and industrial buildings, which is mainly attributed to peak loads during specific times of hot summers and cold winters (ISNA).

In accordance with the national plan of Iran, the government and researchers started to suggest different solutions for the existing energy-related problems. To reduce energy consumption, the government enacted the "Targeted Subsidies Law" for price rationalisation in the year 2010 which was an increase up to 90% of the border prices in five years (Moshiri "The Effects of the Energy Price Reform on Households Consumption in Iran" 179). However, according to UNRISD, the implementation of the policy has faced several difficulties, since subsidy reform entails long-run political commitment (Lindebjerg, Peng and Yeboah 14). In spite of the positive impacts of the reform in terms of controlling energy consumption, its achievements were short-lived (Demirkol et al. 14194). Accordingly, a study revealed that the removal of subsidies has temporarily affected households' energy use pattern (Ojand and Nazari 147). Therefore, energy efficiency gained researchers' attention to achieve a sustainable change in energy use patterns, instead of a total removal of energy subsidy (Sovacool 156; Barkhordar, Fakouriyan and Sheykhha 542). In this regard, researchers started to accompany government policies by

demand-side incentives or supply-side initiatives for the purpose of energy conservation (Gelan 187; Ghadaksaz and Saboohi 2). In terms of supply-side solutions, the development of renewable energy technologies was mainly focused in research studies (Oryani et al. 971; Soltani et al. 11). Unfortunately, due to the fact that renewable energy technologies do not play an adequate role in the energy supply of Iran (Solaymani "A Review on Energy and Renewable Energy Policies in Iran" 7328), the solution of reduction in demand-side gradually began to be in the spotlight in Iran (Rahmani et al. 4). In this regard, (Soltani et al. 11) demonstrated that reducing energy consumption requires crucial countermeasures to be implemented by not only government, but people. Therefore, households' demographic information, behaviour, lifestyles and energy consumption pattern became the main focus in studies regarding demand-side solutions (Soltani et al. 12; Ojand and Nazari 131).
Although studies exist regarding achieving energy efficiency through households' behaviour change and energy use models (Jackson 30; Sepehr et al. 481; Chatzigeorgiou and Andreou; Crowley et al. 2209), the existing interventions and models seem to have issues in terms of sustainable behavioural change to achieve energy conservation. This may be due to the fact that most of the existing solutions focus on environmental and monetary aspects. This has resulted in ineffective behavioural change solutions for Iranian households. This research aims to demonstrate the necessity of paying more attention to reduction of energy consumption in housing sector by highlighting the importance of behaviour change towards a more energy efficient lifestyle to resolve unplanned recurring blackouts in Iran. For this purpose, this study will focus on values of households to achieve sustainable behavioural change rather than solely focusing on environmental or monetary aspects. To achieve this goal, first, different interventions and policies will be studied to analyse demand-side approaches to achieve a behaviour change regarding energy consumption. Second, wellbeing is proposed as a motivation to change wrong energy consumption pattern in Iranian households' lifestyle to achieve a more sustainable behaviour change. In other words, the study will introduce a new area of study in energy efficiency researches by highlighting the importance of wellbeing-centred activities of households and energy consumption. This study also endeavours to introduce a possibility of well-being related awards to sustain the change in households' energy consumption habits.

2 Energy related challenges in Iran

The concept of sustainability has significantly increased concerns in terms of energy related issues in Iran (Mohammadi et al. 261) as the world's eighth largest emitter of GHG in 2015 (CarbonBrief). According to a report by Energy Information Administration, energy use in building sector is predicted to have a rise by 42% by the year 2040 worldwide (EIA 104). Among different Iranian building sectors, housing sector accounts for one of the largest sectoral energy consumer after the industry sector (Abbasizade et al. 4218). Therefore, housing sector contributors to sustainability challenges of GHG emissions in Iran (Kazemi and Hosseinzadeh 231). Most of the energy use in buildings is supplied by natural gas and electricity, which is equivalent for 23.3% of total CO_2 emissions in the year 2017 (Energy-Ministry 82). In recent years, nearly 30% of CO_2 emissions in this country are attributed to households' energy consumption (Delavar and Sahebi 1).
As a result of the arising issues related to energy consumption, energy efficiency in buildings has recently gained increasing attention among Iranian researchers due to inefficient performance, especially in housing sector (Sepehr et al. 481; Belussi et al. 1). A variety of factors (number of households, floor area and etc.) can affect energy consumption and thus

energy supply and demand on a global or local scale (Shittu 11). However, the most influential factor in daily energy related activities is indicated to be lifestyle which dictates the residential energy consumption pattern (Fong et al. 395). In addition to this, oil-rich countries are facing another major issue of energy subsidy which has significantly contributed to a further increase in energy demand of households (Tofigh and Abedian 1304; Mohammadnejad et al. 4654). The goal of energy subsidy is to make electricity and other energy resources accessible by reducing energy prices for low-income households (OECD 46). However, this has not only led to a significant burden on government budgets in Iran, but has caused over consumption, energy inefficiency and environmental degradation (Moshiri "Consumer Responses to Gasoline Price and Non-Price Policies" 1; Li, Shi and Su 51; Sovacool 154; Araghi and Barkhordari 399). Energy subsidies have also discouraged investments on renewable energy technologies to benefit from cleaner energy resources (O. IEA 26; Charles, Moerenhout and Bridle iv; Stiglitz et al. 12). Therefore, although subsidies have been considered as a poverty relief solution for low-income households, higher income group may benefit even more than other income groups (Groot and Oostveen 1927). This is due to the fact that higher income households account for a larger share of energy consumption when compared to lower income groups (Solaymani "Impacts of Energy Subsidy Reform on Poverty and Income Inequality in Malaysia" 2708). A study by (Del Granado, Coady and Gillingham 2234) demonstrated that nearly 65% of subsidy benefits belong to higher income groups. To resolve such problems, different policies, namely increasing gasoline prices, energy price reform through removal of subsidy have been adopted (Moshiri "Consumer Responses to Gasoline Price and Non-Price Policies" 1). Although the reform policy was considered to be a real step toward sustainable development (Craig and Feng 786), it has faced challenges and setbacks in Iran, which resulted in unclear outcomes. (Solaymani "Energy Subsidy Reform Evaluation Research – Reviews in Iran" 520) showed an evidence that the removal of energy subsidies in Iran was solely effective in reducing energy consumption in the first 2 years of policy implementation. Moreover, it is worth mentioning that Iranian household welfare, especially low-income groups will decrease if a 400% or 500% rise in energy prices occurs (Araghi and Barkhordari 398). As a result, researchers concluded that this reform should be accompanied by both demand-side and supply-side measures to better encourage energy conservation (Gelan 186).

In previous years, the increasing gap between energy supply and demand had led to peak loads which in turn had caused issues in terms of unplanned blackouts in Iran (Veloza and Santamaria 45). However, in recent years this gap has been widened in such a way that resulted in recurring blackouts, raising concerns regarding future energy supply security in Iran. According to a study by (Dehghan, Amin-Naseri and Nahavandi 12), with the current pricing policy in Iran, supply will fail to meet the electricity demand and country budget will not be sufficient to increase the supply in order to meet demand, leading to more serious blackouts in 2025, 2028 and 2024 in base, low and high demand scenarios, respectively. Iran is recently experiencing recurring power outages, impacting all building sectors of housing, commercial and health care centres. This is mainly attributed to peak loads during specific times of days when the energy consumption of households reaches to the highest amount. Power outages seem to be inevitable due to existing gap between demand and supply. Many researches have been conducted in terms of power outages to estimate the value of constant electricity supply for households by their willingness to pay (Cohen et al. 139; Ozbafli and Jenkins 443; Amador, González and Ramos-Real 953; Praktiknjo, Hähnel and Erdmann 7828). A study conducted by (Morrissey, Plater and Dean 141) revealed that

households were willing to pay to avoid lengthy blackouts for the ones which were mostly occurred during peak times. This can demonstrate the important role of blackouts on objective and subjective costs in households' life (Fig.1). Other attributes which affected households' willingness to pay are duration of the blackout, peak or off-peak times, day of the week, planned or unplanned and winter or summer season.

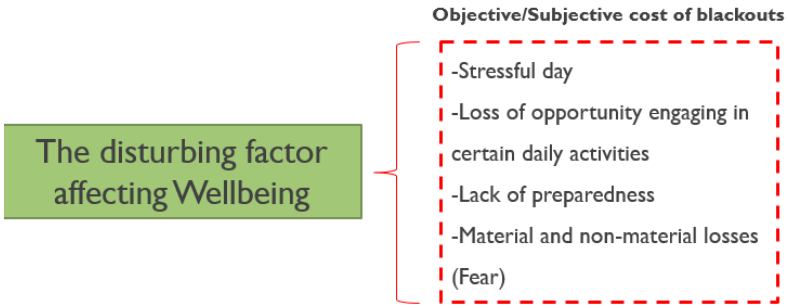

Figure 1: Costs of blackout for Iranian households

According to reports by Iran's Energy ministry, blackouts are mostly attributed to the increase in power peaks, which in turn increases the gap between energy demand and supply. One of the most disturbing blackouts is unplanned one, which can not only be stressful, but it can bring life into a grinding halt, leading to a loss of opportunity to engage in certain daily activities. This loss of opportunity can have significant impact on the quality of life, causing damages from lack of preparedness. According to (Praktiknjo, Hähnel and Erdmann 7825), the damages differs based on households' personal needs, their existing assets and individual preferences. Therefore, constant electricity supply is considered as a fundamental requirement for well-functioning modern societies. In addition to the negative impacts of sudden blackouts on home appliances, spoiled food, it can cause non-material losses, such as inconvenience or fear, which in turn could affect households' health and wellbeing (Morrissey, Plater and Dean 142). The non-material cost of blackouts can be more devastating in future if energy consumption pattern of Iranian households continues with the current trend. Such costs are indicated to be quality of life, economical costs, environment, health and lifestyle. It has been indicated that (Praktiknjo, Hähnel and Erdmann 7826) electricity corresponds to many basic needs of human beings as indicated in Maslow's Hierarchy of Needs (physiological, safety and health, belonging, esteem, self-actualisation). As a result, when supply fails to satisfy households' needs, loss of welfare will be unavoidable. Among non-material blackout costs, home activities or non-working time are classified as power outage costs which indirectly affects quality of life, unless they were substituted with other activities. This means that several domestic activities are only partially possible during blackouts (Praktiknjo, Hähnel and Erdmann 7829). The problem caused by blackouts is not limited to housework. Due to digitalisation, all kinds of home activities will become dependent on electricity in near future, thus discomfort perceptions will increase among Iranian households.

Overall, the issue of unplanned blackouts in Iran necessitates crucial measures to be employed regarding supply and demand-side solutions. In the studies concerning energy supply issues, shifting to more renewable energy technologies was a suggested solution by studies implemented in Iran (Tavana et al. 1194; Oryani et al. 971; Ahmadi, Mirghaed and Roshandel 265). However, barriers such as high initial capital cost, lack of awareness and knowledge as well as sanctions have significantly slowed Iran's transition to a cleaner

energy system (Wilkins 68). Another solution suggested for energy supply problems was to increase power plant capacity to address winter and summer blackouts caused by limited natural gas and electricity supply, respectively (Vedadi Kalantar, SEFODDIN and Hajinezhad 276). However, (Basiri, Sobhani and Sadjadi 1) demonstrated that natural gas availability can be achieved by both a sufficient supply and efficient energy use by occupants. According to several reports in Iran, although production capacity may lessen the existing gap during peak loads, the wrong consumption pattern has always been faster than the growth of power plants' capacity (IRNA). Therefore, government, policymakers and researchers have started to pay more attention to demand-side of energy including households' characteristics, behaviour and habits of consumption as a more feasible solution to achieve energy efficiency in the near future in Iran (Mohammadi et al. 263; Oryani et al. 974; Soltani et al. 1; Sepehr et al. 481). In this regard, both government and researchers have proposed several interventions to achieve energy efficiency in household's energy consumption.

3 Policies and strategies proposed by the government and researchers

In terms of energy policies, government and researchers have proposed several policies and strategies to reduce households' energy consumption. One of the policies focused on peak and off-peak energy costs to lower peak load times in energy consumption. In a study by (Ojand and Nazari 131), suitable electricity prices for the peak load and off-peak times were suggested to contribute to the decrease of energy use during peak load times, while keeping social welfare in a high level. This policy included discounts for off-peak times and overpayments during peak load time consumption. However, it should be noted that social and economic challenges for low-income households, such as household welfare, unemployment and higher inflation have hindered the applicability of this policy (Moshiri "The Effects of the Energy Price Reform on Households Consumption in Iran" 178). Moreover, the rise in the tariffs did not significantly affect the consumption pattern of high income households. In another policy named "Omid electricity", government aimed to institutionalize the culture of optimal electricity consumption in housing sector by using incentives (e.g. discounts) for households with lower electricity consumption. In this plan, subscribers were divided into three categories (low, good and high consumption) in accordance to the acceptable energy consumption pattern in their local area. Those with low consumption would enjoy incentive benefits in proportion to their amount of consumption, including discounts of up to 100% on electricity tariffs. In this project, households with 100% discount could also be eligible for solar panel installation for their homes. Although this policy was successful in 2020, but government faced major problems, since Iranian households already pay 50 % of the energy price, which has caused a shortfall in the annual budgets of the power plants. Also, due to low energy prices in Iran, higher consumption households receive 10 times more subsidies from the Ministry of Energy than lower consumption subscribers (Fig.2). Therefore, there is a recent debate to revise the plan through increase the electricity cost for high-consumption subscribers, who are mostly high income households, and to lower energy cost based on the same amount for lower consumption subscribers. This means higher amount of consumption during peak loads will result in higher electricity price without subsidy.

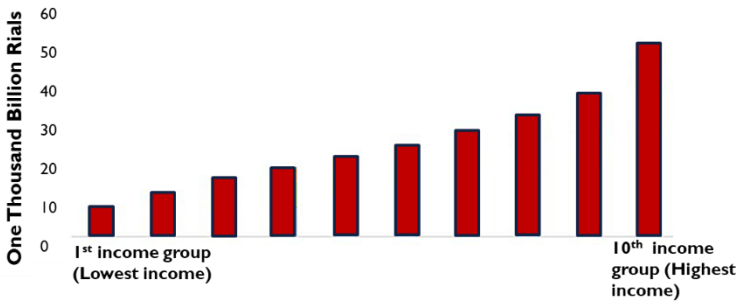

Figure 2: Subsidy distribution for different income groups in 2018.

It can be concluded that neither the elimination of subsidies nor other policies proved to be successful in resolving the gap between energy demand and supply. Therefore, researchers started to consider human aspects as the most effective factor in households' energy demand. Various researchers have studied the effects of human behaviour on household energy consumption (Ucal 775; Park and Kwon 494). In their studies, different solutions were proposed based on households' attitudes on the energy-related issues such as home appliances or electrical energy use. In this regard, researchers proposed energy behaviour models to predict energy consumption of households (Sepehr et al. 481; Larsen and Nesbakken 179; Zhang et al. 110; Kim and Cho 72; Mora, Carpino and De Simone 125; Paatero and Lund 273; Swan and Ugursal 1819; Richardson et al. 1878), however, studies have showed that difficulties in prediction have occurred during specific times of a day. After modelling the energy consumption profile for houses in Iran, (Sepehr et al. 487) noticed that although the predicted model was well matched to the measured consumption profile in most hours of a day, the error has occurred in the time intervals like hours 12–16 and 21–23. They concluded that the residential subscribers' peak usually occurs during these times of the day, leading to difficulties in the model's predictions.

Other studies proposed a set of actions undertaken to bring about changes in behaviours related to energy consumption called intervention. Each proposed intervention was based on different strategies to be effective for households' energy related behaviour (Abrahamse et al. 273). Different approaches of energy saving programmes were mostly categorized into education (Estabrooks et al. 25; Kaufman and Rousseeuw 4; Carrico and Riemer 1; Wensing, Bosch and Grol 85; McMakin, Malone and Lundgren 848); persuasion (Grier and Bryant 319; Philip Kotler and Lee 10; Peattie and Peattie 260; Gonzales, Aronson and Costanzo 1049; Emeakaroha, Ang and Yan 290), law and public policy (Gillingham, Newell and Palmer 597; Hedlund 82; Houston and Richardson Jr 2063), feedback use (Gölz 1453); home retrofits (Elsharkawy, Rutherford and Buildings 295) and technological interventions (Karatas, Stoiko and Menassa 539). Although the aforementioned interventions were successful at the beginning of their adoption, but such policy tools were ineffective in reducing household energy consumption over longer period of time (Drews, Exadaktylos and van den Bergh 1; Dietz et al. 18452). Furthermore, these programs could not address different characteristics of households and their different activities, which played a key role to induce energy-change patterns, since households reacted in different ways to intervention strategies.

Another problem was their high emphasis on environmental issues raised from high energy consumption (e.g. pro-environmental behaviour and energy efficiency) and their less attention to other aspects and values of households. Study of different policies and interventions revealed that most of them based their strategies on restriction, motivation,

persuasion, education to elicit intentions of households to save energy. Most of the suggested programs were either short term or less effective. For example, campaigns often emphasise both the environmental and economic benefits of energy saving behaviour, although studies indicated that this may not be the most persuasive method (van den Broek, Walker and Klöckner 811). Other interventions used motivational approach, to pledge households to save more energy in the future (Bull et al. 1998). However, research on the effectiveness of interventions that involved pledges or goal-setting reported mixed findings (McCalley and Midden 590). Other campaigns have focused on social norms to persuade householders to reduce their energy use (Allcott 1082). However, besides the success of the program, only 2.3–2.4% reductions in energy use were observed. (Schwartz et al. 15244) concluded that behavioural changes of energy use interventions have accounted for 2.7% reductions in energy use in their study, which indicates the ineffectiveness of such interventions in sustaining energy-related behaviour changes. This may be due to the fact that households' may pay more attention to value-based solutions rather than economic solutions. Since, energy consumption can indirectly affect households' wellbeing (Fig.3). This means consumer behaviour can be extremely complex which rarely follows the rational decision-making theories of economics.

Figure 3: Electricity as a possible criterion for measuring the level of wellbeing.

Overall, the significant effects of households' activities, characteristics and their incidental behaviour on prediction errors, necessitates more value-based strategies aiming to reduce peak load time's electricity consumption among households. As a result, with regard to the proposed interventions and policies regarding energy efficiency, it can be concluded that blackouts can be resolved through a more effective solution which includes peak load duration reduction in houses to further take the burden of inadequate energy supply and blackouts in specific times of days.

Investigation of various policy and strategies proposed by government and researchers indicates that the approach of their solutions are based on restrictions with punishments or motivations with environmental awareness or monetary rewards. Nonetheless, literature revealed that problems still exist regarding feasibility and sustainability of such programs. Therefore, a research gap exists in terms of strategies which are mostly based on households' perceived value of reducing energy consumption during peak and off-peak times and their wellbeing which may help to resolve problems regarding applicability and sustainability of the existing programs.
The burden of an electricity outage may vary among different user profiles. For instance, larger households experience higher objective and subjective costs since more people experience this problem. Therefore, understanding the households' demographic information and its relation with energy consumption pattern can be crucial to reveal contributing factors of inefficiency in energy use and blackouts. This can also lead to a

development of a more feasible incentives and motivations for energy conservation attitudes.

4 Household lifestyle and energy consumption (Demographic Information)

As indicated previously, the damages of blackouts differ based on households' needs and preferences. Therefore, understanding households' demographic characteristics and energy consumption pattern can be a crucial step to recognise the reason behind their tendency towards inefficient energy use.

Various researchers highlighted different variables affecting households' daily energy demand. The inefficient use of energy is mostly attributed to increasing growth in population, number of households, floor area, changes in lifestyle and climate change (Aryanpur et al. 60; Papadis and Tsatsaronis 2; Yetano Roche, Paetz and Dienst 12; Tofigh and Abedian 1302; Mohammadnejad et al. 4652; IEA). For instance, (Ojand and Nazari 139) concluded that family income, size of house and number of households were amongst the primary factors of electricity demand in Iran. In another study, (Soltani et al. 1) demonstrated that demographic feature of household age, gender, size and awareness level impacted households' energy conservation. They have concluded that women are more involved in housing activities (e.g. cooking), therefore, consuming more energy. In terms of age, researchers have shown young adult-headed households were more likely to have high electricity use. Also, in this study, they pointed out that the increase in income did not displayed more energy-saving actions at home. In terms of household size, it has been revealed that with the increasing number of households, the incidental behaviour has increased, which has resulted in unpredictable peak loads (Sepehr et al. 487). (Sarmast and Poor Hassan 1) as well as (Tabli and Khajavi 66) highlighted income and their residential district (location) have caused differences between energy consumption patterns of Iranian households. In another research, (Akbari, Talebi and Jalaei 1) revealed that space area, the number of home appliances and space layout have affected energy consumption among Iranian households. According to above-mentioned researches, an increase in space area from 100 m^2 to 140 m^2 has accompanied by a rise in appliance ownership and energy consumption in Iran.

Although energy consumption can be effected by various indicators of income, climate, age, household size etc., incidental behaviour of households seems to be underestimated as an effective driver for unpredictability of peak loads, leading to unplanned blackouts in Iran. Nowadays, the Iranian households' lifestyle has been pursued to a higher living standard, resulting in an excessive amount of energy use (Rahmani et al. 2). A report by the Statistical Centre of Iran (SCI 51) shows that with the increase of Iranian's per capita disposal income, the direct energy consumption has also increased. In this regard, previous studies have demonstrated that daily energy related activities were mostly dependent on households' lifestyle, which dictated the residential energy consumption pattern (Fong et al. 395; Lotfalipour, Mahdavi Adeli and Rezaei 54-56). Moreover, (Soltani et al. 12) concluded that the amount of energy consumption in households was surprisingly not concerning climatic conditions, but mostly based on a habitual life routine. Thus, increasing energy consumption (heating or cooling) was mainly regarded as a routine procedure in different climates. This points out the notion of "consumption routine" which is referred to a repeated consumption learned by groups of consumers in response to their living context. Based on this notion, a shift in households' routine lifestyle seems to be an effective approach to affect their daily energy demands. Various theories exist regarding lifestyle and consumption pattern of households. According to Veblen (Gao et al. 515) lifestyle is an integrated system of

attitudes, values, opinions and interests of households, which can affect consumption pattern of households. Therefore, consumption pattern can be altered when considering households' values and interests in their life routine activities.
Unfortunately, little number of researches and energy efficient campaigns have focused on the notion of changing lifestyles to impact wrong energy consumption patterns so as to achieve a more sustainable energy related behaviour change. For instance, previous campaigns and researches have proposed programs and incentives to change households' energy related behaviour by proposing various energy saving strategies, emphasising environmental and monetary benefits of energy efficient activities. However, studies have shown that consumption does not specifically address living and basic needs, but it includes signs, symbols, ideas and values. This highlights the important role of households' experience and values on choosing their daily life activities, which can be used as an effective reward for a more energy efficient consumption pattern rather than environmental or monetary outcomes of their activity.

5 Interventions towards household's interests

As indicated previously, interventions were proposed to change energy consumption behaviour of households in global scale. Each proposed intervention was based on different strategies of education, persuasion, feedback and home retrofits. The most prevalent techniques that have been implemented by researchers were goal setting behaviour, problem solving, feedback on behaviour, social support and education. Among these interventions, energy consumption and resource efficiency were the mostly focused goal.
Studies have revealed that there are some limitations, contributing to their limited success and maintenance of the desired behaviour over longer periods of time. The first limitation is that such single policy tools were ineffective in reducing household energy consumption (Dietz et al.). Although informational programmes appeal and they can change attitudes while increasing knowledge, they usually have failed to achieve sustainable behaviour change (Karatas, Stoiko and Menassa 539). To address this issue, various studies integrated education with other intervention approaches (e.g. persuasion, penalties etc.), for those households with extreme energy-use patterns (Azar and Menassa 211). However, not all households react in the same way to multi-level intervention strategies. Therefore, interventions may need to consider different characteristics of occupants and their daily activities, to develop a more feasible strategy for a sustainable behaviour change.
Another limitation is that technological interventions have highly uncertain energy-reduction benefits (Chidiac et al. 620; Entrop, Brouwers and Reinders 628; Schneider and Rode); relatively high initial costs (Nemry et al. 976; Yudelson 108); reluctant stakeholder commitment, especially while taxes and energy prices are still low (Menassa 3577); and lack of information about the existing building systems and the challenges of integrating new technologies. In terms of retrofit solutions, (Galvin 398) did not find significant relationship between behaviour change and retrofitted built environment and stated that households in retrofitted homes often consume more energy than expected. This is due to the fact that retrofitting homes can solely reduce energy consumption to a certain extent (Elsharkawy and Rutherford 32).
The limitation of existing intervention programs showed that for the creation of a lasting behaviour change, a value-based approach can be a better solution to encourage households to a more desired behaviour, which is also beneficial for their wellbeing containing energy efficiency as an additional reward. This can also become a motivating factor for households to maintain their wellbeing, while reducing energy consumption and

preventing unplanned blackouts. Accordingly, blackouts have caused difficulties in implementing activities which are valued by households in certain times of a day. This can be considered as a main reason that unplanned blackouts could affect households' wellbeing, since households may implement different activities during certain times. Therefore, exploring daily life activities and households' life routines can be a contributing approach to identify the value of domestic activities and its substitution with other activities which can be valued by households to be integrated in the life routines to maintain wellbeing while achieving energy efficiency.

Areas of life which can be related to energy use differs based on households' daily domestic activities. In Iran, domestic consumption of lights, household appliances, and air conditioning is the main sources of the electric power demand (Bazzazan, Ghashami and Mousavi 9). However, daily life activities are not solely limited to such energy-related activities. In a recent report of Statistical Centre of Iran (SCI), households have spent most of their time in leisure as well as self-care activities. Iranian households spent approximately half of their day, in self-care activities (including sleeping, eating and drinking, health care - medical, trips related to care and self-care activities, etc.). According to this report, the average of time spent per day was 11 hours and 42 minutes, which was the highest percentage of daily activities in 2019. The second highest percentage allocated to different leisure activities (exercise, entertainment, studying, watching TV etc.) with 4 hours and 13 minutes on average. Housework of cooking and cleaning, which were in the third place, were spent about 2 hours and 51 minutes on average by Iranian households.

According to the above-mentioned report, it can be concluded that wellbeing related activities are as important as other energy related activities in Iranian households' lifestyle. This demonstrates that a reduction in energy demand may not necessarily effect their life routine in a negative way, if substituted by self-care activities. In this regard, lifestyle changes can be introduced to reduce energy demand while improving levels of personal health and wellbeing.

6 Conclusions and Recommendations

This research endeavoured to explore the neglected impact of lifestyle on household's energy consumption pattern and introduced a new area of study in energy efficiency researches by highlighting the forgotten hidden link of wellbeing related activities of households and energy consumption pattern. This study introduced a possibility of well-being related awards to sustain the change in households' energy consumption habits.

Given the above issues regarding blackouts and the limitation of the existing interventions to achieve a sustainable behaviour change, it can be concluded that the main goal of energy interventions need to be shifted from monetary values to more user-centred values. The unsustainability of behaviour changes over time has demonstrated that most of the daily activities seem to be unintentional. This necessitates further considerations of households' lifestyle and the way in which changing of behaviour can be sustaining by a more user value-based intervention approaches. A routinized type of behaviour can be achieved by emphasising wellbeing of households in the first place. Since researchers showed that many households are not motivated to reduce the energy use for the sake of minimising GHG emissions or reducing energy bills. Therefore, the nature of motivation should be more focused on wellbeing benefits of energy efficient actions rather than emphasising pro-environmental behaviour. This can be achieved by identifying the value of their daily life activities (including bodily activities and mental activities) and afterwards identify a way to substitute wrong energy consumption patterns with more well-being related activities valued

by households, which will lead to a reduction in energy loads during peak and off peak times. Therefore, blackouts can be addressed in terms of energy use patterns and substituting them with more value-based activities to decrease the energy demand side. This research highlighted that value-based activities such as self-care can play a crucial role in motivating households towards a more sustainable behaviour change. This needs further exploration regarding motivational knowledge and states of emotion of households when implementing domestic energy related activities.
Based on this review, the future study will focus on bridging the gap between human behaviour and existing Iranian energy policy and will endeavour to propose a predictive model based on Iranian households' energy consumption behaviour (Fig.4).

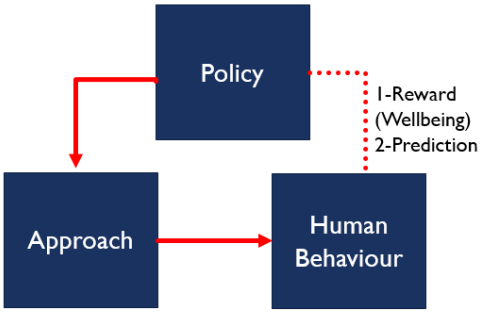

Figure 4: Vision of the future study

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