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# Governance of energy transition in Iran: Investigating public acceptance and willingness to use renewable energy sources through socio-psychological model



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## ABSTRACT

Despite extensive renewable energy sources (RES) potentials in Iran, their share in current energy mix remains minor comparatively to fossil fuels and nuclear energy. Government strategies and targets for deployment of RES in Iran exist. Also several scientific works were written on technical and economic feasibility of such solution. However, the question about public acceptance in Iran of energy transition based on deployment of RES remains open. In this research we assume that socio-psychological factors might play a significant role in public acceptance to use RES. We base our research on the theory of planned behavior (TPB), which we expand to investigate the question of willingness to use and public acceptance of RES. As one of the methods of analysis, we conducted a survey ( $N=260$ ) among Iranian students in the universities of the city of Esfahan, in the center of Iran. We assume that these stakeholders will play a key role in deployment of RES in the future, they will be active as energy project managers, as they are currently studying engineering disciplines, and might contribute to the energy transition in Iran. We analyzed empirical data from the survey with the help of structural equation modeling. Our results show that moral norms, attitudes and perceived behavioral control are significant factors influencing willingness to use and public acceptance of RES, while subjective norms and self-identity do not play a significant role.

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## 1. Introduction

Energy, as a fundamental component of modern society and life, has a direct impact on each human activity and plays a critical role in socio-economic development ([37,60,79,41]). Indeed, energy is deeply embedded in each component of mankind development: economic, social and environmental ones [79]. However, an increasing global energy demand, concerns about energy security such as availability of fossil-fuel resources and dependency on them, anthropogenic emissions of greenhouse gases and environmental degradation caused by energy generation from fossil fuels stimulated debates about future efficacy of fossil fuel ([12,87,19,70]). In this situation, renewable energies sources (RES), such as biomass, solar thermal and photovoltaic, wind turbines, hydropower, ocean thermal, geothermal, and tidal energies, can be one of the options to satisfy energy demand with low carbon energy generation [63,51]. International climate and energy policies stress the need of energy transition in both developed and developing countries, based on a greater share of RES in the primary and final energy consumption [55].

Even though environmentally friendly products find growing public support and willingness to use among consumers, deployment of RES generation capacities and infrastructure still raises questions about public support and willingness to use in both developed and developing countries. Scientific evidence shows that public acceptance is an important issue for deployment of RES [83,89]. It also determines the extent, to which public is willing to support development and use of RES [19]. In other words, deployment of RES is not only a question of technical and economic capacities [50] but these are people, including citizen and lay people, who play a central role in energy transition. Also, nowadays no technological or legislative choice on any energy model can be effectively implemented without social acceptance [55]. For example, in Europe public acceptance and large public protests are blocking further deployment of RES transmission infrastructure [13]. Public protests can be directed against RES, in general, or against any particular type of RES, like waste to energy power plants, which caused large protests in Greece [2], wind parks in UK [25] or micro-generation [69].

In other words, public perceptions, awareness and acceptance of RES are significant social factors, which shall be taken into consideration in developing future energy systems and governing energy transition [62,51]. Implementation and deployment of RES can be sustainable and effective only in the case if public is aware about benefits and needs for deployment of RES and supports energy transition based on RES generation. Studies in other filed such as genetically modified food, organic agriculture (81,33) revealed that a lack of public support, due to risks and benefits perceptions, knowledge, unfavorable attitude, the level of awareness can lead to rejection of emerging technologies and scientific innovation.

The government of Iran is recognizing the potentials of RES and announced the plan to deploy 2 GW of RES capacity between the years 2010–2015. Taken into reference RES potentials in Iran, surprisingly little was written in science about energy transition based on the deployment of RES. Some of the existing studies approached the question from the technical side by estimating physical potentials [67] or from economic side by estimating the economic potentials of RES generation [59]. However, the question about governance of such energy transition and public acceptance

among general public but also separate groups of stakeholders for new energy technologies remained, to our knowledge, almost untouched [50]. Driven by the need of governance for energy transition, some research questions inevitably arise, for instance:

- What are attitudes from different stakeholders towards RES?
- What encourages them to accept or reject them?
- What factor/s determine/s their intention toward RES?

The answers have important policy ramifications for the implementation of RES programs by creating a dialogue between general public and those in the scientific community by suggesting strategies for effective communication [19] about the needs and benefits from RES to increase public awareness and acceptability.

In this paper we deal with the question of how a group of specialized stakeholders, such as future managers of the infrastructure projects, perceive benefits of RES and potentials for their deployment in Iran. This question is especially interesting, as Iran is marked by high level of fossil fuel energy consumption per capita. Therefore, positive perceptions of RES and willingness of key stakeholders to use RES and to contribute to energy transition remains a crucial challenge nowadays.

## 2. Background

Recently a number of studies was published about public attitudes and intentions towards RES in developed countries [13,12,23,68,49] as well as in developing countries such as South Africa [64], China [89], Jordan [87], India [48] and others. Other studies were investigating the nature of protests against siting renewable energy infrastructure and which factors might have contributed positively on public acceptance. There is evidence that issues of ownership and participation might affect positively acceptance of communities [76]. Also inhabitants are getting more positive towards RES installations if they contribute to an increase in quality of life through increased income of local population, availability of electricity, upgrading of infrastructure [8]. Other studies investigated factors, which would have rather negative influence on public acceptance. They found out that so-called NIMBY feelings could be also caused by skepticism of inhabitants towards private company or authority who wants to install the project, can be a matter of political interest or result from a situation when environmental advantages of RES are perceived to be at the global or national levels, at the same time as environmental impacts be occurring at the local level [47]. Or that inhabitants who were opposing the project could be in opposition with the electricity utility or energy policy or the way the project was planned and realizing rather than opposing deployment of RES itself [26].

The number of scientific works about public acceptance of RES diversifying among specific groups of stakeholders, and not only about “public” in general, is limited. To our knowledge, almost no studies have considered factors that influence intentions and perceptions towards RES of professional stakeholders, such as managers of infrastructure projects.

In this study, we assume that to increase public acceptance and awareness of RES, we should, first, understand the existing behavioral patterns and attitudes towards RES as well as its drivers, and develop recommendations about how these behavioral patterns can be changed or influenced by policy relevant measures. This requires

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