AN ASSESSMENT ON HYDROPOWER POLICIES IN TURKEY

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Abstract

The aim of this study is to provide analysis and discussion on the hydropower policies in Turkey, in an effort to provide future visions about energy policies. Emphasizes are on the recent status of hydropower in Turkey, weaknesses and strengths of Turkish energy regulations and policies, and the dependency on foreign hydroelectric equipment. Such evaluations will be possible by developing a hydropower database and also analysing this database. An accurate and comprehensive national hydropower database which includes details such as turbine types is not available in Turkey to the best of the author's knowledge.

Turkey is dependent on foreign sources in terms of energy. The dependency is on both energy resources and technology. As the energy demand increases rapidly, it is essential to utilize national resources as well as national research and development for a sustainable and independent energy strategy. It is believed that such an action will be possible via building, arranging and analysing the national database. Developing the national energy roadmap also requires the utilization of national database effectively.

Key words

Hydropower; energy policies; environmental impact assessment; foreign dependency

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1 INTRODUCTION

Technological advancements and growing population have increased energy demand in Turkey significantly over the past few decades. As a result, Turkey is under constant pressure for increasing the energy production. It is essensial to use national resources and technology, while maintaining the energy security. Also decreasing the foreign dependency on the energy sources and technology is another national goal. The numbers (such as installed capacity) as well as the policies, laws and regulations are changing rapidly in the energy sector. These changes are outcomes of the multiple revisions of the previously applied rules and regulations. It is reasonable to say that the changes are geared towards improvement and reducing the foreign dependency. A closer look, nevertheless, indicates that there are some issues being raised as well, as these changes in the rules and regulations are implemented.

In terms of increase in the energy demand among the OECD members, Turkey is the leading country and has the second place after China in the world when the last ten years are considered [1]. Since 2001, electricity consumption per capita in Turkey has increased by 72.8% and reached 3199 kWh in 2012. Long-term demand projection report of Turkish Electricity Transmission Company (TEIAS) indicates that the generation of power plants will be insufficient to supply the electricity demand by 2015 when the existing plants in operation and in project stage are considered [2].

Total import of Turkey was reported to be worth $240.8 billion and import related to energy was $20.5 billion excluding energy demand for transportation in 2011 [3]. In terms of electrical energy, natural gas has the largest share in foreign import equivalent to 104,499.2 GWh, followed by imported coal with 29,210.5 GWh and third being imported fuel-oil with 981.3 GWh. As of the 2012, electricity production in Turkey based on foreign resources is 135,348.4 GWh [4]. At his point, the commonsense is that hydropower could be the remedy to the energy problem.

2 ANALYSIS OF THE AVAILABLE NATIONAL HYDROPOWER DATA

Theoretical hydropower potential of Turkey is 433 TWh which corresponds to 1% of world theoretical potential. Economical hydropower potential of Turkey is 140 TWh and hydroelectricity production was reported to be 57.865 TWh in 2012 [4]

Hydropower production of Turkey, though with an increasing trend as shown in Fig. 1, has failed to respond to rapid growth in the electricity demand [4]. For instance, in 2012, hydropower was able to meet only 24% of the demand. The other 82.135 TWh of unused hydropower potential is able to contribute around 34% of (242,369.9 GWh in 2012) the total electricity demand in Turkey. Although this comparison suggests the gain to be accomplished utilizing the 100% of the nation's hydropower potential, it is also clear that hydropower alone is not enough for a strong energy security structure.

Nevertheless, the growth in the production is mostly due to the new laws established as shown as inset in Fig.1. Installed power of hydropower-plants (HPPs) is 22,222.759 MW in Turkey and increased by nearly a 100% between the years of 2000 and 2013 mostly due to the laws listed in Fig.1 [4]. Electricity Market Law in 2001 ended the 8 years of stagnation in hydropower sector as shown in Fig.1. Especially with the publication of Renewable Energy Law, acceleration in the installed hydropower is observed clearly between the years of 2005 and 2013. Although there is an increase, the share of hydropower was only 34.4% of 57.059,4 MW total installed power in 2012. Economic crisis and preference of other forms of energy production methods such as natural gas, as a faster solution for energy security, are also

affecting the development of installed hydropower directly. The relation between legal adjustments and hydropower investments cannot be explained alone by ignoring these kinds of effects.

Although small hydropower as a clean energy source is supported by the policies and regulations (by mostly those established after 2001) to utilize the unused hydropower potential of Turkey, uncontrolled construction and operation conditions causes environmental problems for certain projects. In this regard, effective watershed management plans compatible with European Union Water Framework Directorate have critical role in sustainability of ecosystems and decrease negative environmental impacts of power plants.

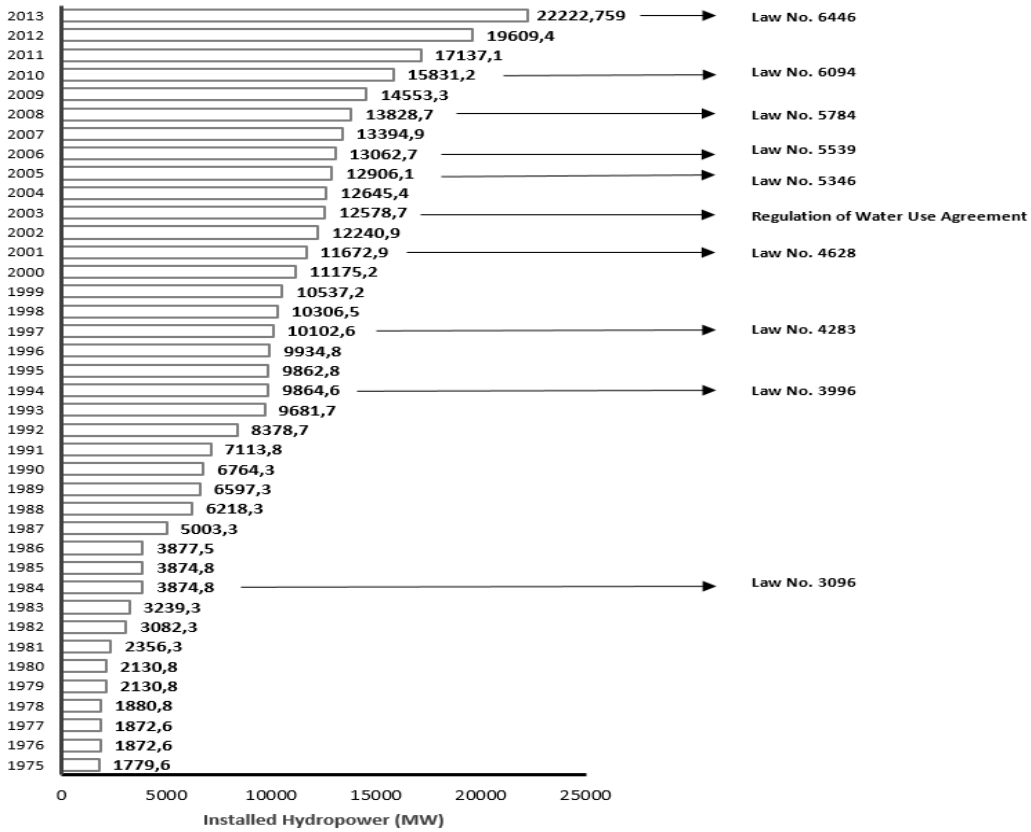

Fig. 1: Total and hydro electricity production and demand over the past years in Turkey (MENR).

That is, according to Environmental Impact Assessment Regulation (EIAR), there was no necessity for Environmental Impact Assessment (EIA) Report for HPPs with an installed capacity of 10 MW or less. Additionally, HPPs with installed capacities between 10-50 MW could be also constructed without the EIA report if the project is approved after an investigation of local authorities in or before 2008 (Turkey is a candidate of European Union (EU) membership, and as a result the EIA regulations have been adopted according to the EU compliance procedure). Especially, successive river type HPPs was significantly increased due to lower investment costs, easiness at legal procedures (no obligation for EIA report and no license application) and incentive mechanism. During this period, 728 HPP projects were legally permitted. Some of these projects were subjected to litigation as a result of objections from local residents. Fig. 2 shows the negative impact of a small HPP project on the environment which lead to litigation. Some of the given licenses were cancelled as a result of court orders. According to HPP data of Energy Market Regulatory Authority (EMRA), 341

licensed applications were rejected, 277 licenses were annulled for various reasons, 97 licenses were returned for revision and 13 licenses were canceled [5]. After the rearrangement in EIAR in 2008, EIA report has been mandatory for projects with 25 MW installed capacity or higher. For projects under this limit, decision body was assigned to be again the local governorships [6]. Therefore, the small hydropower projects are subject to conflicts and complications due to the environmental problems discussed above.

Fig. 2: Rize Uzundere region before (left) and after the HES construction. This project didn't have an EIA report [7].

While the incentives and discounts encourage the investors, the coexisting or newly required extra fees such as water contribution share, in addition to fee for the right to use water, affect negatively the investors and as a result the national goals. Nevertheless, actions are taken by the government in order to dictate the EIA report for most of the small hydro projects regardless of the installed capacity.

One important contributor to the Turkish dependency on foreign sources is also the technology and equipment used in power plants.

Distribution of the licensed HPPs in Turkey according to installed power capacities are shown in Fig. 3. Majority of HPPs are clustered between 0-50 MW (small and mid-sized plants). A total of 97 LHPPs (>50 MW) have a capacity of 17601.655 MW. This corresponds to about 64% of total installed hydropower. The rest of the installed power (36%) is from 791 HPPs categorized as either small or mid-sized plants [5].

Turkey has a total of 888 HPPs licensed by EMRA. 514 of them are in design/planning stages, 19 of them are partially in operation and 355 of them are in operation. Installed power of 412 HPPs of total 514 licensed HPPs in design/planning stages are under 25 MW. In this respect, it is clear that the remaining hydropower potential in Turkey is planned to be utilized mostly by employing SHPPs.

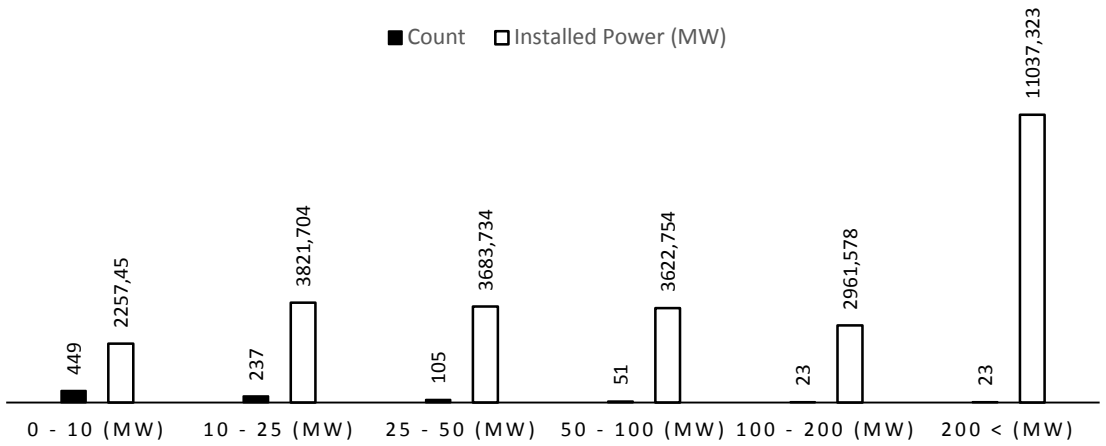

Fig. 3. Distribution of number of HPPs and total installed power by different classifications (EMRA).

According to the MENR, as one of the national energy goals, Turkey is planning to utilize the nation's entire hydropower potential by 2023 (this year is the centenary of the republic). Within the framework of this plan, domestic designing and production of electro-mechanic equipment is necessary in order to keep the investments in the country and decrease the cost of hydroelectricity. According to analysis of EMRA for 2010-2030 period, total energy investment cost of Turkey is estimated as 225-280 $ billion and out of this total, the part for the equipment investment can be assumed as almost 100 $ billion [**8**]. Electro-mechanic equipment is mostly supplied by American, European and Chinese companies and the only national company that is in this sector is a public corporation named TEMSAN (Turkish Electro-Mechanic Industry). National investments in hydropower sector are facing cost barrier due to lack of availability of affordable domestic electro-mechanic equipment. Although each project has its unique design conditions, a general assumption based on similar projects can be made for capital costs calculations. Hydro turbine cost per kW varies in the range of $975-1950, for which, in this study a representative value of $1300 will be used in calculations as average [9]. Based on this assumption, required total fund for hydro turbines of total of 514 licensed HPP projects with 16,415.716 MW installed power corresponds to about $21.34 billion. When maintenance and repair costs are also added to this fund, economical load of electro mechanic equipment import can be understood clearly.

Ability to design and manufacture electro-mechanic equipment for HPPs is one of the national priorities in Turkey. In this respect, the current situation of HPPs in Turkey should be emphasized in terms of installed power capacities and thereby a first start for the characteristics of unused hydropower potential can be identified to guide the production of necessary turbine types.

3 SUMMARY AND DISCUSSION

The overall progress in utilizing the hydropower potential is promising and the laws/regulations, almost in a way, evolve in an effort to fix the problems encountered on the way and continue to develop. However, as much as it is also inevitable that the hydropower (utilizing small hydropower) alone is not the remedy for energy security in Turkey now and in the future, it is crucial that the hydro potential is used at its full potential for reducing the foreign dependency.

The problems with the environmental impact, inspection and operation of the HPPs in general would be overcome by restoring the EIA report process for all types of hydropower plant.

Another important cost and dependency about energy issue in Turkey is the electro-mechanical equipment. Data and our analysis indicate the increasing numbers in small hydro power plants. The roadmap to reach the national goal certainly needs to involve the identification of types of the turbine technologies appropriate for the planned HPPs. Turkey is not designing and building (100% national) hydro turbines but the high demand for small hydro power plants would be used to gear the research and development efforts towards the right direction in turbine market. Kaplan type turbines seem to be one of the strong prospects in this regard. Establishing a national turbine design and manufacturing capability should also produce outcomes which also fit the needs in both the short and long term.

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