



THE EDUCATION AND TRAINING OF RENEWABLE ENERGY RESOURCES FOR SUSTAINABLE DEVELOPMENT IN TURKEY

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Abstract

The existence of quality human resources is a necessity for each development process to continue successfully. This is also true for the use of renewable energy in the developing countries that largely lack the quality human resources. Learning science is the best way of starting quality careers. For meeting the need for the quality human resources in developing countries, providing various educational programs are necessary. This education should take the new developments in science and technology into account. For the effective planning and management of such programs, high quality technical personnel should be trained to be involved in decision-making process. Energy studies are considered as a new education method and energy is classified under two groups. One of them is focused on the developing energy profession and the other one aims establishment of a society with energy conscious by focusing on the university and further education after obligatory primary and secondary school education. The best way of finding solutions to such problems is to make use of the renewable energy resources. But, for this to happen, there is a need for dissemination of the information about the renewable energy and widespread provision of the renewable energy education across the country, encouraging the use of renewable energy systems to conduct better studies of renewable energy and implementing more effective systems. In this study, prospects and proposals on the development of proper education programs for every stage of education in Turkey. Furthermore, the awareness programs for the public are presented.

Keywords: Renewable Energy Resources, Education, Training, Turkey, Awareness.

TÜRKİYE'DE SÜRDÜRÜLEBİLİR GELİŞME İÇİN YENİLENEBİLİR ENERJİ KAYNAKLARININ EĞİTİMİ VE ÖĞRETİMİ

Özet

Her gelişme sürecinde kaliteli insan kaynakları kullanılabilirliği bir gerekliliktir. Gelişmekte olan ülkelerde eksiliğin çok önemli olduğu yenilenebilir enerji alanında da aynen böyledir. Bilim öğretmenin iyi ve kaliteli bilimsel mesleklere başlamanın en iyi yoludur. Bilim ve teknoloji entelektüel seviyede değerleri biçimlendirmek ve yaratıcılık için yeteneklere teşvik etmek için doğa ve çevrenin kavranmasında ve ek olarak çağdaş dünyanın anlaşılmasında vazgeçilmez bir alet olarak görünürler. Enerji çalışmaları yeni bir eğitim yöntemleri olarak ortaya çıkmış ve enerji eğitiminin iki tipi içinde sınıflandırılmıştır. Bunlardan biri, gelişen enerji mesleği üzerine odaklanır ve diğeri ise zorunlu ilköğretim ve orta öğretimden sonra üniversite ve daha ilerisini geçerek enerji bilinçli bir toplumun üretilmesine amaçlamaktadır. Bunu çözenin en iyi yolu yenilenebilir enerji kaynaklarını kullanmaktır. Bu yol, kalite, yaygınlık, yoğun yenilenebilir enerji eğitimi, mükemmel yenilenebilir enerji araştırmaları ve bunların uygulamaları için yenilenebilir enerji sistemlerinin ülke içinde yayımı ve tüm insanların bilgilendirilmesi gereklidir. Bu çalışmada Türkiye'de eğitimin her çağına uygun eğitim programlarının geliştirilmesi üzerine öneriler ve beklentiler verilmiştir. Ayrıca halk içinde farkındalık programları sunulmuştur.

Anahtar Kelimeler: Yenilenebilir enerji kaynakları, Eğitim, Öğretim, Türkiye, Farkındalık.

1 Introduction

Today, one of the most important consumption matters as much as food and drink is the energy. Energy sources have always played an important role in development of communities. Since the energy revolution, energy has accelerated the development process of modern civilization [1]. For this reason, energy consumption is considered as the criterion for development levels of countries. Though the population of developing countries constitutes three fourths of world population, it has a one third share in the world's energy consumption [2]. In these countries, together with economic development, the energy demand increases rapidly. More than 4 million people must get and use the energy to continue their growth and development. Not to be able to get sufficient energy sources negatively affects the development process of

developing countries.

Big energy requirements, rapid consumption of nonrenewable energy sources and local and environmental pollutions are important problems that must be solved in the world as well as in Turkey. The best way in solution of these problems is to use renewable energies. This can be achieved with extensity, intense renewable energy education, perfect renewable energy researches, spreading of renewable energy systems and raising the awareness of all the people. Besides, the renewable energy education is one of the hot subjects of today. Because, the issues like security of the country, foreign energy source dependency, effects of energy using on the society, careful using of energy, global warming, environmental pollution, health and economy urge us to find an alternative energy source. This alternative energy source is the renewable energies. Many sections of the

society lack of information about renewable energy sources.

The opportunities and difficulties faced about renewable energy education in Turkey generally occur in the level of university. Before emphasizing the situation of renewable energy education in Turkey, the situation in other countries can be summarized as follows. Buckley and Kuetz [3] developed teaching modules on renewable energy education for students between ages of 16-18 for renewable energy field in Europe, especially for the photovoltaic field. Broman [4], with his 20-year experience, studied the situation of renewable energy and Garg and Kandpal [5] studied the energy engineering education and REE in developing countries in master and doctorate level. Ruzinsky et al. [6], with cooperation between the Slovak Technical University and Florence University, made research and development studies in photovoltaic renewable energy field and clearly summarized education activities in photovoltaic engineering field for undergraduate courses. Berkovski and Gottschalk [7] used the engineering education program of UNESCO related to new and renewable energy technologies in postgraduate level. Besides, they stated that UNESCO made material preparations to meet the aims of remote education in developing countries and explained these preparations. O'Mara and Jennings [8] studied the simple principles and strategies of using worldwide network (www) to establish the internet sites and sources on renewable energy, energy efficiency and global warming where the worldwide students and teachers can find most of the sources they look for. Axaopoulos and Pitsilis [9] introduced six educational energy software programs. The software allowed to observe the results of experiments.

Bhattacharya [10] emphasized the renewable energy education in university level and its growing significance. Jain et al. [11] made a study in Botsvana about needs of renewable energy education, its situation in the country and education programs suggested for its education. He presented the findings of that study and suggestions made on that subject. Zografakis et al. [12] defined the energy attitudes that occur in different levels of education, by recording the behaviors of students and their parents related to the energy, and stated the contributions of such behaviors in the energy education. Jennings [13] defined the courses on renewable energy science, renewable energy engineering, renewable energy policy and planning and renewable energy technician education and discussed the education of researches who worked in cooperation with the renewable energy industry. Kecebas and Alkan [14] discussed ways to conduct formal and informal education and the importance of RE education. Acikgoz [15] presented an analysis and classification of RES, how to find RES origins, ways to spark students' interest in energy topics related to renewable sources, and the development of didactic competencies in special blended learning arrangements for educators, trainers, and lecturers in RE adult education in Turkey. Yumurtaci and Kecebas [16] discussed RES in Turkey and actions that must be taken to promote RE education in institutes of higher education. They also explained the educational insufficiencies in such institutions and made suggestions about how to improve the existing situation. Karabulut et al. [17] researched RE education at the university level in Turkey and discussed what should be done to disseminate findings in this field. In this study, the renewable energy education in Turkey and developing countries and awareness-raising activities and education according to each age are discussed.

2 Renewable Energy Education in Turkey

2.1 Primary and Secondary School Education

The energy education in Turkey is given in the framework of formal education in conformity to the widespread model under scope of Science and Social Sciences starting from the 4th class. In the secondary school energy education, a single course model is applied with the Environment and Human course generally included in selective courses of High School 1 since 1992. In recent researches, it is stated that problems related to ecology, environment and energy education appear as early as in the primary education. The reasons of inefficient environment and energy education are the applied education programs, teaching education and insufficient source of information.

The secondary education schools in Turkey are divided into two; General High Schools and Vocational High Schools. These high schools do not apply any program containing energy issues. In future, the non-renewable energy sources will run short and energy problem will occur. To prevent this, students must be educated about this serious issue. Even if at present it is impossible to include renewable energy programs at secondary education schools, we can raise the awareness with scientific activities, technical tours and conferences.

2.2 University Education

During the higher education and professional practice process, it is essential to ensure continues and participating education and to discourage creativity and innovation. For this reason, it is necessary to contact to engineering faculties and trade bodies and organize joint seminaries and broadcasting in short term. Then, courses on energy management, renewable energies and PV must be given at related educational institutions, designers and producers must be educated and certificated and continues broadcasting on that subject must be ensured.

The renewable energy can be deeply introduced only with education. Here, the place of education, instructor, education documents, materials and education level and education diplomas are the main subjects. The education is be given by faculties, institutes and research centers. There are subdivisions depended on them. The specialist researchers and educators on renewable energy give courses. The education documents at universities are: books, translations, course notes and research results. Computer data bases, special computer programs and simulations are also used. Models and laboratory tools reinforce the education. Both undergraduate and master level courses are giver at engineering or similar departments of universities. At departments that give renewable energy education, deeper information is given on that subject. No diploma or certificate on renewable energy subject is given. This problem prevents specialist persons to work formally at universities.

2.3 Informing the Public and the Foundations

Whatever the culture and education level in Turkey is, people in general do not have sufficient awareness and knowledge about the environment and energy. Even the people who are educated on that subject do not update their knowledge and assimilate an integral point of view. This insufficiency prevents formation of individual and social value judgments. It is inevitable that students and teachers at primary, secondary schools and universities and as well as employers, employees and decision makers must be educated permanently on renewable energy field.

Lack of educated manpower on renewable energy causes using

of equipment in renewable energy technologies insufficiently, loss of income, nonconformity to the developing technologies and decreasing of confidence in part of producers. To prevent this, national mastership certificate must be given on renewable energies, certificate courses must be opened to audit that technology, and short courses must be given for purchasing, maintenance and service works of managerial personnel.

The public education programs must be prepared to inform the developments in the world about the renewable energy applications of future and must be used in internet in addition to nationwide broadcasting by means of media. With these broadcastings, the awareness of the public must be raised and legislators, institutions and industry establishments must be informed.

3 Needs of the Renewable Energy Education

The purpose of education is to prepare people for the future. In education, the future needs of a society, for instance 30-50 years later, must be considered. The energy is a vital need of each society and it reflects living standards and development situation of each nation. A nation that meets energy needs of its people must acknowledge the size of risks it will face in the future. It is expected that in future there will be a rapid increase in energy consumption level and improvement in variety of production methods because of the reasons below; i) growing population in Turkey and world and increase in energy consumption; ii) ecological risks of some energy sources, especial global warming because of the sera effect caused by emissions of gases; iii) uncertainty of nuclear wastes; iv) requirement for people who observe the powerful policy of energy economy in the world; v) increasing demand for renewable energy sources in future.

4 Suggestions and Expectations on Renewable Energy Education

The first rule of establishing a convenient energy future is the renewable energy education. For this purpose, education organizations must be made for educators, institutions, consumers, personnel in renewable energy technologies and the public. The legislators, institutions and public must be informed with these renewable energy organizations. The renewable energy education programs must be established for each age group. The renewable energy education in Turkey is limited with theoretical information because of limited number of educational places where practice can be made. In this case, renewable energy technology cannot be perceived and the renewable energy field developed with research and development cannot be transferred to other fields effectively. Educators in engineering field have found many new and innovative methods in teaching of the subject. The UNESCO has prepared a "learning package" containing a course book, multimedia products and software for remote education and self-learning [7].

The number of renewable energy software at renewable energy laboratories increase day by day. The purpose is to develop interactive, speedy, easy to use and simple language software programs for engineering education [3]. The programs must be in conformity to the secondary school and higher education. These educational tools emphasized on graphical model decreases complexity of theoretical algorithms for users and demonstrate the results of calculations. The success of

simulation in education is better than other pedagogic approaches. Students can better understand the complex and realistic problems with simulation education. As the experiments are expensive and time consuming, to understand the results of simulation will be easier and take shorter time.

5 Conclusion

Though Turkey has a high renewable energy potential, the brain power to develop technology cannot be used sufficiently and effectively. For this reason, an institutional infrastructure must be established to ensure development and spreading of renewable energy applications and necessary legal arrangements must be made. To develop cost effective and productive solutions in application, a source must be allocated for researches and related companies and user must be supported with suitable incentives.

Expectations and suggestions to develop a full education program in every stage of education must be assessed and increasing of public awareness on renewable energies must be emphasized. The renewable energy programs must be supported to increase the expectations and developments for a good energy future. Besides, an education program must be prepared for professional public education and apprenticeship education to raise awareness. Additionally, legislators, institutions and industrial organizations must be informed sufficiently.

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