

Wuppertal Institute
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German-Iranian Co-operation VI

“Development of three cornerstones for a sustainable Energy future in Iran “

Work package 3.

Energy Education Programs; A Comparative Study in Iran and Germany

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Summary

Renewable energy technologies are becoming increasingly important for countries' economic development and job creation. The turnover for renewable markets, energy efficiency and other "green markets" is growing at an enormous rate per year. With the growing market for renewable technologies and energy efficiency technologies, the education programs in the area of renewable energy had also been growing worldwide.

Germany is one of the developed countries that has made an aggressive investment in renewable energies and developed extensive educational programs in different levels. This can be seen in the context of the country being highly dependent on energy imports and the same time in forefront of technological progress. Government policies in general support investments in renewable energies and private sector has been actively participating in various renewable energy development projects. Along with the physical investment, Germany has also developed university programs and research institutes to provide the knowledge and the skills required for the renewable energy sector. Therefore, a review of the renewable energy education programs in Germany can be useful for other countries.

In Germany, various study programs at the Bachelor and Master levels with different focus on these subjects are developed in universities (studies). In addition, some schools and institutes offer professional and vocational trainings. Specifically, the following programs are offered by educational institutes¹ :

- Bachelor studies
- Master studies
- Diploma studies
- Dual education
- Further education beside work and distance studies

¹ <http://www.studium-erneuerbare-energien.de> Updated in November 2009

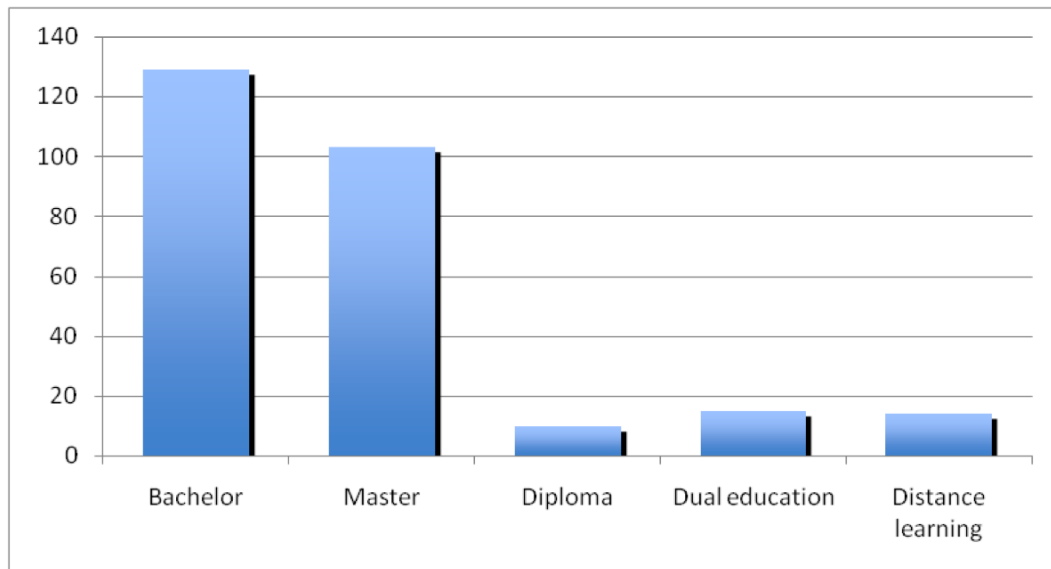


Figure 1: Number of existing courses on renewable technologies and energy efficiency by type of studies

A Bachelor's degree gives students a professional qualification after three to four years. Admission to the second cycle, a Master's degree, depends on the student's performance in the first cycle. The Bachelor/Master's system gives students new opportunities to combine qualifications together with additional flexibility to plan their studies and professional activities. Diploma is a traditional German academic degree, which can be compared to a Master's degree. This kind of study contains a combination of a Bachelor's and a Master's degree. The reform process of the European higher education replaces these old degree courses with the new Bachelor/Master's system.

Dual education combines vocational training after the final secondary-school examination with higher education. This form of education designed for company's staff and provides extra-occupational courses. Distance studies are another form of extra-occupational programs.

The programs are in the following categories:

- Renewable Energies
- Electrical Engineering (focus on renewable energies)
- Energy management and Energy systems (focus on renewable energies)
- Energy technologies (focus on renewable energies)
- Energy economics
- Building technologies (focus on renewable energies)
- Mechanical engineering (focus on renewable energies)
- Process technologies (focus on renewable energies)
- Environmental technologies and Environment management

Figure 2 gives an overview over the existing German courses focused on renewable energies. These are the only programs that officially have their specialization in renewable energies.

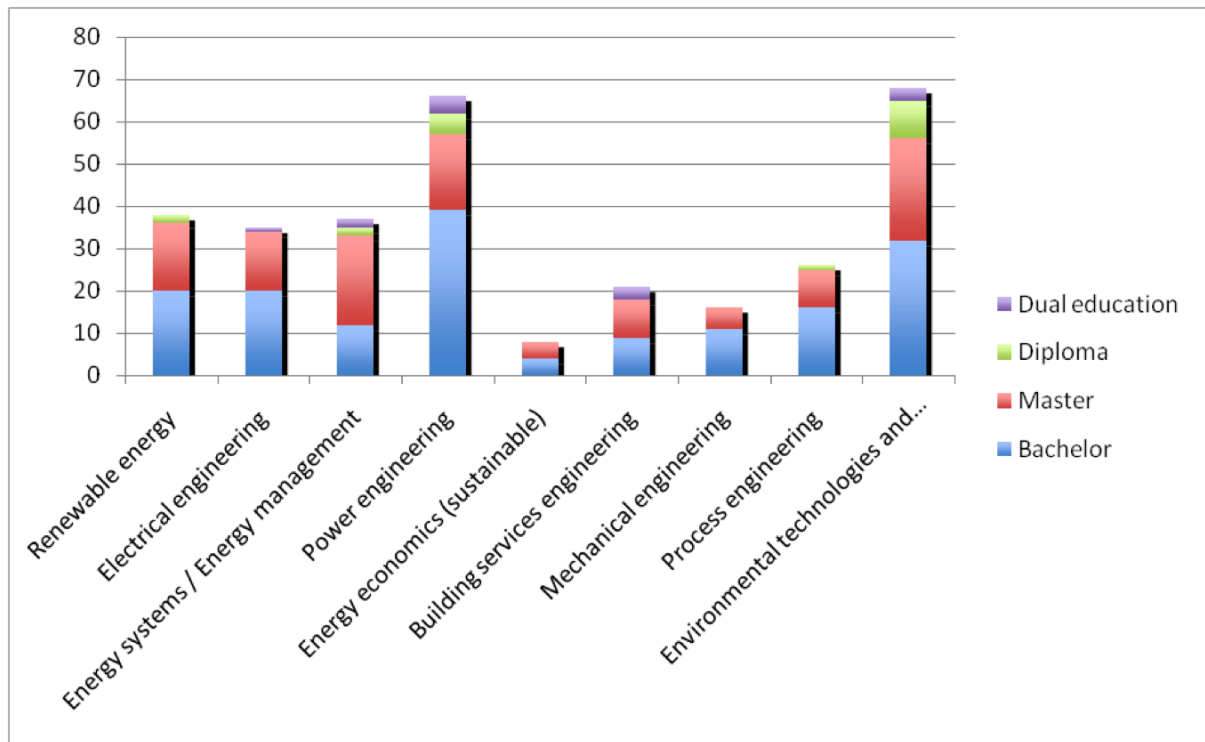


Figure 2: Number of university programs in renewable technologies and energy efficiency in Germany²

In this paper one special program is described in more detail, including the curriculum plan: the MSc Renewable Energy Management (REM) program which is offered by the Center for Renewable Energy (ZEE) within the faculty of Forest and Environmental Sciences at the Albert-Ludwigs University of Freiburg, Germany.

The **Iranian universities** have recently developed programs in energy studies at different departments at both undergraduate and graduate levels. The majority of the programs are offered in engineering or economic faculties. However, study programs focusing on renewable energies are still missing in the country. With immense renewable energy resources, Iran needs invest more in energy education and introduce new study fields. This is necessary to catch up with new knowledge and state-of-the-art technologies.

Iran's energy education consists of two areas: Technical education and non-technical education. The former is offered in the engineering faculties and departments and the latter in faculties of economics. Although the energy education programs in higher education institutes, particularly in the area of energy economics and management, started late in Iran, they have been playing an important role in preparing experts and skilled workers for the energy sector. They take in talented students through the national exam competition and graduate them with qualification to work in different sectors of the energy market. However, the energy programs need to develop further particularly in terms of quality and covering new areas such as energy efficiency, renewable energies, and energy policy. The latter is particularly important as the energy

² own diagram based on the data from <http://www.studium-erneuerbare-energien.de/>

markets are becoming more complicated and dynamic, requiring high and multidimensional skills for developing right energy policies for a country. The energy policy programs are interdisciplinary programs consisting of social sciences (economics, political science, sociology, business and management) and engineering (energy systems), which can be offered at the graduate level involving various departments.

For example: The Energy Systems Engineering is a MEng program which is offered in three fields: Energy Systems, Energy Technology, and Energy and Environment. The program is interdisciplinary and includes 32 credit hours of courses in engineering, economics, and management including a thesis. The program takes two years and the graduates are expected to work in the areas of energy management and plan, energy production and conversion, research, scientific and technical advice in energy, economic, and environmental organizations. To be eligible to enroll in this program, students must have a degree in engineering, physics, chemistry, or applied mathematics, and write a national entrance exam.

The major courses are energy system analysis, advanced mathematical planning, process engineering, risk analysis, and principles of economics. Students are also required to take additional courses related to their specific fields. For instance, in the field of Energy Technologies, students should take courses in renewable energy technologies such as wind, hydro, biomass, solar, and hydrogen. The Energy Systems program is offered by some technical universities such as Sharif University of Technology, Islamic Azad University, Science and Research branch, and Khaje Nasir University.

Other graduate programs at Iran's universities like Energy Economics, Renewable Energy Engineering and Energy Engineering are described within this paper.

With the vast energy resources, Iran needs to catch up with the new concepts, technologies, and management skills developed in the world energy markets through the universities. A skilled workforce is absolutely necessary for countries aiming to increase the share of renewables in their energy mix, and education can help achieve this objective. High-tech industries like the renewable energy industry require a skilled workforce for at least two reasons: (1) expanding and supporting the domestic renewable energy market, and (2) building the domestic research capacity in the area of renewable technology in order to drive innovation and domestic competitiveness. In both cases, renewable energy education plays a central role. They can set up joint programs with international universities which have long and high quality reputations in energy programs to exchange professors and students. They can also set up and participate in international workshops and seminars to catch up with new knowledge and the state-of-the-art technologies.