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Research Article

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Cultivation Strategy for Bachelor of Energy Storage Technology

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Abstract The demand for the energy storage market has shown substantial growth with the continuous expansion of the scale of clean and renewable energy development and utilization. However, the development of the energy storage industry has a relatively short history, and a rich bachelor pool has not formed. So the energy storage industry is facing a severe challenge of professionals' shortage. In this paper, a cultivation strategy of energy storage technology bachelors was proposed, a four-module curriculum system was constructed, and a new training model of "school-enterprise integration, integration of science and education, and multiple assessments" was proposed. This new strategy is of great significance for promoting the development of energy storage technology, the training of bachelors, and the progress of the industry.

Keywords bachelor cultivation; energy storage technology; curriculum system; renewable energy

Introduction

In order to cope with severe challenges, such as global energy shortage and environmental pollution, countries around the world have put forward energy development strategies that transform the energy structure from traditional fossil energy to clean and renewable energy such as wind and solar energy. However, most of the clean and renewable energy sources have problems, such as low energy density, intermittent, and large fluctuations in the utilization process, which brings great difficulties to large-scale applications. Energy storage technology can solve the problem of time, space, intensity and other mismatches in the process of energy utilization. Therefore, the application of energy storage systems in renewable energy power stations, grid transmission and distribution sides, and user sides can promote the consumption of renewable energy. The key to the large-scale development and utilization of clean and renewable energy is also an important technical support for the adjustment of the energy structure of the world [1-6].

With the continuous expansion of the scale of clean and renewable energy development and utilization, the demand for the energy storage market has shown substantial growth. However, the development of the energy storage industry has a relatively short history, and has not formed a rich bachelor pool. There is a serious supply of bachelors at all levels in the energy storage field. Insufficiency, the energy storage industry is facing a severe challenge of bachelor shortage [7-10]. Therefore, cultivating top-notch innovative bachelors in the field of energy storage has important practical significance for promoting the development of energy storage technology, the training of bachelors, and the progress of the industry.

Construction of Bachelor Training System for Energy Storage Technology

Nowadays, the competition among countries in the world is essentially a competition for bachelors, and national security, economic and social developments are inseparable from innovative bachelors. Facing the new economy characterized by new technologies, new industries, new formats and new models, based on the new concepts, new structures, new models and new systems of engineering education, we will focus on improving

students' ability to solve complex and uncertain engineering problems in order to cultivate outstanding engineering bachelors with high quality, strong foundation and innovation.

Ideas and Goals of Bachelor Training

The lack of energy storage technology professionals has greatly restricted the healthy development of the energy storage industry. In order to conform to the new trend of international engineering education development, colleges and universities can rely on existing disciplines and specialties, start from the needs of industrial application, take industrial applied bachelors as the training goal, consider the training ideas from the three dimensions of quality, knowledge and ability, and cultivate bachelors with high comprehensive quality. The goal is to cultivate excellent professional knowledge, strong comprehensive ability and outstanding engineering bachelors with high quality, strong foundation and innovation in the field of energy storage with international vision.

The quality dimension includes the concept of carbon neutrality, the concept of sustainable development, international vision, and the service consciousness of keeping up with the development of industry. The knowledge dimension includes basic knowledge, professional knowledge, interdisciplinary knowledge and engineering application knowledge; the ability dimension includes the ability to capture frontier knowledge, the ability to think systematically, the practical ability to use mathematical, scientific and engineering knowledge, and the ability to judge the effect of engineering solutions in the context of globalization, economy, environment and society. The exertion of personal ability can not only make the role of knowledge plays incisively and vividly, but also reflect its own value, while quality can guide the ability to move in the right direction.

Curriculum System

According to the requirements of engineering education professional certification standards, the curriculum system is composed of general education curriculum modules, mathematics and natural science curriculum modules, engineering science curriculum modules and concentrated practice modules. The basic structure of the curriculum system is shown in Figure 1.

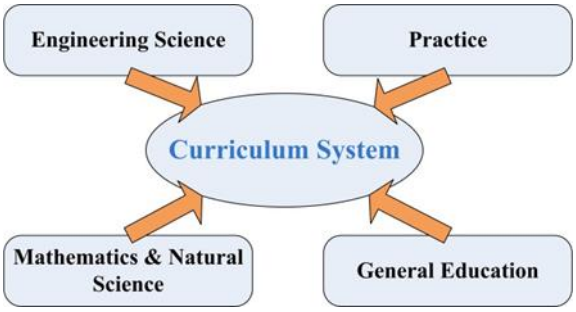

Figure 1: Curriculum System

(1) The general education curriculum module consists of general education compulsory courses and general education elective courses. The compulsory general education courses consist of politics, English, physical education, computer basics, military theory and other types of courses, which will lay general basic knowledge for students' training; general education elective courses will consist of humanities courses, traditional culture, career planning, employment guidance and other types of courses. The course composition is mainly used to improve students' non-engineering knowledge and comprehensive quality ability.

(2) The mathematics and natural science curriculum modules will be composed of mathematics, physics, chemistry and other types of courses, mainly used to cultivate students' natural science knowledge system and provide basic knowledge support for engineering courses.

(3) The engineering science course module is composed of engineering foundation, professional foundation, professional compulsory courses and professional elective courses. Engineering foundation is mainly composed of engineering drawing, electrical engineering technology, engineering materials, mechanical design, computer programming and other types of courses. It mainly cultivates students to master engineering technology knowledge and provides support for professional courses. The professional foundation is mainly composed of

theory/material mechanics, thermodynamics, fluid mechanics, and heat transfer and so on. It mainly cultivates students to master basic thermal science knowledge and provides professional foundation support for subsequent professional courses. The major compulsory courses are mainly composed of energy storage principles, energy chemistry, energy storage materials, an introduction to energy Internet, thermal engineering tests, etc., mainly to train students to master the basic theories and basic knowledge in energy storage technology and materials, and provide for the development of subsequent professional elective courses The necessary knowledge support. The professional electives mainly involve two mainstream energy storage methods, thermal energy storage and electrochemical energy storage, and are mainly composed of distributed energy, hydrogen and hydrogen energy, heat exchanger principle and design, carbon emission reduction and low-carbon management, solar cell principle and application, fuel cell principle and application, energy and environment, energy economics, integrated energy system design and analysis, clean energy and circular economy, synthetic chemistry of energy materials, etc. Students can choose courses based on personal interests and career development plans.

(4) The centralized practice module is composed of professional practice links, innovative practice links and graduation design links. Professional practice is mainly composed of public welfare labor, cognitive internship, metalworking internship, curriculum design, to enhance students' practical ability and professional knowledge application ability. The innovation practice link is mainly composed of a second classroom for college students and energy storage innovation training. Energy storage innovation training is a professional competition, and all training results participate in the competition. The graduation design adopts the school-enterprise joint guidance model, uses the actual technical projects of the enterprise as the topic, and is carried out in the practical teaching base.

Training Model

The combination of production, teaching and research is one of the effective ways to realize the close integration of professional bachelor training and industry needs, which is more conducive to promoting social development. Therefore, starting from the needs of the society and centering on the bachelor training goals of energy storage disciplines, a new bachelor training model in the energy storage field of "school-enterprise alliance, integration of science and education, and diversified assessment" will be constructed.

(1) School-enterprise joint training model. As an off-campus practical teaching base, enterprises accept students' practice training and teacher project training, while universities provide students with theoretical knowledge learning and experimental sites, and build a practical teaching platform together with enterprises. First of all, the introduction of engineering projects from enterprises, through horizontal analysis and vertical decomposition of multiple projects, derives different levels of experimental teaching, forming an experimental teaching system from theory to practice, from passive to active, from knowledge transfer to innovative ability training. Or after the students have mastered certain basic knowledge, they can participate in the horizontal project research or some comprehensive practical projects commissioned by the company, and take the project as a guide, let the students participate in the project application, project establishment, implementation, and train the students to think and analyze independently. Secondly, teachers go to the company to conduct project training from time to time, to timely understand the difficult problems to be overcome in the project, and teach for the purpose of solving the problems. The school occasionally invites corporate technical personnel to the school to conduct special lectures and conduct academic discussions with teachers and students to enrich the teaching content of teachers. Through the school-enterprise joint training model, effectively unite the energy storage research teams of colleges and universities and enterprises to establish a technological collaborative innovation platform to allow students and teachers to "go out", to "invite in" enterprise technical personnel and projects, and to give full play to both inside and outside the school. Resource advantages, with the construction of energy storage disciplines, unite with all walks of life to promote the training of bachelors in energy storage disciplines, technological innovation and the transformation of scientific and technological achievements.

(2) Science and education integration training model. The cultivation of high-quality bachelors in the field of energy storage is inseparable from the support of energy storage scientific research, so the transformation of scientific research resources in the field of energy storage into teaching resources is of great significance to bachelor training. To this end, universities can establish energy storage research centers and actively offer

frontier courses or lectures to give full play to the role of scientific research in bachelor training. Relying on scientific research projects, reasonably decompose them, integrate scientific research results into teaching, encourage students to participate in scientific research projects, so that they can transfer from simple textbook knowledge learning to the palace of scientific research, cultivate students' independent thinking and innovative thinking, and stimulate their sense of accomplishment and mission.

(3) Diversified assessment modes. The cultivation of bachelors under the background of the new engineering course pays more attention to quality and ability. In the past teaching, the test scores of the face-to-face test accounted for a large proportion of the students' mastery of a certain subject, which caused the students to have serious thinking about the test and the focus of surprise before the test. Knowledge, students' own ability level has not been greatly improved, and insufficient attention has been paid to process assessment. Therefore, a diversified evaluation model is proposed, and the final scores of the final exam will not exceed 50% of the final score. The experimental scores, internship scores, project design scores, classroom attendance rate, classroom activity level, etc. are added to the final scores, its proportion is not less than 50%. This assessment mode can guide students to pay attention to comprehensive quality and ability training, and improve the ability to use theoretical knowledge to solve practical engineering problems, team cooperation ability and innovation ability.

Conclusion

Starting from the three dimensions of quality, knowledge, and ability, following the theme of "interdisciplinary integration" curriculum design, an education system of energy storage technology bachelors has been constructed, and a bachelor training model of "school-enterprise integration, integration of science and education, and multiple assessments" has been proposed. This cultivation strategy can more accurately cultivate "high-quality, strong foundation, and innovative" application-oriented bachelors that meet the needs of the energy storage industry.

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