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# The Role and Challenge of Dual Carbon Goals in Promoting Electric Power Education: Exploring the Path of Integrating Renewable Energy and Low Carbon Technology

**Haibing Wang[1,a,*], Anjie Zhao[1,b], Tianhang Zheng[1,c]**

[1]*School of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, China*
[a]*wanghb91@usst.edu.cn,* [b]*2106492650 @qq.com,* [c]*1342946610@qq.com*
[*]*Corresponding author*

***Abstract:*** *This article aims to explore the development trends of the electricity industry in light of dual carbon goals. It analyzes the role of these goals in promoting electricity education and addresses the challenges associated with their implementation. Specifically, the article emphasizes the significance of integrating renewable energy and low-carbon technologies. It investigates the effective introduction of emerging technologies and concepts into electricity education, with the goal of nurturing professionals capable of meeting the future demands of the power industry. Additionally, it delves into the close collaboration between electricity education and the electricity industry, highlighting their joint efforts in carbon emission reduction within the power system. The primary objective of this research is to offer guidance for the reform and development of electricity education, playing a vital role in facilitating the low-carbon transformation of the power industry.*

***Keywords:*** *Dual carbon, Electrical engineering, Renewable energy, Low-carbon technology, Carbon emission reduction*

## 1. Introduction

With the intensification of global climate change, reducing carbon emissions has become a common challenge all countries face. In response to climate change, many countries have proposed the dual carbon goal of reducing carbon emissions to zero or negative and accelerating the implementation of sustainable development strategies. In this context, the power industry, as one of the crucial sources of carbon emissions, must actively participate in low-carbon transformation and promote the application of renewable energy.

Power education also faces unprecedented challenges and opportunities as a critical link in cultivating future professional talents in the power industry. The traditional power education model and course content can no longer meet the needs of the power industry under the dual carbon goal. Therefore, this study explores the driving effect of dual carbon goals on electricity education and how to integrate the concepts and practices of renewable energy and low-carbon technologies in electricity education.

This article first analyzes the driving effect of the dual carbon target on the power industry, focusing on the application prospects of renewable energy and low-carbon technology in the power system. Then, through analyzing the challenges faced by electricity education and the changes in demand, this paper proposes the integration path of renewable energy and low-carbon technology to promote electricity education. In addition, this article also explores the cooperative development between power education and the power industry to encourage close connections between schools and enterprises and cultivate power professionals with practical abilities and innovative thinking.

The purpose of this study is to provide guidance for the reform and development of electricity education and contribute to the electricity industry's low-carbon transformation. By integrating renewable energy and low-carbon technologies, power education can cultivate professional talents with innovative awareness and sustainable development thinking, laying a solid foundation for the sustainable development of the power industry. By strengthening cooperation between schools and enterprises, we aim to jointly promote carbon emission reduction in the power industry and provide effective support for

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achieving the dual carbon goals.

## 2. The Driving Effect of Dual Carbon Goals on the Power Industry

### *2.1. The Importance of Renewable Energy Technology*

The dual carbon goal requires reducing carbon emissions to zero or negative values, and the power industry is one of the critical areas to achieve the goal. The power industry has relied on traditional fossil fuels for decades. Still, their combustion process generates many carbon emissions and other harmful substances, causing significant environmental pollution. Under the dual carbon target, the power industry must shift towards using renewable energy sources, such as solar, wind, hydro, etc. These energy sources reduce carbon emissions and have higher economic efficiency and greater sustainability [1].

The power industry can significantly reduce its dependence on fossil fuels by developing renewable energy technologies. At the same time, applying renewable energy can also drive new employment opportunities and industrial development, further stimulating economic growth potential. Therefore, under the dual carbon goal, vigorously developing renewable energy technologies has become an inevitable choice for the sustainable development of the power industry.

### *2.2. The Application Prospects of Low Carbon Technology in Power Systems*

As shown in Figure 1, low-carbon technology is another essential means of addressing the dual carbon goal, and its application prospects in power systems are broad. Low-carbon technologies include but are not limited to high-efficiency coal-fired power plant, nuclear energy, CCS, hydrogen energy, electric vehicles, energy storage, and other technologies. These technologies can significantly reduce carbon emissions while improving energy utilization efficiency.

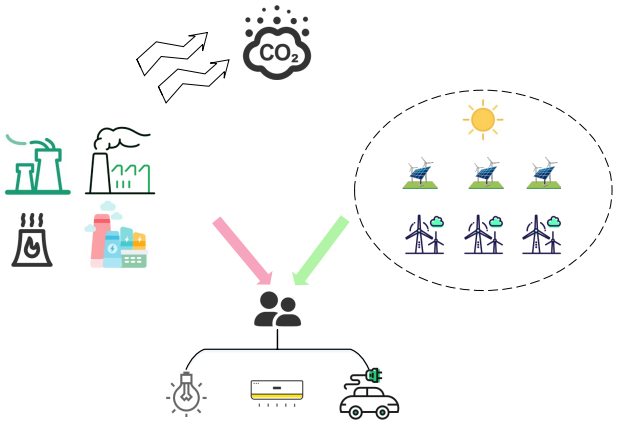


*Figure 1: The application prospects of low carbon.*

For example, efficient coal power technology can reduce carbon emissions from coal combustion, improve power generation efficiency and reduce energy costs. Hydrogen energy technology can be applied to fields such as automobiles, ships, and aviation to replace traditional fuel and reduce carbon emissions. Energy storage technology can improve the efficiency of renewable energy use while further reducing energy costs. The application of low-carbon technology can not only meet the energy demand under the dual carbon goal but also promote technological innovation and industrial upgrading in the power industry, injecting new vitality into the sustainable development of the power industry [2].

Under the dual carbon goal, the application of renewable energy technology and low-carbon technology will be a critical path for the development of the power industry, and power education needs to actively introduce these emerging technologies and concepts to cultivate professional talents who can meet the needs of the future power industry.

## 3. Analysis of the Challenges and Demand Changes in Electric Power Education

The power industry is in a critical period of energy transformation, and renewable energy and low-carbon technology have become new directions for developing the power industry. This also poses new challenges and changes in demand for electricity education.

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With renewable energy development, the power industry has gradually shifted from traditional thermal power generation to renewable energy. The modern power system has evolved from a centralized, integrated power grid to a distributed one. Integrating renewable energy and low-carbon technologies is necessary for power system adjustment and optimization. Therefore, electricity education needs to incorporate the educational content of renewable energy and low-carbon technologies into the traditional electricity education system and cultivate professional talents proficient in these advanced technologies.

In traditional power education content, the main focus is on the design and operation of thermal power generation and transmission lines. However, with the power industry's energy transformation, the power system's structure and function are undergoing significant changes, and education content also needs to be adjusted accordingly. Educational institutions need to update course content, textbooks, and teaching methods promptly according to the new needs of the power industry and cultivate professional talents who master the latest technology and adapt to the development of new energy. In addition, power education institutions also need to adjust to the dynamic growth and changes of the industry, introduce interdisciplinary, cutting-edge technology and other teaching models and content, and ensure the cultivation of advanced technical talents to adapt to the rapid development of the power industry and comprehensively improve the quality of power education.

Power education should closely follow the overall development direction of the power industry, integrate renewable energy and low-carbon technologies into the power education system through adjustments to the education system and curriculum content, cultivate professional talents, and promote sustainable development of the power industry.

## 4. Promoting the Integration Path of Renewable Energy and Low-Carbon Technologies in Electricity Education

### *4.1. Introducing Advanced Teaching Methods and Practical Projects*

Electric power education should adjust its curriculum and add professional courses related to renewable energy and low-carbon technology. These courses can include the principles and applications of renewable energy sources such as solar energy, wind energy, and hydropower, as well as the theory and practice of low-carbon technologies such as high-efficiency coal-fired power, nuclear energy, hydrogen energy, and energy storage. At the same time, the course content should be regularly updated to keep up with the latest developments in renewable energy and low-carbon technologies.

Provide students with opportunities for practical projects and experimental teaching, allowing them to personally participate in designing, constructing, and operating renewable energy and low-carbon technologies. By collaborating with practical projects, students can better understand the application of theoretical knowledge and the challenges of useful operation and cultivate practical skills and problem-solving abilities. For example, case teaching and problem-driven learning methods allow students to think and solve practical problems. At the same time, incorporating practical projects into the curriculum will enable students to participate in research and practice related to renewable energy and low-carbon technologies, improving their functional operation and problem-solving abilities [3].

Promote the integration of different disciplines, and cultivate students' comprehensive abilities and interdisciplinary thinking. For example, multidisciplinary courses on electricity economy and policy can help students understand the economic, policy, and social impacts of renewable energy and low-carbon technologies and encourage students to reflect on the interactions between multiple disciplines. Encourage students and teachers to conduct academic research and innovative projects on renewable energy and low-carbon technologies. Through academic research and innovation, it can promote in-depth exploration and breakthroughs in renewable energy and low-carbon technologies in the academic community, providing more solutions and innovative ideas for the sustainable development of the power industry.

### *4.2. Building Laboratory Facilities that Adapt to Technological Development*

Power education institutions need to build high-quality laboratory facilities to adapt to technological development. These facilities can include advanced power system simulation laboratories, smart grid laboratories, renewable energy generation laboratories, etc. Through these laboratory facilities, students can conduct various practical operations and simulation experiments to gain a deeper understanding of the working principles of power systems and the utilization of renewable energy. In addition, scientific

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research projects can also be carried out to study problems in the power industry and provide innovative solutions for industry development [4].

The construction of laboratory facilities that adapt to technological development also needs to consider the following aspects. First, the purchase of equipment and instruments should consider the latest scientific and technical development and industry needs to ensure the progressiveness and practicality of facilities. Secondly, laboratory facilities should provide an excellent experimental environment and guarantee conditions, including stable power supply, ventilation facilities, and safety measures. In addition, to promote academic research and industry-university research cooperation, laboratory facilities can also provide an open-sharing mechanism, encouraging students and teachers to communicate and cooperate with other schools and enterprises.

By building laboratory facilities that adapt to technological development, electric power education institutions can provide students with high-quality, practical platforms and cultivate their practical operation abilities and innovative thinking. At the same time, laboratory facilities also offer:

- A good foundation for cooperation between schools and industries.
- Promoting the application and promotion of renewable energy and low-carbon technologies.
- Promoting sustainable development of the power industry.

## 5. Cooperative Development of Electric Power Education and the Electric Power Industry

Power education institutions should strengthen cooperation between industry, academia, and research and establish close cooperative relationships with the power industry to meet the needs of the power industry better. By collaborating with industry-leading enterprises, research institutions, and others, power education institutions can understand the latest trends and technological developments in the industry and adjust their educational content and training objectives. At the same time, cooperation can also allow students to participate in practical projects, allowing them to understand the needs and challenges of the power industry in practice and cultivate problem-solving abilities [5].

Power education institutions should cooperate with the power industry and provide internship and training opportunities to strengthen the cultivation of students' practical abilities. By collaborating with enterprises, students can participate in practical work projects, understand the operational mechanisms of the power industry, and master practical application skills and knowledge. In addition, power education institutions can also collaborate with power enterprises to carry out professional training courses to help employees update their knowledge and skills promptly. This form of cooperation is beneficial for improving students' employment competitiveness and promoting talent cultivation and development in the power industry.

By strengthening industry-university research cooperation and providing internship training opportunities, power education, and the power industry can achieve positive interaction and cooperative development. Students can better understand and adapt to the needs of the power industry, and the power industry can also obtain professional talents with practical skills and industry awareness. This collaborative approach helps to combine education with suitable needs, promoting innovation and development in the power industry.

## 6. Case Analysis

This section takes the integration of renewable energy and low-carbon technologies in an integrated energy system as an example to analyze their integration with professional education. As shown in Figure 2, comprehensive measures can be taken for students majoring in electrical engineering from various aspects, such as curriculum, practical projects, experiments and practical training, academic research, industry cooperation and internships and interdisciplinary cooperation. so that students can lay a solid foundation in the field of renewable energy and low-carbon technology.

In terms of curriculum, a specialized module, known as "Renewable Energy and Integrated Energy Systems," is incorporated into energy-related courses for students. This module encompasses the fundamental principles, practical applications, and latest research advancements in renewable energy and low-carbon technologies. By combining theoretical knowledge with practical cases, it provides students with a comprehensive understanding of the subject matter.

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In terms of practical projects, the department develops a project related to the comprehensive energy system each academic year. Students collaborate in groups with local energy industries and enterprises to address practical issues, such as designing and optimizing a city's renewable energy supply system. Students have the opportunity to apply the theoretical knowledge acquired in the classroom to these projects, encompassing aspects from planning and technical design to economic evaluation.

In terms of experiments and practical training, students should be provided with comprehensive equipment and simulation environments related to the energy system through specialized laboratories. This enables students to engage in hands-on activities, where they personally operate and practice with various components and equipment, including solar modules, wind turbines, and energy storage systems. This allows students to gain a deeper understanding of equipment operation processes and methods for performance evaluation.

In terms of academic research, students are encouraged to undertake research projects focusing on integrated energy systems. For instance, a student group opted to integrate solar photovoltaic and geothermal energy using smart grid technology to enhance energy efficiency. Theoretical models and simulation software are utilized by students to derive optimized designs for integrated energy systems.

In terms of teacher training and professional development, educational institutions in the field of power provide opportunities for teachers in energy-related disciplines to update their knowledge and skills. Teachers actively participate in academic conferences and industry visits, enabling them to exchange ideas and learn from industry experts. This approach allows teachers to incorporate the latest industry developments and practical case studies into their teaching methods.

In terms of industry cooperation and internships, educational institutions in the power sector form collaborative relationships with the energy industry and related enterprises, offering students valuable internship opportunities. Students are exposed to integrated energy systems in practical work environments, gaining familiarity with the latest industry trends and practical methods. For example, students involved in an internship project related to energy supply in local industrial parks assist in energy scheduling and optimization to enhance energy efficiency.

In terms of interdisciplinary cooperation, educational institutions in the power sector establish mechanisms to foster collaboration between energy majors and other disciplines. The creation of a Transdisciplinarity Center facilitates cooperation with departments such as environmental science, economics, sociology, and more. This collaboration aims to explore the socio-economic impact of energy systems and develop sustainable development strategies.

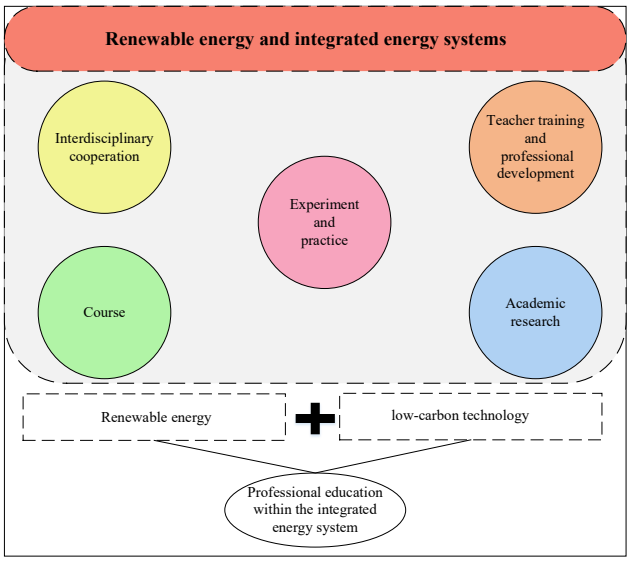


*Figure 2: The integration of renewable energy and low-carbon technologies in the integrated energy system.*

By implementing these comprehensive measures, the integration of renewable energy and low-carbon technologies in professional education within the integrated energy system can be achieved. Upon graduation, students will possess a comprehensive professional understanding and practical skills. They will have acquired knowledge and proficiency in the principles and applications of renewable energy and low-carbon technologies, comprehended the design and optimization methods for integrated energy

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systems, and developed problem-solving abilities. This comprehensive education lays a strong foundation for students' career development in the energy sector and contributes positively to energy transformation.

## 7. Conclusion

This study serves as a valuable reference for the reform and development of electricity education, facilitating carbon emission reduction and promoting sustainable development within the electricity industry. Through the integration of renewable energy and low-carbon technologies, our objective is to enhance the technical capabilities and awareness of power professionals and drive the power industry towards low-carbon development. Simultaneously, this initiative fosters collaboration both within and outside the industry, providing essential support for power education and establishing strong connections between educational institutions and enterprises. Consequently, this cultivates power professionals equipped with practical application skills and innovative thinking. Ultimately, these efforts contribute to the establishment of a sustainable power industry and make significant contributions to future energy transformation and environmental preservation.

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